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BA01685D/06/EN/03.24-00

Operating Instructions **Proline Prowirl D 200 HART**

Vortex flowmeter







- 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 organization will supply you with current information and updates to this manual.

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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

DANGER

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

WARNING

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

A CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

| Symbol | Meaning |
|---|---|
| | Direct current |
| \sim | Alternating current |
| \sim | Direct current and alternating current |
| <u>+</u> | Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |
| Potential equalization connection (PE: Protective earth) Ground terminals that must be connected to ground prior to establishing any connections. | |
| | The ground terminals are located on the interior and exterior of the device: Interior ground terminal: potential equalization connection is connected to the supply network. Exterior ground terminal: device is connected to the plant grounding system. |

1.2.3 Communication-specific symbols

| Symbol | Meaning |
|--------|---|
| ([[- | Wireless Local Area Network (WLAN) Communication via a wireless, local network. |
| * | Bluetooth Wireless data transmission between devices over a short distance via radio technology. |

1.2.4 Tool symbols

| Symbol | Meaning |
|------------------------------|------------------------|
| 0 | Flat-blade screwdriver |
| $\bigcirc \not \blacksquare$ | Allen key |
| Ń | Open-end wrench |

1.2.5 Symbols for certain types of information

| Symbol | Meaning |
|--------------|--|
| \checkmark | Permitted Procedures, processes or actions that are permitted. |
| | Preferred Procedures, processes or actions that are preferred. |
| × | Forbidden Procedures, processes or actions that are forbidden. |
| i | Tip 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 |
| ۲. | Result of a step |
| ? | Help in the event of a problem |
| | Visual inspection |

1.2.6 Symbols in graphics

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

- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

| Document type | Purpose and content of the document |
|---|--|
| Technical Information (TI) | Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device. |
| Brief Operating Instructions (KA) | Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. |
| Operating Instructions (BA) | Your reference document The 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. |
| Description of Device Parameters (GP) | Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. |
| Safety instructions (XA) | Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device. |
| Supplementary device-dependent documentation (SD/FY) | Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation. |

1.4 Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, Texas USA

KALREZ[®], VITON[®]

Registered trademarks of DuPont Performance Elastomers L.L.C., Wilmington, DE USA

GYLON®

Registered trademark of Garlock Sealing Technologies, Palmyar, NY, USA

2 Safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ► Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ► Follow the instructions in this manual.

2.2 Intended use

Application and media

The measuring instrument described in this manual is intended only for the flow measurement of liquids, gases and vapors.

Depending on the version ordered, the measuring instrument can also be used to measure potentially explosive ¹⁾, flammable, toxid and oxidizing media.

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

To ensure that the measuring instrument is in perfect condition during operation:

- Only use the measuring instrument in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Using the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring instrument only for media to which the process-wetted materials are sufficiently resistant.
- ► Keep within the specified pressure and temperature range.
- Keep within the specified ambient temperature range.
- Protect the measuring instrument permanently against corrosion from environmental influences.

Incorrect use

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

WARNING

Danger of breakage due to corrosive or abrasive fluids and ambient conditions!

- Verify the compatibility of the process fluid with the sensor material.
- ► Ensure the resistance of all fluid-wetted materials in the process.
- ► Keep within the specified pressure and temperature range.

¹⁾ Not applicable for IO-Link measuring instruments

NOTICE

Verification for borderline cases:

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

Residual risks

ACAUTION

Risk of hot or cold burns! The use of media and electronics with high or low temperatures can produce hot or cold surfaces on the device.

• Mount suitable touch protection.

2.3 Workplace safety

When working on and with the device:

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

2.4 Operational safety

Damage to the device!

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

Modifications to the device

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

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

Repair

To ensure continued operational safety and reliability:

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

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

2.6 IT security

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

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

2.7 **Device-specific IT security**

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater inoperation safety if used correctly. The following list provides an overview of the most important functions:

2.7.1Protecting access via hardware write protection

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

2.7.2Protecting access via a password

A password can be used to protect against write access to the device parameters.

This controls write access to the device parameters via the local display or other operating tools (e.q. FieldCare, DeviceCare) and, in terms of functionality, corresponds to hardware write protection. If the CDI service interface is used, read access is only possible by first entering the password.

User-specific access code

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code ($\rightarrow \cong 117$).

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

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning for safety reasons.
- Follow the general rules for generating a secure password when defining and managing the access code and network key.
- The user is responsible for the management and careful handling of the access code and network key.
- For information on configuring the access code or on what to do if you lose the password, for example, see "Write protection via access code" $\rightarrow \square 117$.

2.7.3Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to "Read only" access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

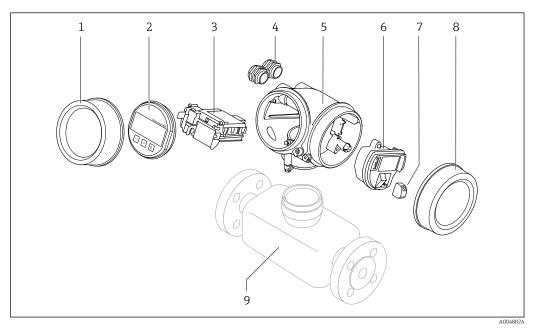
For detailed information on device parameters, see: "Description of Device Parameters" document $\rightarrow \square$ 193.

3 Product description

The device consists of a transmitter and a sensor.

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

3.1 Product design



- 1 Electronics compartment cover
- 2 Display module
- 3 Main electronics module
- 4 Cable glands
- 5 Transmitter housing (incl. HistoROM)
- 6 I/O electronics module
- 7 Terminals (plug-in spring terminals)
- 8 Connection compartment cover9 Sensor

Endress+Hauser

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

- 1. Check the packaging for damage.
 - └→ Report all damage immediately to the manufacturer. Do not install damaged components.
- 2. Check the scope of delivery using the delivery note.
- 3. Compare the data on the nameplate with the order specifications on the delivery note.

4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.

If one of the conditions is not satisfied, contact the manufacturer.

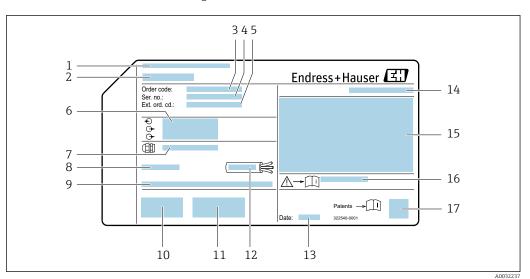
4.2 Product identification

The device can be identified in the following ways:

- Nameplate
- Order code with details of the device features on the delivery note
- Enter the serial numbers from the nameplates in the *Device Viewer* (www.endress.com/deviceviewer): all the information about the device is displayed.
- Enter the serial numbers from the nameplates into the *Endress+Hauser Operations app* or scan the DataMatrix code on the nameplate with the *Endress+Hauser Operations app*: all the information about the device is displayed.

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

- The "Additional standard device documentation" and "Supplementary device-dependent documentation" sections
- The *Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations app*: Enter the serial number from the nameplate or scan the DataMatrix code on the nameplate.

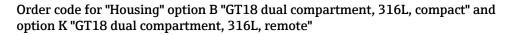


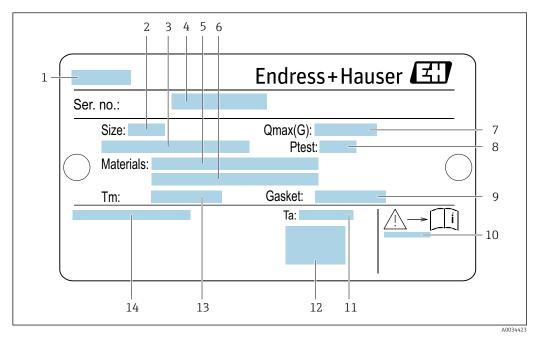
4.2.1 Transmitter nameplate

■ 1 Example of a transmitter nameplate

- 1 Manufacturer address/certificate holder
- 2 Name of the transmitter
- 3 Order code
- 4 Serial number
- 5 Extended order code
- 6 Electrical connection data, e.g. available inputs and outputs, supply voltage
- 7 Type of cable glands
- 8 Permitted ambient temperature (T_a)
- 9 Firmware version (FW) and device revision (Dev.Rev.) from the factory
- 10 CE mark, RCM-Tick mark
- 11 Additional information on version: certificates, approvals
- 12 Permitted temperature range for cable
- 13 Date of manufacture: year-month
- 14 Degree of protection
- 15 Approval information for explosion protection
- 16 Document number of safety-related supplementary documentation
- 17 2-D matrix code

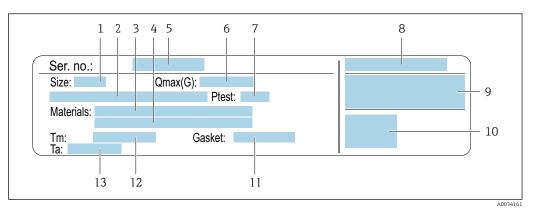
4.2.2 Sensor nameplate





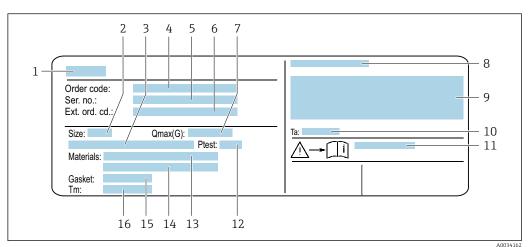
- 2 Example of a sensor nameplate
- 1 Name of sensor
- 2 Nominal diameter of sensor
- 3 Flange nominal diameter/nominal pressure
- 4 Serial number (Ser. no.)
- 5 Measuring tube material
- 6 Measuring tube material
- 7 Maximum permitted volume flow (gas/steam): $Q_{max} \rightarrow \square 166$
- 8 Test pressure of the sensor: OPL
- 9 Seal material
- 10 Document number of safety-related supplementary documentation $\rightarrow \square$ 193
- 11 Ambient temperature range
- 12 CE mark
- 13 Medium temperature range
- 14 Degree of protection

Order code for "Housing" option C "GT20 dual compartment, aluminum, coated, compact"



■ 3 Example of a sensor nameplate

- 1 Nominal diameter of sensor
- 2 Flange nominal diameter/nominal pressure
- 3 Measuring tube material
- 4 Measuring tube material
- 5 Serial number (Ser. no.)
- 6 Maximal permitted volume flow (gas/steam)
- 7 Test pressure of the sensor
- 8 Degree of protection
- 9 Approval information for explosion protection and Pressure Equipment Directive → 🗎 193
- 10 CE mark
- 11 Seal material
- 12 Medium temperature range
- 13 Ambient temperature range



Order code for "Housing" option J "GT20 dual compartment, aluminum, coated, remote"

E 4 Example of a sensor nameplate

- 1 Name of sensor
- 2 Nominal diameter of sensor
- *3 Flange nominal diameter/nominal pressure*
- 4 Order code
- 5 Serial number (Ser. no.)
- 6 Extended order code (ext. ord. cd.)
- 7 Maximal permitted volume flow (gas/steam)
- 8 Degree of protection
- 9 Approval information for explosion protection and Pressure Equipment Directive
- 10 Ambient temperature range
- 11 Document number of safety-related supplementary documentation \rightarrow \blacksquare 193
- 12 Test pressure of the sensor
- 13 Measuring tube material
- 14 Measuring tube material
- 15 Seal material
- 16 Medium temperature range



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 approvalrelated specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the # placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the + placeholder symbol (e.g. XXXXXX-ABCDE +).

4.2.3 Symbols on the device

| Symbol | Meaning | |
|--|---|--|
| Â | WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. Please consult the documentation for the measuring instrument to discover the type of potential danger and measures to avoid it. | |
| Reference to documentation Refers to the corresponding device documentation. | | |
| | Protective ground connection A terminal that must be connected to the ground prior to establishing any other connections. | |

5 Storage and transport

5.1 Storage conditions

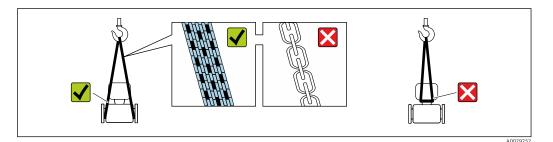
Observe the following notes for storage:

- 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. Avoid unacceptably high surface temperatures.
- ► Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature: -50 to +80 °C (-58 to +176 °F)

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.

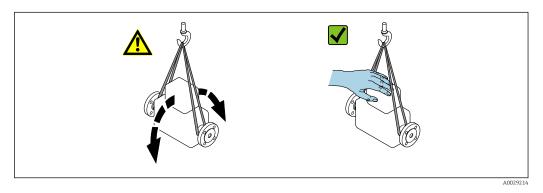
5.2.1 Measuring devices without lifting lugs

WARNING

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

Risk of injury if the measuring device slips.

- Secure the measuring device against slipping or turning.
- Observe the weight specified on the packaging (stick-on label).



5.2.2 Measuring devices with lifting lugs

ACAUTION

Special transportation instructions for devices with lifting lugs

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

5.2.3 Transporting with a fork lift

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

5.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

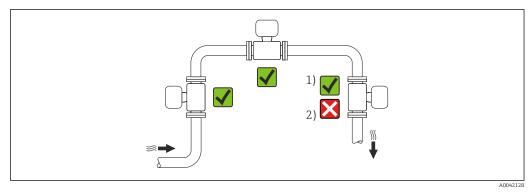
- Outer packaging of device
- Stretch wrap made of polymer in accordance with EU Directive 2002/95/EC (RoHS) Packaging
 - Wood crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
 - Cardboard box in accordance with European packaging guideline 94/62/EC, recyclability confirmed by Resy symbol
- Transport material and fastening fixtures
 - Disposable plastic pallet
 - Plastic straps
 - Plastic adhesive strips
- Filler material Paper pads

6 Installation

6.1 Installation requirements

6.1.1 Installation position

Mounting location



1 Installation suitable for gases and steam

2 Installation not suitable for liquids

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).

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. Therefore, please note the following:

| | Orientation | | Recommendation | |
|---|---|----------|-------------------|----------------|
| | | | Compact version | Remote version |
| A | Vertical orientation (liquids) | A0015591 | ✓ ✓ ¹⁾ | |
| A | Vertical orientation (dry gases) | | | |
| В | Horizontal orientation, transmitter head up | | 2) | |

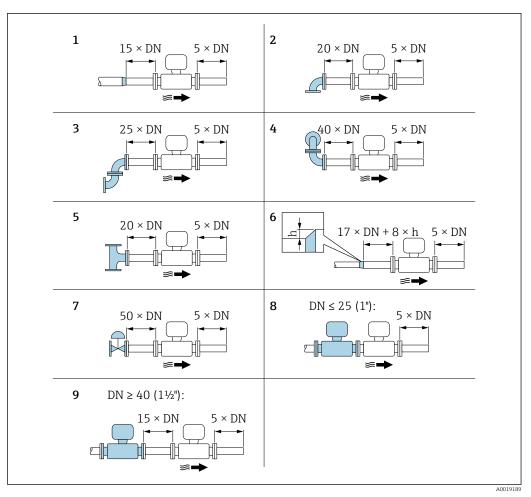
| | Orientation | | Recommendation | |
|---|--|----------|------------------------|----------------|
| | | | Compact version | Remote version |
| C | Horizontal orientation, transmitter head down | A0015590 | X ³⁾ | |
| D | Horizontal orientation, transmitter head at side | A0015592 | | |

In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (Fig. A). 1) Disruption in flow measurement!

- In the case of hot media (e.g. steam or medium temperature (TM) ≥ 200 °C (392 °F): orientation C or D In the case of very cold media (e.g. liquid nitrogen): orientation B or D 2)
- 3)

Inlet and outlet runs

To attain the specified level of accuracy of the measuring instrument, the inlet and outlet runs mentioned below must be maintained at the very minimum.



■ 5 Minimum inlet and outlet runs with various flow obstructions

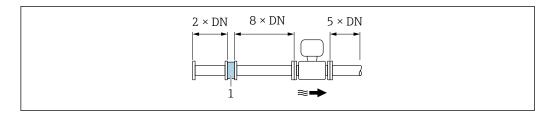
- h Difference in expansion
- 1 Reduction by one nominal diameter size
- 2 Single elbow (90° elbow)
- *3* Double elbow (2 × 90° elbows, opposite)
- 4 Double elbow 3D (2 × 90° elbows, opposite, not on one plane)
- 5 T-piece
- 6 Extension
- 7 Control valve
- 8 Two measuring instruments in a row where $DN \le 25$ (1"): directly flange on flange
- 9 Two measuring instruments in a row where $DN \ge 40 (1\frac{1}{2})$: for spacing, see graphic

• If there are several flow disturbances present, the longest specified inlet run must be maintained.

Flow conditioner

If the inlet runs cannot be observed, the use of a flow conditioner is recommended.

The flow conditioner is fitted between two pipe flanges and centered by the mounting bolts. Generally this reduces the inlet run needed to $10 \times DN$ with full measurement accuracy.



1 Flow conditioner

The pressure loss for flow conditioners is calculated as follows:

 $\Delta p \text{ [mbar]} = 0.0085 \cdot \rho \text{ [kg/m³]} \cdot v^2 \text{ [m/s]}$

| Example for steam | Exa |
|---|-------|
| p = 10 bar abs. | ρ = 9 |
| t = 240 °C \rightarrow ρ = 4.39 kg/m^3 | v = 2 |
| v = 40 m/s | |
| $\Delta p = 0.0085 \cdot 4.39 \cdot 40^2 = 59.7 \text{ mbar}$ | Δp |

| Example for H_2O condensate (80 °C) | |
|---|--|
| $\rho = 965 \text{ kg/m}^3$ | |
| v = 2.5 m/s | |
| | |
| $\Delta p = 0.0085 \cdot 965 \cdot 2.5^2 = 51.3 \text{ mbar}$ | |

 ρ : density of the process medium

v: average flow velocity

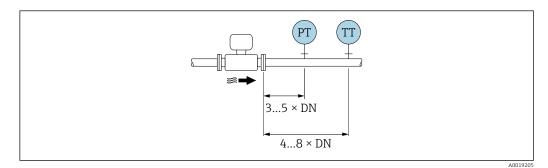
abs. = absolute



For the dimensions of the flow conditioner, see the "Technical Information" document, "Mechanical construction" section

Outlet runs when installing external devices

If installing an external device, observe the specified distance.



PT Pressure

TT Temperature device

Installation dimensions

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

6.1.2 Environmental and process requirements

Ambient temperature range

Compact version

| Measuring instrument | Non-hazardous area: | -40 to +80 °C (-40 to +176 °F) ¹⁾ |
|----------------------|---------------------|--|
| | Ex i, Ex nA, Ex ec: | -40 to +70 °C (-40 to +158 °F) ¹⁾ |

| | Ex d, XP: | -40 to +60 °C (-40 to +140 °F) ¹⁾ |
|---------------|--------------|---|
| | Ex d, Ex ia: | -40 to +60 °C (-40 to +140 °F) ¹⁾ |
| Local display | | -40 to +70 °C (-40 to +158 °F) ^{2) 1)} |

- Additionally available as order code for "Test, certificate", option JN "Transmitter ambient temperature -50 °C (-58 °F)". This option is only available in combination with a "High-temperature sensor -200 to +400 °C(-328 to +750 °F)", see order code 060 for "Sensor version; DSC sensor; measuring tube" with options BA, BB, CA, CB.
- At temperatures below -20 °C (-4 °F), depending on the physical characteristics involved, it may no longer be possible to read the liquid crystal display.

Remote version

| Transmitter | Non-hazardous area: | -40 to +80 °C (-40 to +176 °F) ¹⁾ |
|---------------|---------------------|---|
| | Ex i, Ex nA, Ex ec: | -40 to +80 °C (-40 to +176 °F) ¹⁾ |
| | Ex d: | -40 to +60 °C (-40 to +140 °F) ¹⁾ |
| | Ex d, Ex ia: | -40 to +60 °C (-40 to +140 °F) ¹⁾ |
| Sensor | Non-hazardous area: | -40 to +85 °C (-40 to +185 °F) ¹⁾ |
| | Ex i, Ex nA, Ex ec: | -40 to +85 °C (-40 to +185 °F) ¹⁾ |
| | Ex d: | -40 to +85 °C (-40 to +185 °F) ¹⁾ |
| | Ex d, Ex ia: | -40 to +85 °C (-40 to +185 °F) ¹⁾ |
| Local display | | -40 to +70 °C (-40 to +158 °F) ^{2) 1)} |

- Additionally available as order code for "Test, certificate", option JN "Transmitter ambient temperature -50 °C (-58 °F)". This option is only available in combination with a "High-temperature sensor -200 to +400 °C(-328 to +750 °F)", see order code 060 for "Sensor version; DSC sensor; measuring tube" with options BA, BB, CA, CB.
- 2) At temperatures < -20 °C (-4 °F), depending on the physical characteristics involved, it may no longer be possible to read the liquid crystal display.
- ► If operating outdoors:

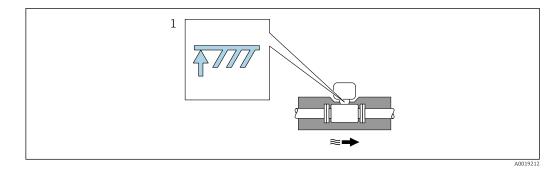
Avoid direct sunlight, particularly in warm climatic regions.

You can order a weather protection cover from Endress+Hauser. $\rightarrow \square$ 161.

Thermal insulation

For optimum temperature measurement and mass calculation, heat transfer at the sensor must be avoided for some fluids. This can be ensured by installing thermal insulation. A wide range of materials can be used for the required insulation.

The maximum insulation height permitted is illustrated in the diagram:



- 1 Maximum insulation height
- When insulating, ensure that a sufficiently large area of the housing support remains exposed.

The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

NOTICE

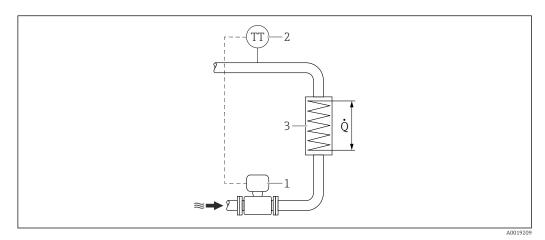
Electronics overheating on account of thermal insulation!

- Observe the maximum permitted insulation height of the transmitter neck so that the transmitter head and/or the connection housing of the remote version is completely free.
- Observe information on the permissible temperature ranges .
- ▶ Note that a certain orientation might be required, depending on the fluid temperature .

Installation for delta heat measurements

The second temperature measurement is taken using a separate temperature sensor. The measuring instrument reads in this value via a communication interface.

- In the case of saturated steam delta heat measurements, the measuring instrument must be installed on the steam side.
- In the case of water delta heat measurements, the device can be installed on the cold or warm side.



E 6 Layout for delta heat measurement of saturated steam and water

- 1 Measuring instrument
- 2 Temperature sensor
- 3 Heat exchanger
- Q Heat flow

Installation in steam systems

The device has been tested for dynamic pressure surges of up to 300 bar (4350 psi) by condensation-induced water hammer (CIWH). Despite the robust and reinforced design,

the following best practice recommendations for steam applications apply to prevent damage from condensation-induced water hammer.

- 1. Ensure sufficient and constant condensate drainage from the pipes by using correctly dimensioned and well-maintained steam traps. These are generally installed every 30 to 50 m (100 to 165 in) in horizontal pipes or at ground points.
- 2. The steam lines must have an adequate gradient of at least 1% in the direction of the steam flow to ensure that the condensate is directed to the steam traps at the drain points
- 3. If the system is shut down, they must be drained completely.
- 4. Avoid pipe configurations that cause accumulations of standing water.
- 5. Slowly increase the static pressure and steam flow rate when starting up the system.
- 6. Make sure steam does not come into contact with significantly cooler condensate.

Protective cover

A protective cover is available as an accessory for the device. It is used to protect against direct sunlight, precipitation and ice.

When installing the protective cover, a minimum upward clearance must be maintained: 222 mm (8.74 in)

The protective cover can be ordered via the product structure together with the device: Order code for "Accessories enclosed" option PB "Protective cover"

 $\fbox{1}$ Ordered separately as an accessory ightarrow 🗎 161

6.2 Installing the device

6.2.1 Required tools

For transmitter

- For turning the transmitter housing: Open-ended wrench8 mm
- For opening the securing clamps: Allen key3 mm

For sensor

For flanges and other process connections: Use a suitable mounting tool.

6.2.2 Preparing the measuring device

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

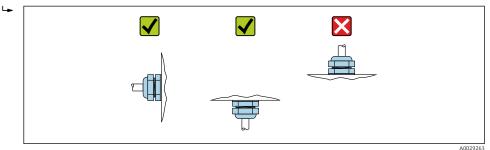
6.2.3 Installing the sensor

WARNING

Danger due to improper process sealing!

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

- **1.** Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
- **2.** To ensure compliance with device specifications, install the measuring instrument between the pipe flanges in a way that it is centered in the measurement section.
- 3. Install the measuring instrument or turn the transmitter housing so that the cable entries do not point upwards.

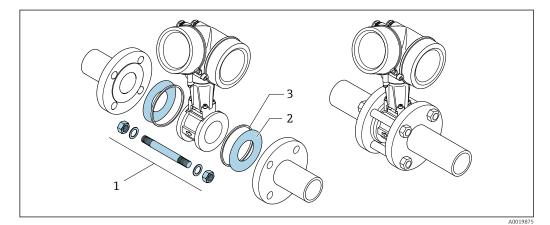


Mounting set for disc (wafer version)

The centering rings supplied are used to mount and center the wafer-style devices.

A mounting set comprises:

- Tie rods
- Seals
- Nuts
- Washers



- Image: Mounting set for wafer version
- 1 Nut, washer, tie rod
- 2 Seal
- *3 Centering ring (is supplied with the measuring instrument)*
 - A mounting set can be ordered separately $\rightarrow \square$ 161.

6.2.4 Installing the transmitter of the remote version

ACAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

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

ACAUTION

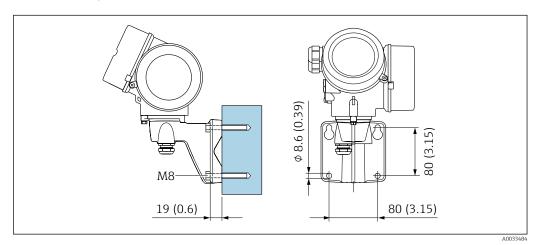
Excessive force can damage the housing!

• Avoid excessive mechanical stress.

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

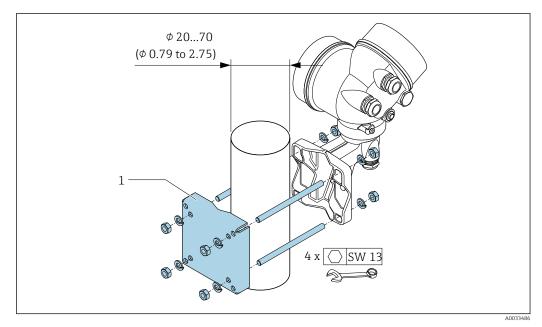
- Wall mounting
- Pipe mounting

Wall mounting



🖻 8 mm (in)

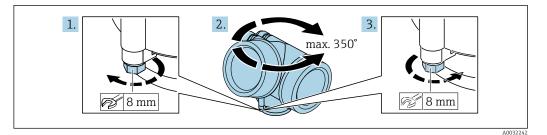
Pipe mounting





6.2.5 Turning the transmitter housing

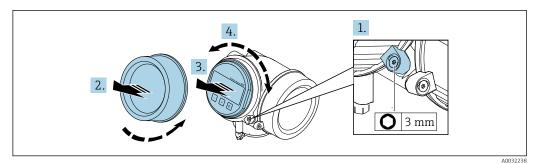
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



- 1. Loosen the securing screw.
- 2. Turn the housing to the desired position.
- 3. Firmly tighten the securing screw.

6.2.6 Turning the display module

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



- 1. Loosen the securing clamp of the electronics compartment cover using an Allen key.
- 2. Unscrew cover of the electronics compartment from the transmitter housing.
- 3. Optional: pull out the display module with a gentle rotational movement.
- 4. Turn the display module to the desired position: Max. $8 \times 45^{\circ}$ in each direction.
- 5. Without display module pulled out:
 - Allow display module to engage at desired position.

With display module pulled out:
 Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.

7. Reassemble the transmitter in the reverse order.

6.3 Post-mounting check

| Is the device undamaged (visual inspection)? | |
|--|--|
| Does the measuring instrument correspond to the measuring point specifications? | |
| For example: Process temperature → ¹ 182 Process pressure (refer to the section on "Pressure/temperature ratings" in the "Technical Information" document) Ambient temperature Measuring range → ¹ 166 | |
| Has the correct orientation been selected for the sensor → According to sensor type As per medium temperature As per medium properties (outgassing, with entrained solids) | |
| Does the arrow on the sensor match the direction of flow of the medium $\rightarrow \square 20$? | |

| Is the tag name and labeling correct (visual inspection)? | |
|--|--|
| Is the device sufficiently protected from precipitation and direct sunlight? | |
| Are the securing screw and securing clamp tightened securely? | |
| Has the maximum permitted insulation height been observed? | |

7 Electrical connection

7.1 Electrical safety

In accordance with applicable national regulations.

7.2 Connecting requirements

7.2.1 Required tools

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

7.2.2 Requirements for connection cable

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

Permitted temperature range

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

Signal cable

4 to 20 mA current output (without HART)

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

Shielded twisted-pair cable.

See https://www.fieldcommgroup.org "HART PROTOCOL SPECIFICATIONS".

Cable diameter

- Cable glands supplied: M20 \times 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
- Plug-in spring terminals for device version without integrated overvoltage protection: wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

7.2.3 Connecting cable for remote version

Connecting cable (standard)

| Standard cable $2 \times 2 \times 0.5 \text{ mm}^2$ (22 AWG) PVC cable with common shield (2 pairs, pair- stranded) ¹⁾ | |
|--|-------------------------------|
| Flame resistance | According to DIN EN 60332-1-2 |
| Oil resistance | According to DIN EN 60811-2-1 |

| Shielding | Galvanized copper-braid, opt. density approx. 85 % |
|----------------------------------|--|
| Cable length | 5 m (15 ft), 10 m (30 ft), 20 m (60 ft), 30 m (90 ft) |
| Continuous operating temperature | When mounted in a fixed position: –50 to +105 $^\circ C$ (–58 to +221 $^\circ F); when cable can move freely: –25 to +105 ^\circ C (–13 to +221 ^\circ F)$ |

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (armored)

| Cable, armored | $2\times2\times0.34~mm^2$ (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) and additional steel-wire braided sheath $^{1)}$ |
|-------------------------------------|--|
| Flame resistance | According to DIN EN 60332-1-2 |
| Oil resistance | According to DIN EN 60811-2-1 |
| Shielding | Galvanized copper-braid, opt. density approx. 85% |
| Strain relief and reinforcement | Steel-wire braid, galvanized |
| Cable length | 10 m (30 ft), 20 m (60 ft), 30 m (90 ft) |
| Continuous operating temperature | When mounted in a fixed position: –50 to +105 $^\circ$ C (–58 to +221 $^\circ$ F); when cable can move freely: –25 to +105 $^\circ$ C (–13 to +221 $^\circ$ F) |

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

7.2.4 Terminal assignment

Transmitter

4-20 mA HART connection version with additional inputs and outputs

| | 3 | 3 | 2 | 2 | | 1 | 4 | | | 3 | | 2 | | 1 | | 4 | Ł |
|---|---|---|---|---|---|--------|---|-------------------------------------|-------------------------------|----------------|------|--------------------|--------|-------|--|---|----------|
| | | | | | | | | | | | | | | | | | |
| | 5 | 6 | 3 | 4 | 1 | 2 | (| | 5 | 6 | 3 | 4 | 1 | 2 | | Ē | |
| | + | - | + | - | + | - | |) | + | - | + | - | + | - | | |) |
| | | | | | | | | A0033475 | | | | | | | | | A0033475 |
| Maximum number of terminals Terminals 1 to 6: Without integrated overvoltage protection | | | | | | ■ Term | ory m on" inals integ inals | ounte 1 to 4 trated 5 to 6 | ed", oj 4: 1 over 6: | ption volta | NA ' | 'Overvo rotecti | oltage | 2 JOF | | | |
| 2 3 | Output 1 (passive): supply voltage and signal transmission Output 2 (passive): supply voltage and signal transmission Input (passive): supply voltage and signal transmission Ground terminal for cable shield | | | | | | | | | | | | | | | | |

| Order code for "Output" | Terminal numbers | | | | | | | |
|--------------------------|------------------------|-------|--|-------|------------------------------------|-------|--|--|
| | Output 1 | | Outr | out 2 | Input | | | |
| | 1 (+) | 2 (-) | 3 (+) | 4 (-) | 5 (+) | 6 (-) | | |
| Option A | 4-20 mA HART (passive) | | - | - | - | | | |
| Option B ¹⁾ | 4-20 mA HART (passive) | | Pulse/frequency/switch output (passive) | | - | | | |
| Option C ¹⁾ | 4-20 mA HART (passive) | | 4-20 mA analog (passive) | | - | | | |
| Option D ¹⁾²⁾ | 4-20 mA HART (passive) | | Pulse/frequency/switch output (passive) | | 4-20 mA current input (passive) | | | |

1) Output 1 must always be used; output 2 is optional.

2) The integrated overvoltage protection is not used with option D: Terminals 5 and 6 (current input) are not protected against overvoltage.

Connecting cable for remote version

Transmitter and sensor connection housing

In the case of the remote version, the sensor and transmitter are mounted separately from on another and connected by a connecting cable. Connection is performed via the sensor connection housing and the transmitter housing.

How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:

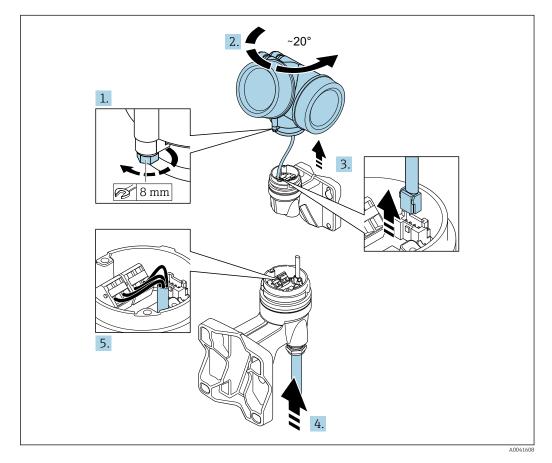
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable

In the following versions, an M12 device connector is used for connection in the transmitter housing:

- All other approvals
- Use of connecting cable (standard)

Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connection via terminals



1. Loosen the securing clamp of the transmitter housing.

2. Turn the transmitter housing clockwise by approx. 20°.

3. NOTICE

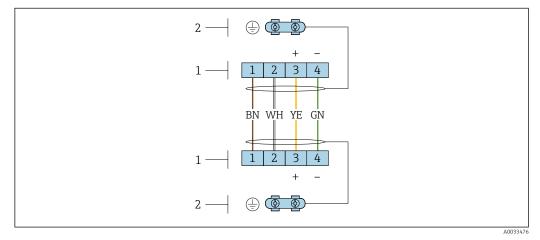
The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!

▶ Pay attention to the signal cable when lifting the transmitter housing!

Lift the transmitter housing, plug the signal cable out of the connection board of the wall holder and remove the transmitter housing.

- 4. Release the cable gland and insert the connecting cable (use the shorter stripped end of the connecting cable).
- 5. Wire the connecting cable $\rightarrow \blacksquare 10$, $\boxdot 35$.
- 6. Reverse the removal procedure to reassemble the transmitter housing.
- 7. Firmly tighten the cable gland.

Connecting cable (standard, reinforced)



🗷 10 Terminals for connection compartment in the transmitter wall holder and the sensor connection housing

1 Terminals for connecting cable

2 Grounding via the cable strain relief

| Terminal number | Assignment | Cable color Connecting cable | | | |
|-----------------|----------------|---------------------------------|--|--|--|
| 1 | Supply voltage | Brown | | | |
| 2 | Grounding | White | | | |
| 3 | RS485 (+) | Yellow | | | |
| 4 | RS485 (-) | Green | | | |

7.2.5 Requirements for the supply unit

Supply voltage

Transmitter

An external power supply is required for each output.

The following supply voltage values apply for the outputs available:

Supply voltage for a compact version without a local display $^{1)}$

| Order code for "Output; input" | Minimum terminal voltage ²⁾ | Maximum Terminal voltage | | |
|---|---|-----------------------------|--|--|
| Option A : 4-20 mA HART | ≥ DC 12 V | DC 35 V | | |
| Option B : 4-20 mA HART, pulse/ frequency/switch output | ≥ DC 12 V | DC 35 V | | |
| Option C : 4-20 mA HART + 4-20 mA analog | ≥ DC 12 V | DC 30 V | | |
| Option D : 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input ³⁾ | ≥ DC 12 V | DC 35 V | | |

1) In event of external supply voltage of the power supply unit with load

2) The minimum terminal voltage increases if local operation is used: see the following table

3) Voltage drop 2.2 to 3 V for 3.59 to 22 mA

| Increase of | f minimum | terminal | voltage | with | local | oneration |
|-------------|-----------|----------|---------|--------|-------|-----------|
| increase of | munumum | lerminui | vollage | VVILII | ιοται | operation |

| Order code for "Display; operation" | Increase in minimum Terminal voltage | | | |
|--|---|--|--|--|
| Option C : Local operation SD02 | + DC 1 V | | | |
| Option E : Local operation SD03 with lighting (backlighting not used) | + DC 1 V | | | |
| Option E : Local operation SD03 with lighting (backlighting used) | + DC 3 V | | | |

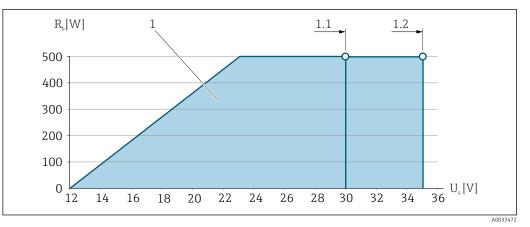
Load

Load for current output: 0 to 500 $\Omega_{\!\!\!\!}$ depending on the external supply voltage of the power supply unit

Calculation of the maximum load

Depending on the supply voltage of the power supply unit (U_S), the maximum load (R_B) including line resistance must be observed to ensure adequate terminal voltage at the device. In doing so, observe the minimum terminal voltage

- $R_B \le (U_S U_{term. min}): 0.022 A$
- $R_B \le 500 \Omega$



I1 Load for a compact version without local operation

1 Operating range

- 1.1 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with Ex i and option C "4-20 mA HART + 4-20 mA analog"
- 1.2 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" for non-hazardous area and Ex d

Sample calculation

Supply voltage of power supply unit:

■ U_S = 19 V

• $U_{term. min}$ = 12 V (measuring device) + 1 V (local operation without lighting) = 13 V

Maximum load: $R_B \le$ (19 V - 13 V): 0.022 A = 273 Ω

The minimum terminal voltage ($U_{Kl min}$) increases if local operation is used. $\rightarrow \square$ 35.

7.2.6 Preparing the measuring instrument

Carry out the steps in the following order:

- 1. Mount the sensor and transmitter.
- 2. Sensor connection housing: Connect connecting cable.
- **3.** Transmitter: Connect connecting cable.
- 4. Transmitter: Connect cable for supply voltage.

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

- Use suitable cable glands corresponding to the degree of protection.
- 1. Remove dummy plug if present.
- 2. If the measuring device is supplied without cable glands: Provide suitable cable gland for corresponding connecting cable.
- If the measuring device is supplied with cable glands:
 Observe requirements for connecting cables →
 ^(a) 31.

7.3 Connecting the device

NOTICE

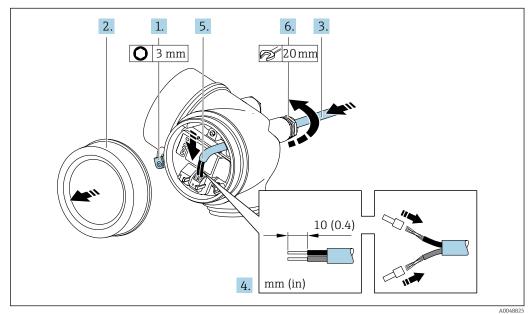
An incorrect connection compromises electrical safety!

- Only properly trained specialist staff may perform electrical connection work.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- ► Always connect the protective ground cable ⊕ before connecting additional cables.
- ► When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.
- The power unit must be safety-approved (e.g. SELV/PELV protection class II limited power).

7.3.1 Connecting the compact version

Connecting the transmitter

Connection via terminals



- **1.** Loosen the securing clamp of the connection compartment cover.
- 2. Unscrew the connection compartment cover.
- **3.** Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
- 4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.

6. **WARNING**

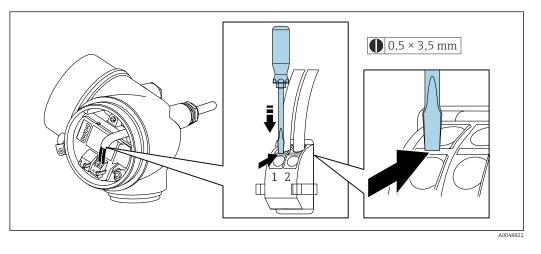
Housing degree of protection may be voided due to insufficient sealing of the housing.

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

Firmly tighten the cable glands.

7. Reassemble the transmitter in the reverse order.

Removing a cable



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

7.3.2 Connecting the remote version

WARNING

Risk of damaging electronic components!

- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.

The following sequence of steps is recommended :

1. Mount the sensor and transmitter.

2. Connect the .

3. Connect the transmitter.

How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:

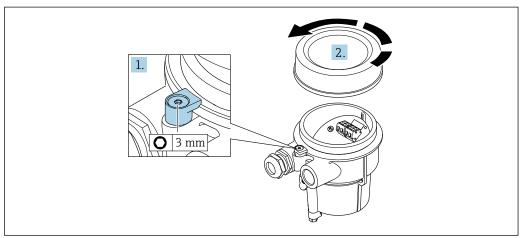
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable

In the following versions, an M12 device connector is used for connection in the transmitter housing:

- All other approvals
- Use of connecting cable (standard)

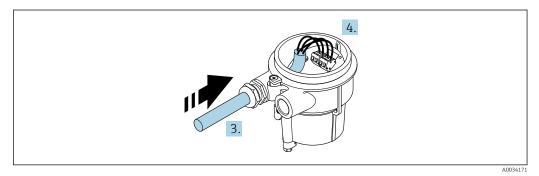
Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connecting the sensor connection housing



1. Loosen the securing clamp.

2. Unscrew the housing cover.



■ 12 Sample graphic

Connecting cable (standard, reinforced)

- **3.** Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
- 4. Wire the connecting cable:
 - Terminal 1 = brown cable Terminal 2 = white cable Terminal 3 = yellow cable
 - Terminal 4 = green cable
- 5. Connect the cable shield via the cable strain relief.
- 6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 7. Reverse the removal procedure to reassemble the connection housing.

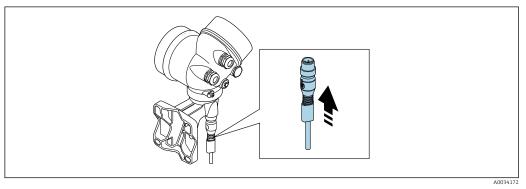
Connecting cable (option "mass pressure-/temperature-compensated")

3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

- 4. Wire the connecting cable:
 - └ Terminal 1 = brown cable
 - Terminal 2 = white cable
 - Terminal 3 = green cable
 - Terminal 4 = red cable
 - Terminal 5 = black cable
 - Terminal 6 = yellow cable Terminal 7 = blue cable
- 5. Connect the cable shield via the cable strain relief.
- 6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 7. Reverse the removal procedure to reassemble the connection housing.

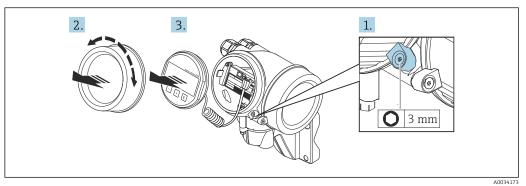
Connecting the transmitter

Connecting transmitter via plug

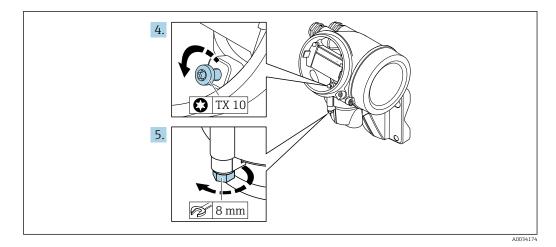


► Connect the plug.

Connecting transmitter via terminals

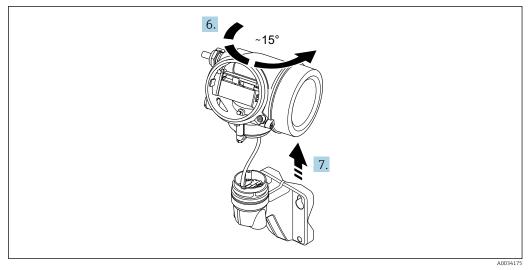


- **1.** Loosen the securing clamp of the electronics compartment cover.
- 2. Unscrew the electronics compartment cover.
- **3.** Pull out the display module with a gentle rotational movement. To make it easier to access the lock switch, attach the display module to the edge of the electronics compartment.



4. Loosen the locking screw of the transmitter housing.

5. Loosen the securing clamp of the transmitter housing.



🖻 13 Sample graphic

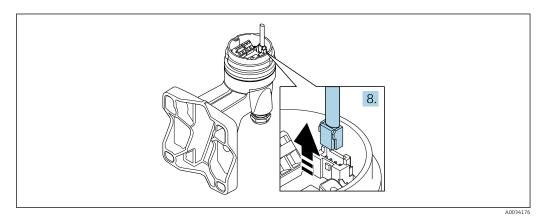
6. Turn the transmitter housing to the right until it reaches the marking.

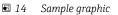
7. NOTICE

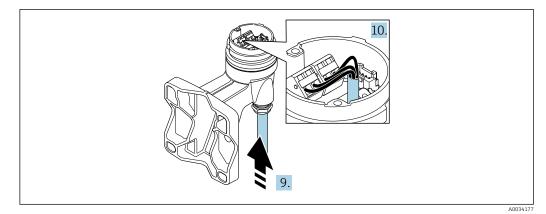
The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!

► Pay attention to the signal cable when lifting the transmitter housing!

Lift the transmitter housing.







■ 15 Sample graphic

Connecting cable (standard, reinforced)

- 8. Disconnect the signal cable from the connection board of the wall housing . by pressing in the locking clip on the connector. Remove the transmitter housing.
- **9.** Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
- **10.** Wire the connecting cable:
 - ➡ Terminal 1 = brown cable Terminal 2 = white cable Terminal 3 = yellow cable Terminal 4 = green cable
- 11. Connect the cable shield via the cable strain relief.
- 12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 13. Reverse the removal procedure to reassemble the transmitter housing.

Connecting cable (option "mass pressure-/temperature-compensated")

- 8. Disconnect both signal cables from the connection board of the wall housing. by pressing in the locking clip on the connector. Remove the transmitter housing.
- **9.** Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

10. Wire the connecting cable:

- Terminal 1 = brown cable Terminal 2 = white cable Terminal 3 = green cable Terminal 4 = red cable Terminal 5 = black cable Terminal 6 = yellow cable Terminal 7 = blue cable
- **11.** Connect the cable shield via the cable strain relief.
- 12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 13. Reverse the removal procedure to reassemble the transmitter housing.

7.4 Potential equalization

7.4.1 Requirements

For potential equalization:

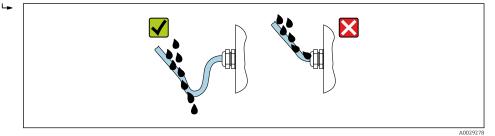
- Pay attention to in-house grounding concepts
- Take account of operating conditions, such as the pipe material and grounding
- Connect the medium, sensor and transmitter to the same electric potential
- Use a ground cable with a minimum cross-section of 6 mm² (10 AWG) and a cable lug for potential equalization connections

7.5 Ensuring the degree of protection

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

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

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



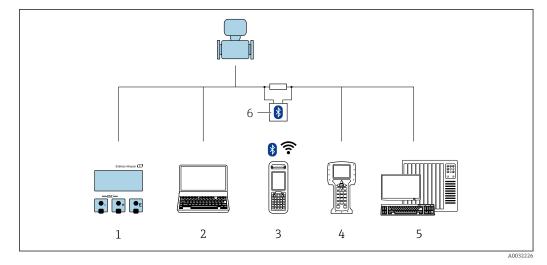
6. The cable glands supplied do not ensure housing protection when not in use. They must therefore be replaced by dummy plugs corresponding to the housing protection.

7.6 Post-connection check

| Are the device and cable undamaged (visual inspection)? | |
|--|--|
| Do the cables used comply with the requirements $\rightarrow \square 31$? | |
| Are the mounted cables strain relieved? | |
| Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" $\rightarrow \square 44$? | |
| Depending on the device version: are all the device plugs firmly tightened $\rightarrow \square$ 38? | |
| Only for remote version:Is the sensor connected to the right transmitter?Check the serial number on the nameplate of the sensor and transmitter. | |
| Does the supply voltage match the specifications on the transmitter nameplate ? | |
| Is the terminal assignment correct ? | |
| If supply voltage is present, do values appear on the display module? | |
| Are all housing covers installed and firmly tightened? | |

| Is | the securing clamp securely tightened? | |
|----|--|--|
| | ave the screws for the cable strain relief been tightened using the correct tightening rque $\rightarrow \cong 39$? | |

Operation options 8



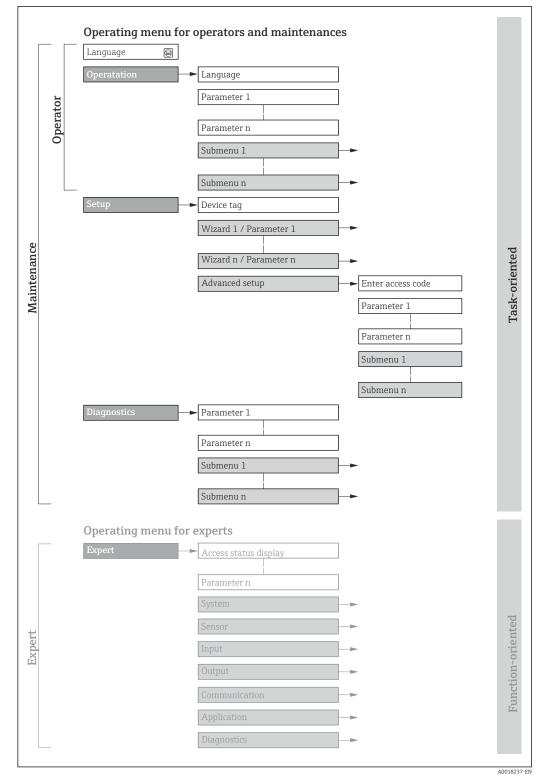
8.1 **Overview of operation options**

- 1
- Local operation via display module Computer with operating tool (e.g., FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) 2
- Field Xpert SFX350 or SFX370 Field Communicator 475 3
- 4
- 5 Automation system (e.g. PLC)
- 6 VIATOR Bluetooth modem with connecting cable

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

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



■ 16 Schematic structure of the operating menu

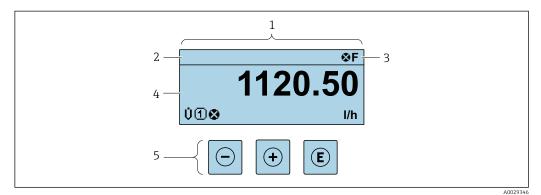
8.2.2 Operating philosophy

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

| Menu/pa | arameter | User role and tasks | Content/meaning |
|-------------|-----------------------|---|---|
| Language | Task- oriented | Role "Operator", "Maintenance" Tasks during operation: | Defining the operating languageResetting and controlling totalizers |
| Operation | | Configuration of the operational displayReading measured values | Configuration of the operational display (e.g. display format, display contrast) Resetting and controlling totalizers |
| Setup | | "Maintenance" role Commissioning: Configuration of the measurement Configuration of the inputs and outputs | Wizards for fast commissioning: Configuring the system units Definition of the medium Configuration of the current input Configuring the outputs Configuration of the operational display Definition of output conditioning Configuring the low flow cut off |
| | | | Advanced setup For more customized configuration of the measurement (adaptation to special measuring conditions) Configuration of totalizers Administration (define access code, reset measuring device) |
| Diagnostics | | "Maintenance" role Troubleshooting: Diagnostics and elimination of process and device errors Measured value simulation | Contains all parameters for error detection and analyzing process and device errors: Diagnostic list Contains up to 5 currently pending diagnostic messages. Event logbook Contains event messages that have occurred. Device information Contains information for identifying the device Measured values Contains all current measured values. Data logging submenu with the "Extended HistoROM" order option Storage and visualization of measured values Heartbeat Technology Verification of device functionality on request and documentation of verification results Simulation Used to simulate measured values or output values. |
| Expert | Function- oriented | Tasks that require detailed knowledge of the function of the device: Commissioning measurements under difficult conditions Optimal adaptation of the measurement to difficult conditions Detailed configuration of the communication interface Error diagnostics in difficult cases | Contains all of the device parameters and allows direct access to these by means of an access code. The structure of this menu is based on the function blocks of the device: System Contains all higher-level device parameters that do not affect measurement or measured value communication Sensor Configuration of the measurement. Input Configuration of the input Output Configuration of the outputs Configuration of the digital communication interface Application Configuration of the functions that go beyond the actual measurement (e.g. totalizer) Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology. |

8.3 Access to operating menu via local display

8.3.1 Operational display



- 1 Operational display
- 2 Tag name $\rightarrow \square 71$
- 3 Status area
- 4 Display area for measured values (up to 4 lines)
- 5 Operating elements $\rightarrow \square 54$

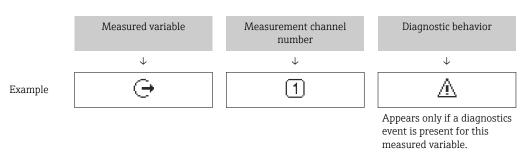
Status area

The following symbols appear in the status area of the operational display at the top right:

- Status signals $\rightarrow \cong 141$
 - F: Failure
 - **C**: Function check
 - S: Out of specification
 - M: Maintenance required
- Diagnostic behavior →
 ¹ 142
 - 🔉: Alarm
 - <u>M</u>: Warning
- 🟦: Locking (the device is locked via the hardware)
- 🖛 : Communication (communication via remote operation is active)

Display area

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



Measured variables

| Symbol | Meaning |
|--------|-------------|
| Ü | Volume flow |

The number and display format of the measured variables can be configured via the **Format display** parameter ($\rightarrow \cong 87$).

Totalizer

| Symbol | Meaning | |
|--------|--|--|
| Σ | Totalizer The measurement channel number indicates which of the three totalizers is displayed. | |

Output

| Symbol | Meaning | |
|--------|--|--|
| Ģ | Output The measurement channel number indicates which of the two current outputs is displayed. | |

Measurement channel numbers

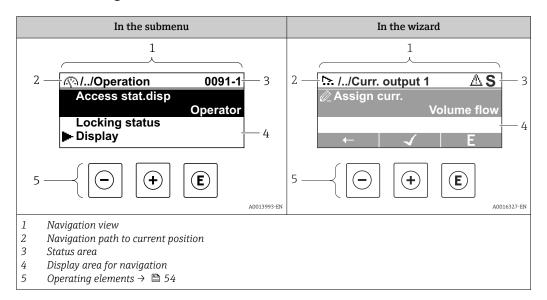
| Symbol | Meaning | |
|--------|--|--|
| 14 | Measurement channel 1 to 4 The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3). | |

Diagnostic behavior

| Symbol | Meaning | |
|--------|--|--|
| 8 | Alarm Measurement is interrupted. Signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. For local display with touch control: the background lighting changes to red. | |
| Δ | WarningMeasurement is resumed.The signal outputs and totalizers are not affected.A diagnostic message is generated. | |

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable.

8.3.2 Navigation view



Navigation path

The navigation path to the current position is displayed at the top left in the navigation view and consists of the following elements:

- The display symbol for the menu/submenu (►) or the wizard (\.).
- An omission symbol (/ ../) for operating menu levels in between.
- Name of the current submenu, wizard or parameter

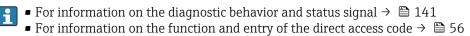
| | Display symbol | Omission symbol | Parameter |
|---------|----------------|-----------------|--------------|
| | \downarrow | \checkmark | \checkmark |
| Example | ► | // | Indication |

For more information about the icons in the menu, refer to the "Display area" section $\rightarrow \cong 51$

Status area

The following appears in the status area of the navigation view in the top right corner:

- In the submenu
 - The direct access code to the parameter (e.g., 0022-1)
- If a diagnostic event is present, the diagnostic behavior and status signal In the wizard
- If a diagnostic event is present, the diagnostic behavior and status signal



Display area

Menus

| Symbol | Meaning | |
|--------|---|--|
| A. | Operation Is displayed: In the menu next to the "Operation" selection At the left in the navigation path in the Operation menu | |

| ير | Setup Is displayed: In the menu next to the "Setup" selection At the left in the navigation path in the Setup menu |
|------------|---|
| પ | Diagnosis Is displayed: In the menu next to the "Diagnostics" selection At the left in the navigation path in the Diagnostics menu |
| ÷ * | Expert Is displayed: In the menu next to the "Expert" selection At the left in the navigation path in the Expert menu |

Submenus, wizards, parameters

| Symbol | Meaning | |
|--------|--|--|
| • | Submenu | |
| ₩. | Wizards | |
| Ø | Parameters within a wizard Image: No display symbol exists for parameters in submenus. | |

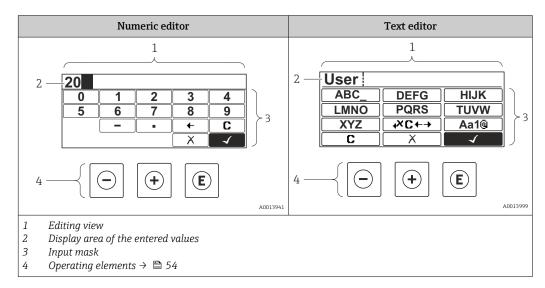
Locking procedure

| Symbol | Meaning | |
|--------|--|--|
| Ô | Parameter lockedWhen displayed in front of a parameter name, indicates that the parameter is locked.By a user-specific access codeBy the hardware write protection switch | |

Wizards

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

8.3.3 Editing view



Input screen

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

Numeric editor

| Symbol | Meaning |
|--------------|---|
| 0 9 | Selection of numbers from 0 to 9 |
| • | Inserts a decimal separator at the cursor position. |
| _ | Inserts a minus sign at the cursor position. |
| \checkmark | Confirms the selection. |
| + | Moves the input position one position to the left. |
| | Exits the input without applying the changes. |
| C | Clears all entered characters. |

Text editor

| Symbol | Meaning |
|--------------------|--|
| Aa1@ | Toggle • Between upper-case and lower-case letters • For entering numbers • For entering special characters |
| ABC_ XYZ | Selection of letters from A to Z. |
| abcxyz | Selection of letters from a to z. |
| ···· ··· ··· | Selection of special characters. |
| | Confirms the selection. |
| +×C+→ | Switches to the selection of the correction tools. |
| X | Exits the input without applying the changes. |
| C | Clears all entered characters. |

Text correction under $\Join c \leftrightarrow$

| Symbol | Meaning |
|--------|--------------------------------|
| C | Clears all entered characters. |

| ₽ | Moves the input position one position to the right. | |
|----|--|--|
| Ð | Moves the input position one position to the left. | |
| ×, | Deletes one character immediately to the left of the input position. | |

8.3.4 Operating elements

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

8.3.5 Opening the context menu

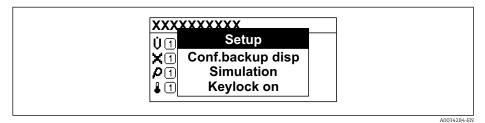
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Configuration backup display
- Simulation

Calling up and closing the context menu

The user is in the operational display.

- **1.** Press the \Box and \blacksquare keys for longer than 3 seconds.
 - └ The context menu opens.



- 2. Press + + simultaneously.
 - └ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

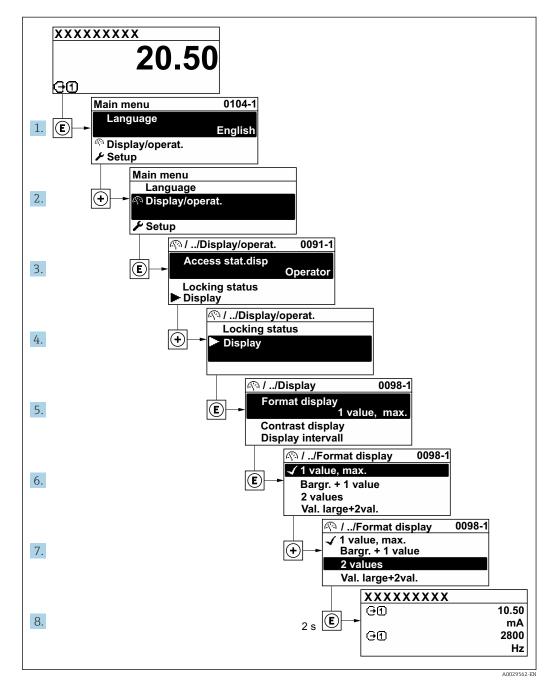
- 1. Open the context menu.
- 2. Press \pm to navigate to the desired menu.
- 3. Press 🗉 to confirm the selection.
 - └ The selected menu opens.

8.3.6 Navigating and selecting from list

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

For an explanation of the navigation view with symbols and operating elements $\rightarrow \cong 51$

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



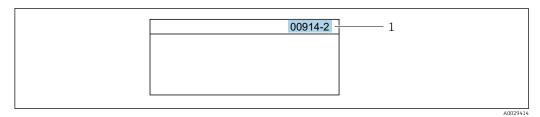
8.3.7 Calling the parameter directly

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

Navigation path

Expert \rightarrow Direct access

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



1 Direct access code

Note the following when entering the direct access code:

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

Example: Enter $00914-2 \rightarrow Assign \ process \ variable$ parameter

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

8.3.8 Calling up help text

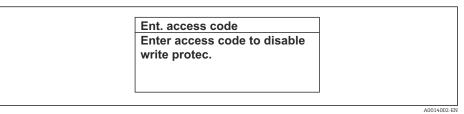
Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Calling up and closing the help text

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

1. Press E for 2 s.

└ The help text for the selected parameter opens.

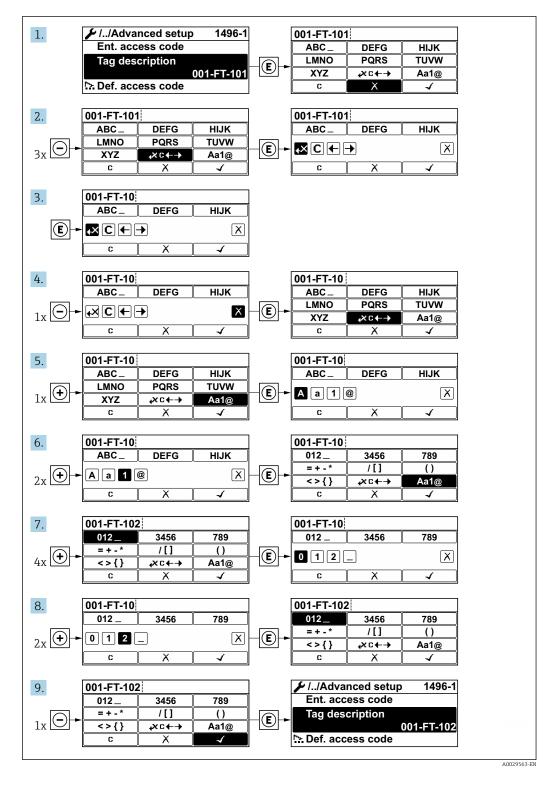


- ☑ 17 Example: Help text for parameter "Enter access code"
- 2. Press + + simultaneously.
 - └ The help text is closed.

8.3.9 Changing the parameters

For a description of the editing view - consisting of the text editor and numeric editor - with symbols $\rightarrow \cong 52$, for a description of the operating elements $\rightarrow \cong 54$

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



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

| | Ent. access code |
|---|------------------------------|
| I | nvalid or out of range input |
| 1 | value |
| | Min:0 |
| | Max:9999 |

8.3.10 User roles and related access authorization

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

Defining access authorization for user roles

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

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

Access authorization to parameters: "Maintenance" user role

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

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

Access authorization to parameters: "Operator" user role

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

1) Despite the defined access code, certain parameters can always be modified and thus are excluded from the write protection as they do not affect the measurement: write protection via access code

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

8.3.11 Disabling write protection via access code

If the @-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation $\rightarrow @$ 117.

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

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

2. Enter the access code.

➡ The B -symbol in front of the parameters disappears; all previously writeprotected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

🛐 For the SD03 display only

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

To activate the keylock manually:

1. The device is in the measured value display.

Press the \boxdot and \boxtimes keys for 3 seconds.

- └ A context menu appears.
- 2. In the context menu select the **Keylock on** option.
 - └ The keypad lock is switched on.

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

Switching off the keypad lock

- ► The keypad lock is switched on.
 - Press the \Box and \blacksquare keys for 3 seconds.
 - └ The keypad lock is switched off.

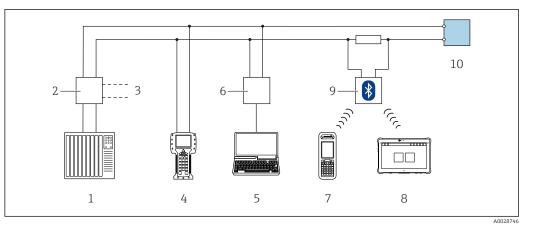
8.4 Access to the operating menu via the operating tool

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

8.4.1 Connecting the operating tool

Via HART protocol

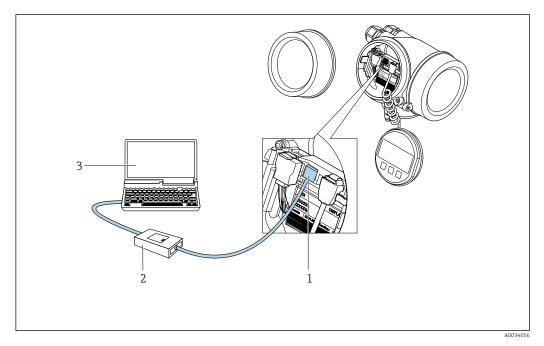
This communication interface is available in device versions with a HART output.



18 Options for remote operation via HART protocol (passive)

- 1 Automation system (e.g. PLC)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA195 and Field Communicator 475
- 4 Field Communicator 475
- 5 Computer with Web browser (e.g. Internet Explorer) for accessing computers with an operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, AMS TREX Device Communicator, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 6 Commubox FXA195 (USB)
- 7 Field Xpert SFX350 or SFX370
- 8 Field Xpert SMT50 (or 70 or 77)
- 9 VIATOR Bluetooth modem with connecting cable
- 10 Transmitter

Via service interface (CDI)



1 Service interface (CDI = Endress+Hauser Common Data Interface) of the measuring instrument

- 2 Commubox FXA291
- 3 Computer with operating tool (e.g. FieldCare or DeviceCare) and (CDI) DeviceDTM

8.4.2 Field Xpert SFX350, SFX370

Function scope

Field Xpert SFX350 and Field Xpert SFX370 are mobile computers for commissioning and maintenance. They enable efficient device configuration and diagnostics for HART and

FOUNDATION Fieldbus devices in the **non-hazardous area** (SFX350, SFX370) and **hazardous area** (SFX370).

For details, see Operating Instructions BA01202S

Source for device description files

See information $\rightarrow \cong 65$

8.4.3 FieldCare

Function range

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

Access is via:

- HART protocol
- CDI service interface $\rightarrow \square 61$

Typical functions:

- Transmitter parameter configuration
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook
- Operating Instructions BA00027S
 - Operating Instructions BA00059S
 - Source for device description files $\rightarrow \square 65$

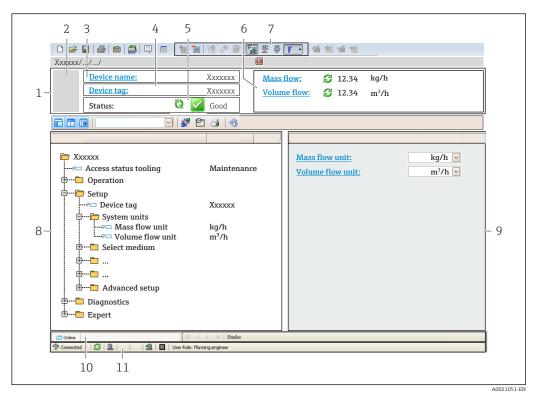
Establishing a connection

- 1. Start FieldCare and launch the project.
- 2. In the network: Add a device.
 - └ The **Add device** window opens.
- 3. Select the CDI Communication TCP/IP option from the list and press OK to confirm.
- 4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.

5. Select the desired device from the list and press **OK** to confirm.

- → The CDI Communication TCP/IP (Configuration) window opens.
- 6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.
- 7. Establish the online connection to the device.
- Operating Instructions BA00027S
 - Operating Instructions BA00059S

User interface



- 1 Header
- 2 Picture of device
- 3 Device name
- 4 Tag name
- 5 Status area with status signal $\rightarrow \square 144$
- 6 Display area for current measured values
- 7 Editing toolbar with additional functions such as save/load, event list and create documentation
- 8 Navigation area with operating menu structure
- 9 Work area
- 10 Action area
- 11 Status area

8.4.4 DeviceCare

Function range

Tool for connecting and configuring Endress+Hauser field devices.

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

Innovation brochure IN01047S

Source for device description files $\rightarrow \cong 65$

8.4.5 AMS Device Manager

Function range

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

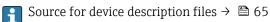


Source for device description files $\rightarrow \triangleq 65$

8.4.6 SIMATIC PDM

Function range

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



8.4.7 Field Communicator 475

Function scope

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

Source for device description files

See information $\rightarrow \square 65$

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

| Firmware version | 01.03.00 | On the title page of the manual On the transmitter nameplate Firmware version parameter Diagnostics → Device information → Firmware version |
|----------------------------------|----------|--|
| Release date of firmware version | 01.2018 | |
| Manufacturer ID | 0x11 | Manufacturer ID parameter Diagnostics → Device information → Manufacturer ID |
| Device type ID | 0x38 | Device type parameter Diagnostics \rightarrow Device information \rightarrow Device type |
| HART protocol revision | 7 | |
| Device revision | 4 | On the transmitter nameplate Device revision parameter Diagnostics → Device information → Device revision |

For an overview of the various firmware versions for the device $\rightarrow \cong 156$

9.1.2 Operating tools

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

| Operating tool via HART protocol | Sources for obtaining device descriptions |
|---|--|
| FieldCare | www.endress.com → Downloads area USB stick (contact Endress+Hauser) DVD (contact Endress+Hauser) |
| DeviceCare | www.endress.com → Downloads area CD-ROM (contact Endress+Hauser) DVD (contact Endress+Hauser) |
| Field Xpert SMT70Field Xpert SMT77 | Use update function of handheld terminal |
| AMS Device Manager (Emerson Process Management) | www.endress.com \rightarrow Downloads area |
| SIMATIC PDM (Siemens) | www.endress.com \rightarrow Downloads area |
| Field Communicator 475 (Emerson Process Management) | Use update function of handheld terminal |

9.2 Measured variables via HART protocol

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

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

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

- Expert \rightarrow Communication \rightarrow HART output \rightarrow Output \rightarrow Assign PV
- Expert \rightarrow Communication \rightarrow HART output \rightarrow Output \rightarrow Assign SV
- Expert \rightarrow Communication \rightarrow HART output \rightarrow Output \rightarrow Assign TV
- Expert \rightarrow Communication \rightarrow HART output \rightarrow Output \rightarrow Assign QV

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

Measured variables for PV (primary dynamic variable)

- Off
- Volume flow
- Corrected volume flow
- Mass flow
- Flow velocity
- Temperature
- Pressure
- Calculated saturated steam pressure
- Total mass flow
- Energy flow
- Heat flow difference

Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)

- Volume flow
- Corrected volume flow
- Mass flow
- Flow velocity
- Temperature
- Calculated saturated steam pressure
- Total mass flow
- Energy flow
- Heat flow difference
- Condensate mass flow
- Reynolds number
- Totalizer 1...3
- HART input
- Density
- Pressure
- Specific volume
- Degrees of superheat

Device variables

The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:

- 0 = volume flow
- 1 = corrected volume flow
- 2 = Mass flow
- 3 = flow velocity
- 4 = temperature
- 5 = calculated saturated steam pressure

- 7 = total mass flow
- 8 = energy flow
- 9 = heat flow difference
- 17 = pressure

9.3 Other settings

Burst mode functionality in accordance with HART 7 Specification:

Navigation

"Expert" menu \rightarrow Communication \rightarrow HART output \rightarrow Burst configuration \rightarrow Burst configuration 1 to n

| ► Burst configuration 1 to n | | |
|------------------------------|----------|--|
| Burst mode 1 to n |) → 🗎 68 | |
| Burst command 1 to n |) → 🗎 68 | |
| Burst variable 0 |) → 🗎 68 | |
| Burst variable 1 |) → 🗎 68 | |
| Burst variable 2 |) → 🗎 68 | |
| Burst variable 3 |) → 🗎 68 | |
| Burst variable 4 |) → 🗎 68 | |
| Burst variable 5 |) → 🗎 68 | |
| Burst variable 6 | → 🖺 68 | |
| Burst variable 7 | → 🖺 68 | |
| Burst trigger mode | → 🗎 68 | |
| Burst trigger level | → 🗎 68 | |
| Min. update period | → 🗎 69 | |
| Max. update period | } → 🗎 69 | |

Parameter overview with brief description

| Parameter | Description | Selection / User entry | Factory setting |
|----------------------|---|--|-----------------|
| Burst mode 1 to n | Activate the HART burst mode for burst message X. | • Off • On | Off |
| Burst command 1 to n | Select the HART command that is sent to the HART master. | Command 1 Command 2 Command 3 Command 9 Command 33 Command 48 | Command 2 |
| Burst variable 0 | For HART command 9 and 33: select the HART device variable or the process variable. | Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Energy flow* Heat flow difference* Condensate mass flow* Reynolds number* Totalizer 1 Totalizer 2 Totalizer 3 HART input Density* Pressure* Specific volume* Degrees of superheat* Percent of range Measured current Primary variable (PV) Secondary variable (SV) Tertiary variable (QV) Not used | Volume flow |
| Burst variable 1 | For HART command 9 and 33: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst variable 2 | For HART command 9 and 33: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst variable 3 | For HART command 9 and 33: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst variable 4 | For HART command 9: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst variable 5 | For HART command 9: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst variable 6 | For HART command 9: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst variable 7 | For HART command 9: select the HART device variable or the process variable. | See the Burst variable 0 parameter. | Not used |
| Burst trigger mode | Select the event that triggers burst message X. | Continuous Window Rising Falling On change | Continuous |
| Burst trigger level | Enter the burst trigger value. Together with the option selected in the Burst trigger mode parameter the burst trigger value determines the time of burst message X. | Signed floating-point number | - |

| Parameter | Description | Selection / User entry | Factory setting |
|--------------------|---|------------------------|-----------------|
| Min. update period | Enter the minimum time span between two burst commands of burst message X. | Positive integer | 1 000 ms |
| Max. update period | Enter the maximum time span between two burst commands of burst message X. | Positive integer | 2 000 ms |

* Visibility depends on order options or device settings

10 Commissioning

10.1 Post-mounting and post-connection check

Before commissioning the device:

- Make sure that the post-installation and post-connection checks have been performed successfully.
- Checklist for "Post-installation" check→ 🗎 29
- Checklist for "Post-connection" check \rightarrow \cong 44

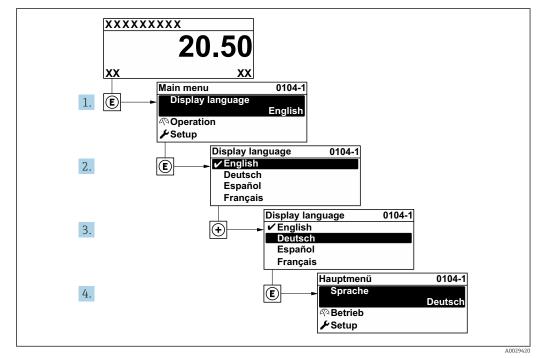
10.2 Switching on the measuring device

- Switch on the device upon successful completion of the post-mounting and postconnection check.
 - ← After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or if a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" $\rightarrow \cong 139$.

10.3 Setting the operating language

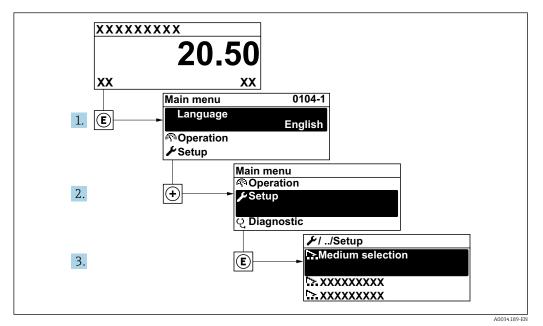
Factory setting: English or ordered local language



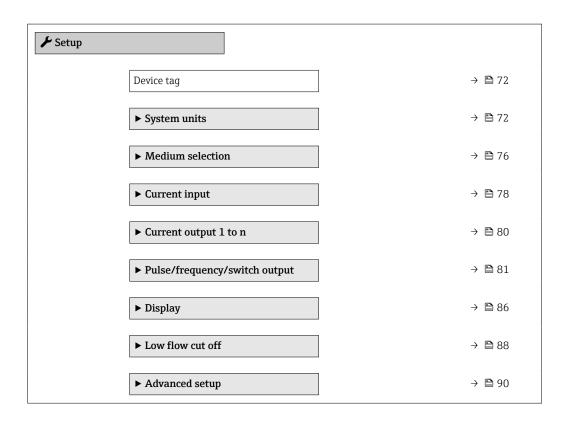
If Taking the example of the local display

10.4 Configuring the device

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

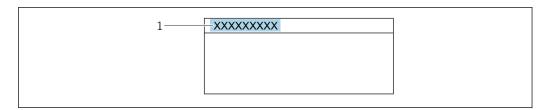


■ 20 Navigation to the "Setup" menuusing the example of the local display



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.



■ 21 Header of the operational display with tag name

1 Tag name

Enter the tag name in the "FieldCare" operating tool $\rightarrow \cong 63$

Navigation

"Setup" menu \rightarrow Device tag

Parameter overview with brief description

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

10.4.2 Setting the system units

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

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

Navigation

"Setup" menu → System units

| ► System units | |
|----------------------------|----------|
| Volume flow unit |) → 🗎 73 |
| Volume unit | → 🗎 73 |
| Mass flow unit |) → 🗎 73 |
| Mass unit |) → 🗎 73 |
| Corrected volume flow unit | → 🗎 73 |
| Corrected volume unit |) → 🗎 73 |
| Pressure unit |) → 🗎 74 |
| Temperature unit | → 🗎 74 |

| Energy flow unit |] | → 🗎 74 |
|------------------------|---|--------|
| Energy unit |] | → 🗎 74 |
| Calorific value unit |] | → 🗎 74 |
| Calorific value unit |] | → 🗎 74 |
| Velocity unit | | → 🗎 75 |
| Density unit | | → 🗎 75 |
| Specific volume unit | | → 🗎 75 |
| Dynamic viscosity unit | | → 🗎 75 |
| Length unit |] | → 🗎 75 |
| | | |

| Parameter | Prerequisite | Description | Selection | Factory setting |
|----------------------------|--------------|--|------------------|--|
| Volume flow unit | - | Select volume flow unit. <i>Effect</i> The selected unit applies to: • Output • Low flow cut off • Simulation process variable | Unit choose list | Country-specific: • m ³ /h • ft ³ /min |
| Volume unit | - | Select volume unit. | Unit choose list | Country-specific: • m ³ • ft ³ |
| Mass flow unit | - | Select mass flow unit. <i>Effect</i> The selected unit applies to: • Output • Low flow cut off • Simulation process variable | Unit choose list | Country-specific: • kg/h • lb/min |
| Mass unit | - | Select mass unit. | Unit choose list | Country-specific: • kg • lb |
| Corrected volume flow unit | - | Select corrected volume flow unit. <i>Effect</i> The selected unit applies to: Corrected volume flow parameter ($\rightarrow \boxdot 130$) | Unit choose list | Country-specific: • Nm ³ /h • Sft ³ /h |
| Corrected volume unit | - | Select corrected volume unit. | Unit choose list | Country-specific: • Nm ³ • Sft ³ |

| Parameter | Prerequisite | Description | Selection | Factory setting |
|-----------------------------|---|--|------------------|---|
| Pressure unit | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Select process pressure unit. <i>Effect</i> The unit is taken from: Calculated saturated steam pressure Atmospheric pressure Maximum value Fixed process pressure Pressure Reference pressure | Unit choose list | Country-specific: • bar • psi |
| Temperature unit | - | Select temperature unit. <i>Effect</i> The selected unit applies to: • Temperature • Maximum value • Minimum value • Maximum value • Maximum value • Minimum value • Minimum value • Minimum value • Average value • Minimum value • Maximum value • Reference combustion temperature • Reference temperature • Reference temperature • Saturation temperature | Unit choose list | Country-specific: • °C • °F |
| Energy flow unit | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Select energy flow unit. <i>Result</i> The selected unit applies to: • Heat flow difference parameter • Energy flow parameter | Unit choose list | Depends on country: • kW • Btu/h |
| Energy unit | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Select energy unit. | Unit choose list | Depends on country: • kWh • Btu |
| Calorific value unit | The following conditions are met: Order code for "Sensor version", "Mass (integrated temperature measurement)" option The Gross calorific value volume option or Net calorific value volume option the Calorific value type parameter. | Select calorific value unit. <i>Result</i> The selected unit applies to: Reference gross calorific value | Unit choose list | Depends on country: • kJ/Nm ³ • Btu/Sft ³ |
| Calorific value unit (Mass) | The following conditions are met: Order code for "Sensor version", "Mass (integrated temperature measurement)" option The Gross calorific value mass option or Net calorific value mass option is selected in the Calorific value type parameter. | Select calorific value unit. | Unit choose list | Depends on country: • kJ/kg • Btu/lb |

| Parameter | Prerequisite | Description | Selection | Factory setting |
|------------------------|---|---|-----------------------------|--|
| Velocity unit | - | Select velocity unit. <i>Result</i> The selected unit applies to: • Flow velocity • Maximum value | Unit choose list | Depends on country: • m/s • ft/s |
| Density unit | - | Select density unit. <i>Effect</i> The selected unit applies to: • Output • Simulation process variable | Unit choose list | Country-specific: • kg/m ³ • lb/ft ³ |
| Specific volume unit | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Select the unit for the specific volume. <i>Result</i> The selected unit applies to: Specific volume | Unit choose list | Depends on country: • m ³ /kg • ft ³ /lb |
| Dynamic viscosity unit | - | Select dynamic viscosity unit. Result The selected unit applies to: • Dynamic viscosity parameter (gases) • Dynamic viscosity parameter (liquids) | Unit choose list | Pa s |
| Length unit | - | Select length unit for nominal diameter. | • m • mm • ft • in | mm |

10.4.3 Selecting and setting the medium

The **Medium selection** wizard systematically guides the user through all the parameters that must be configured in order to select and set the medium.

Navigation

"Setup" menu \rightarrow Medium selection

| ► Medium selection | |
|------------------------|--------|
| Select medium | → 🗎 76 |
| Select gas type | → 🗎 76 |
| Gas type | → 🗎 77 |
| Relative humidity | → 🗎 77 |
| Select liquid type | → 🗎 77 |
| Steam calculation mode | → 🗎 77 |
| Enthalpy calculation | → 🗎 78 |
| | → ■ 78 |
| Density calculation | |
| Enthalpy type | → 🗎 78 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------|--|---------------------------|--|-------------------|
| Select medium | - | Select medium type. | GasLiquidSteam | Steam |
| Select gas type | The following conditions are met: • Order code for "Sensor version", Option "Mass (integrated temperature measurement)" • The Gas option is selected in the Select medium parameter parameter. | Select measured gas type. | Single gas Gas mixture Air Natural gas User-specific gas | User-specific gas |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|------------------------|---|---|---|-------------------------------------|
| Gas type | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Single gas option is selected. | Select measured gas type. | Hydrogen H2 Helium He Neon Ne Argon Ar Krypton Kr Xenon Xe Nitrogen N2 Oxygen O2 Chlorine Cl2 Ammonia NH3 Carbon monoxide CO Carbon dioxide CO2 Sulfur dioxide SO2 Hydrogen sulfide H2S Hydrogen chloride HCl Methane CH4 Ethane C2H6 Propane C3H8 Butane C4H10 Ethylene C2H4 Vinyl Chloride C2H3Cl | Methane CH4 |
| Relative humidity | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Air option is selected. | Enter humidity content of air in %. | 0 to 100 % | 0 % |
| Steam calculation mode | The Steam option is selected in the Select medium parameter parameter. | Select calculation mode of steam: based on saturated steam (T-compensated) or automatic detection (p-/T- compensated). | Saturated steam (T-compensated) Automatic (p-/T- compensated) | Saturated steam (T- compensated) |
| Select liquid type | The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Liquid option is selected in the Select medium parameter parameter. | Select measured liquid type. | Water LPG (Liquefied Petroleum Gas) User-specific liquid | Water |
| Fixed process pressure | The following conditions are met: Order code for "Sensor version", Option "Mass flow (integrated temperature measurement)" In the External value parameter (→ Pressure option is not selected. | Enter fixed value for process pressure. Dependency The unit is taken from the Pressure unit parameter. For detailed information on the calculation of the measured variables with steam: | 0 to 250 bar abs. | 0 bar abs. |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------|--|---|--|-----------------|
| Enthalpy calculation | The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" In the Select medium parameter, the Gas option is selected and in the Select gas type parameter, the Natural gas option is selected. | Select the norm the enthalpy calculation is based on. | • AGA5 • ISO 6976 | AGA5 |
| Density calculation | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. | Select the norm the density calculation is based on. | AGA Nx19 ISO 12213- 2 ISO 12213- 3 | AGA Nx19 |
| Enthalpy type | The following conditions are met: In the Select gas type parameter, the User- specific gas option is selected. Or In the Select liquid type parameter, the User- specific liquid option is selected. | Define which kind of enthalpy is used. | HeatCalorific value | Heat |

10.4.4 Configuring the current input

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

Navigation

"Setup" menu \rightarrow Current input

| ► Current input | | | |
|-----------------|----------------------|---|--------|
| | External value |] | → 🗎 79 |
| | Atmospheric pressure |] | → 🖺 79 |
| | Current span |] | → 🗎 79 |
| | 4 mA value | | → 🖺 79 |
| | 20 mA value |] | → 🖺 79 |
| | Failure mode |] | → 🖺 79 |
| | Failure value | | → 🖺 79 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------|--|--|--|--|
| External value | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Assign variable from external device to process variable. For detailed information on the calculation of the measured variables with steam: | Off Pressure Gauge pressure Density 2nd temperature delta heat | Off |
| Atmospheric pressure | In the External value parameter, the Gauge pressure option is selected. | Enter atmospheric pressure value to be used for pressure correction. | 0 to 250 bar | 1.01325 bar |
| | | Dependency The unit is taken from the Pressure unit parameter | | |
| Current span | - | Select current range for process value output and upper/lower level for alarm signal. | 420 mA 420 mA NAMUR 420 mA US | Country-specific: • 420 mA NAMUR • 420 mA US |
| 4 mA value | - | Enter 4 mA value. | Signed floating-point number | 0 |
| 20 mA value | - | Enter 20 mA value. | Signed floating-point number | Depends on country and nominal diameter |
| Failure mode | - | Define input behavior in alarm condition. | Alarm Last valid value Defined value | Alarm |
| Failure value | In the Failure mode parameter, the Defined value option is selected. | Enter value to be used by the device if input value from external device is missing. | Signed floating-point number | 0 |

10.4.5 Configuring the current output

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

Navigation

"Setup" menu \rightarrow Current output 1 to n

| ► Current output 1 to n | |
|------------------------------|----------|
| Assign current output 1 to n | → 🖺 80 |
| Current span |) → 🗎 80 |
| 4 mA value |) → 🗎 80 |
| 20 mA value | → 🗎 81 |
| Fixed current | → 🗎 81 |
| Damping output 1 to n |) → 🗎 81 |
| Failure mode | → 🗎 81 |
| Failure current | → 🗎 81 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------------|---|--|--|--|
| Assign current output | - | Select process variable for current output. | Off Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated saturated steam pressure* Total mass flow Energy flow* Heat flow difference* | Volume flow |
| Current span | - | Select current range for process value output and upper/lower level for alarm signal. | 420 mA NAMUR 420 mA US 420 mA Fixed current | Depends on country: • 420 mA NAMUR • 420 mA US |
| 4 mA value | In Current span parameter (→ 🗎 80), one of the following options is selected: • 420 mA NAMUR • 420 mA US • 420 mA | Enter 4 mA value. | Signed floating-point number | Depends on country: • 0 m ³ /h • 0 ft ³ /min |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------|---|--|---|---|
| 20 mA value | In Current span parameter (→ 🗎 80), one of the following options is selected: • 420 mA NAMUR • 420 mA US • 420 mA | Enter 20 mA value. | Signed floating-point number | Depends on country and nominal diameter |
| Fixed current | The Fixed current option is selected in the Current span parameter ($\rightarrow \cong 80$). | Defines the fixed output current. | 3.59 to 22.5 mA | 4 mA |
| Damping output | A process variable is selected in the Assign current output parameter (→ 🗎 80) and one of the following options is selected in the Current span parameter (→ 🗎 80): • 420 mA NAMUR • 420 mA US • 420 mA | Set reaction time for output signal to fluctuations in the measured value. | 0.0 to 999.9 s | 1.0 s |
| Failure mode | A process variable is selected in the Assign current output parameter (→ 🗎 80) and one of the following options is selected in the Current span parameter (→ 🗎 80): • 420 mA NAMUR • 420 mA US • 420 mA | Define output behavior in alarm condition. | Min. Max. Last valid value Actual value Defined value | Max. |
| Failure current | The Defined value option is selected in the Failure mode parameter. | Enter current output value in alarm condition. | 3.59 to 22.5 mA | 22.5 mA |

* Visibility depends on order options or device settings

10.4.6 Configuring the pulse/frequency/switch output

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

Navigation

"Setup" menu \rightarrow Pulse/frequency/switch output

| Pulse/frequency/switch output | | |
|-------------------------------|--|--------|
| Operating mode | | → 🗎 81 |

| Parameter | Description | Selection | Factory setting |
|----------------|---|--|-----------------|
| Operating mode | Define the output as a pulse, frequency or switch output. | PulseFrequencySwitch | Pulse |

Configuring the pulse output

Navigation

"Setup" menu \rightarrow Pulse/frequency/switch output

| Pulse/frequency/switch output | |
|-------------------------------|----------|
| Assign pulse output 1 |) → 🗎 82 |
| Value per pulse |) → 🗎 82 |
| Pulse width |) → 🗎 82 |
| Failure mode |) → 🗎 82 |
| Invert output signal | } → 🗎 82 |

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------------|---|--|---|---|
| Assign pulse output 1 | The Pulse option is selected in Operating mode parameter. | Select process variable for pulse output. | Off Volume flow Corrected volume flow Mass flow Total mass flow* Energy flow* Heat flow difference* | Volume flow |
| Value per pulse | The Pulse option is selected in the Operating mode parameter ($\rightarrow \boxminus 81$) and a process variable is selected in the Assign pulse output parameter ($\rightarrow \boxminus 82$). | Enter measured value at which a pulse is output. | Positive floating point number | Depends on country and nominal diameter |
| Pulse width | The Pulse option is selected in the Operating mode parameter ($\rightarrow \boxminus 81$) and a process variable is selected in the Assign pulse output parameter ($\rightarrow \boxminus 82$). | Define time width of the output pulse. | 5 to 2 000 ms | 100 ms |
| Failure mode | The Pulse option is selected in the Operating mode parameter ($\rightarrow \boxminus 81$) and a process variable is selected in the Assign pulse output parameter ($\rightarrow \boxminus 82$). | Define output behavior in alarm condition. | Actual valueNo pulses | No pulses |
| Invert output signal | - | Invert the output signal. | NoYes | No |

* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu \rightarrow Pulse/frequency/switch output

| Pulse/frequency/switch output | |
|--------------------------------------|----------|
| Assign frequency output |) → 🗎 83 |
| Minimum frequency value |) → 🗎 83 |
| Maximum frequency value |) → 🗎 84 |
| Measuring value at minimum frequency |) → 🗎 84 |
| Measuring value at maximum frequency |) → 🗎 84 |
| Failure mode |) → 🗎 84 |
| Failure frequency |] → 🖺 84 |
| Invert output signal |) → 🗎 84 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-------------------------|--|--|---|-----------------|
| Assign frequency output | The Frequency option is selected in Operating mode parameter (→ 🖹 81). | Select process variable for frequency output. | Off Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated steam pressure* Total mass flow* Energy flow* Heat flow difference* | Off |
| Minimum frequency value | The Frequency option is selected in the Operating mode parameter ($\rightarrow \square 81$) and a process variable is selected in the Assign frequency output parameter ($\rightarrow \square 83$). | Enter minimum frequency. | 0 to 1 000 Hz | 0 Hz |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|--|---|---|---|
| Maximum frequency value | The Frequency option is selected in the Operating mode parameter ($\rightarrow \cong 81$) and a process variable is selected in the Assign frequency output parameter ($\rightarrow \cong 83$). | Enter maximum frequency. | 0 to 1000 Hz | 1 000 Hz |
| Measuring value at minimum frequency | The Frequency option is selected in the Operating mode parameter ($\rightarrow \cong 81$) and a process variable is selected in the Assign frequency output parameter ($\rightarrow \cong 83$). | Enter measured value for minmum frequency. | Signed floating-point number | Depends on country and nominal diameter |
| Measuring value at maximum frequency | The Frequency option is selected in the Operating mode parameter ($\rightarrow \implies 81$) and a process variable is selected in the Assign frequency output parameter ($\rightarrow \implies 83$). | Enter measured value for maximum frequency. | Signed floating-point number | Depends on country and nominal diameter |
| Failure mode | The Frequency option is selected in the Operating mode parameter ($\rightarrow \cong 81$) and a process variable is selected in the Assign frequency output parameter ($\rightarrow \cong 83$). | Define output behavior in alarm condition. | Actual valueDefined value0 Hz | 0 Hz |
| Failure frequency | In the Operating mode parameter ($\rightarrow \bowtie 81$), the Frequency option is selected, in the Assign frequency output parameter ($\rightarrow \bowtie 83$) a process variable is selected, and in the Failure mode parameter, the Defined value option is selected. | Enter frequency output value in alarm condition. | 0.0 to 1250.0 Hz | 0.0 Hz |
| Invert output signal | - | Invert the output signal. | NoYes | No |

* Visibility depends on order options or device settings

Configuring the switch output

Navigation

"Setup" menu \rightarrow Pulse/frequency/switch output

| Pulse/frequency/switch output | | | | |
|-------------------------------|--------|--|--|--|
| Switch output function | → 🗎 85 | | | |
| Assign diagnostic behavior | → 🗎 85 | | | |
| Assign limit | → 🖺 85 | | | |
| Assign status | → 🗎 85 | | | |

| Switch-on value |) → 🗎 85 |
|----------------------|----------|
| Switch-off value | → 🗎 86 |
| Switch-on delay | → 🗎 86 |
| Switch-off delay |) → 🗎 86 |
| Failure mode | → 🗎 86 |
| Invert output signal | → 🗎 86 |
| | |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------------|---|---|--|--|
| Switch output function | The Switch option is selected in the Operating mode parameter. | Select function for switch output. | Off On Diagnostic behavior Limit Status | Off |
| Assign diagnostic behavior | In the Operating mode parameter, the Switch option is selected. In the Switch output function parameter, the Diagnostic behavior option is selected. | Select diagnostic behavior for switch output. | AlarmAlarm or warningWarning | Alarm |
| Assign limit | The Switch option is selected in Operating mode parameter. The Limit option is selected in Switch output function parameter. | Select process variable for limit function. | Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated steam pressure* Total mass flow* Energy flow* Heat flow difference Reynolds number* Totalizer 1 Totalizer 2 Totalizer 3 | Volume flow |
| Assign status | The Switch option is selected in Operating mode parameter. The Status option is selected in Switch output function parameter. | Select device status for switch output. | Low flow cut off | Low flow cut off |
| Switch-on value | The Switch option is selected in the Operating mode parameter. The Limit option is selected in the Switch output function parameter. | Enter measured value for the switch-on point. | Signed floating-point number | Depends on country: • 0 m ³ /h • 0 ft ³ /h |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------|---|--|---|--|
| Switch-off value | The Switch option is selected in the Operating mode parameter. The Limit option is selected in the Switch output function parameter. | Enter measured value for the switch-off point. | Signed floating-point number | Depends on country: • 0 m ³ /h • 0 ft ³ /h |
| Switch-on delay | The Switch option is selected in the Operating mode parameter. The Limit option is selected in the Switch output function parameter. | Define delay for the switch-on of status output. | 0.0 to 100.0 s | 0.0 s |
| Switch-off delay | The Switch option is selected in the Operating mode parameter. The Limit option is selected in the Switch output function parameter. | Define delay for the switch-off of status output. | 0.0 to 100.0 s | 0.0 s |
| Failure mode | - | Define output behavior in alarm condition. | Actual statusOpenClosed | Open |
| Invert output signal | - | Invert the output signal. | NoYes | No |

* Visibility depends on order options or device settings

10.4.7 Configuring the local display

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

Navigation

"Setup" menu → Display

| ► Display | |
|-----------------------|--------|
| Format display | → 🗎 87 |
| Value 1 display | → 🖺 87 |
| 0% bargraph value 1 | → 🗎 87 |
| 100% bargraph value 1 | → 🗎 87 |
| Value 2 display | → 🗎 87 |
| Value 3 display | → 🗎 87 |
| 0% bargraph value 3 | → 🗎 87 |
| 100% bargraph value 3 | → 🖺 87 |
| Value 4 display | → 🗎 87 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------------|---|--|--|--|
| Format display | A local display is provided. | Select how measured values are shown on the display. | 1 value, max. size 1 bargraph + 1 value 2 values 1 value large + 2 values 4 values | 1 value, max. size |
| Value 1 display | A local display is provided. | Select the measured value that is shown on the local display. | Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Condensate mass flow* Energy flow* Heat flow difference* Reynolds number* Density* Pressure* Specific volume* Degrees of superheat* Totalizer 1 Totalizer 3 Current output 1 Current output 2* | Volume flow |
| 0% bargraph value 1 | A local display is provided. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific: • 0 m ³ /h • 0 ft ³ /h |
| 100% bargraph value 1 | A local display is provided. | Enter 100% value for bar graph display. | Signed floating-point number | Depends on country and nominal diameter |
| Value 2 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \cong 87$) | None |
| Value 3 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter (→ 🗎 87) | None |
| 0% bargraph value 3 | A selection was made in the Value 3 display parameter. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific: • 0 m ³ /h • 0 ft ³ /h |
| 100% bargraph value 3 | A selection was made in the Value 3 display parameter. | Enter 100% value for bar graph display. | Signed floating-point number | 0 |
| Value 4 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \square 87$) | None |
| Value 5 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \cong 87$) | None |
| Value 6 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \square 87$) | None |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------|------------------------------|--|---|-----------------|
| Value 7 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\Rightarrow \square 87$) | None |
| Value 8 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \square 87$) | None |

* Visibility depends on order options or device settings

10.4.8 Configuring the output conditioning

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

Navigation

"Setup" menu → Output conditioning

| ► Output conditioning | |
|-----------------------|--------|
| Display damping | → 🖹 88 |
| Damping output 1 | → 🖹 88 |
| Damping output 2 | → 🗎 88 |
| Damping output 2 | → 🗎 88 |

Parameter overview with brief description

| Parameter | Prerequisite | Description | User entry | Factory setting |
|------------------|---|---|----------------|-----------------|
| Display damping | - | Set display reaction time to fluctuations in the measured value. | 0.0 to 999.9 s | 0.0 s |
| Damping output 1 | - | Set the reaction time of the output signal of the current output to fluctuations in the measured value. | 0 to 999.9 s | 1 s |
| Damping output 2 | The measuring device has a second current output. | Set the reaction time of the output signal of the second current output to fluctuations in the measured value. | 0 to 999.9 s | 1 s |
| Damping output 2 | The measuring device has a pulse/frequency/switch output. | Set the reaction time of the output signal of the frequency output to fluctuations in the measured value. | 0 to 999.9 s | 1 s |

10.4.9 Configuring the low flow cut off

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

The measuring signal must have a certain minimum signal amplitude so that the signals can be evaluated without any errors. Using the nominal diameter, the corresponding flow can also be derived from this amplitude.

The minimum signal amplitude depends on the setting for the sensitivity of the DSC sensor, the steam quality \mathbf{x} and the force of the vibrations present \mathbf{a} .

The value **mf** corresponds to the lowest measurable flow velocity without vibration (no wet steam) for a density of 1 kg/m^3 (0.0624 lbm/ft^3).

The value **mf** can be set in the range of 20 to 6 m/s (6 to 1.8 ft/s) (factory setting 12 m/s (3.7 ft/s)) with the **Sensitivity** parameter (value range 1 to 9, factory setting 5).

Navigation

"Setup" menu \rightarrow Low flow cut off

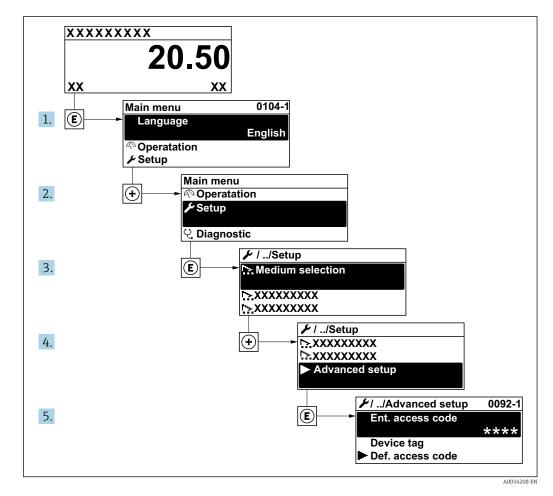
| ► Low flow cut off | |
|--------------------|----------|
| Sensitivity |) → 🗎 89 |
| Turn down |) → 🗎 89 |

| Parameter | Description | User entry | Factory setting |
|-------------|--|-------------|-----------------|
| Sensitivity | Adjust sensitivity of the device in the lower flow range. Lower sensitivity leads to more robustness against external interference. | 1 to 9 | 5 |
| | The parameter determines the level of sensitivity at the lower end of the measuring range (start of measuring range). Low values can improve the robustness of the device with regard to external influences. The start of measuring range is then set to a higher value. The smallest specified measuring range is when sensitivity is at a maximum. | | |
| Turn down | Adjust the turn down. Lower turn down increases the minimum measureable flow frequency. | 50 to 100 % | 100 % |
| | The measuring range can be limited with this parameter, if necessary. The upper end of the measuring range is not affected. The start of the low end of the measuring range can be changed to a higher flow value, making it possible to cut off low flows, for example. | | |

10.5 Advanced settings

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

Navigation to the "Advanced setup" submenu

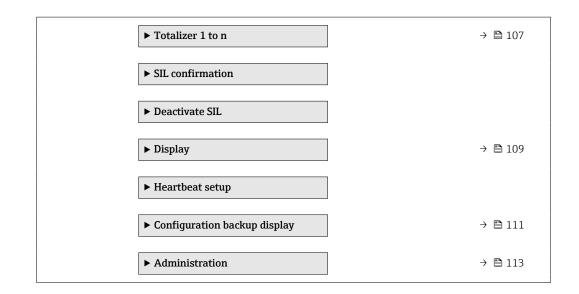


The number of submenus and parameters can vary depending on the device version. Certain submenus and parameters in these submenus are not described in the Operating Instructions. Instead a description is provided in the Special Documentation for the device ("Supplementary documentation").

Navigation

"Setup" menu → Advanced setup

| ► Advanced setup | |
|-------------------------|---------|
| Enter access code | |
| ► Medium properties | → 🗎 91 |
| ► External compensation | → 🗎 104 |
| ► Sensor adjustment | → 🖺 106 |



10.5.1 Setting the medium properties

In the **Medium properties** submenu the reference values for the measuring application can be set.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Medium properties

| ► Medium properties | |
|----------------------------------|----------|
| Enthalpy type |] → 🗎 92 |
| Calorific value type |] → 🗎 92 |
| Reference combustion temperature |] → 🗎 92 |
| Reference density |] → 🗎 92 |
| Reference gross calorific value |] → 🗎 92 |
| Reference pressure |) → 🗎 93 |
| Reference temperature |] → 🗎 93 |
| Reference Z-factor |) → 🗎 93 |
| Linear expansion coefficient |] → 🗎 93 |
| Relative density |] → 🗎 93 |
| Specific heat capacity |] → 🗎 93 |
| Calorific value |] → 🗎 94 |
| Z-factor | → 🗎 94 |

| ► Gas composition |] → 🗎 94 |
|-------------------|----------|
| Dynamic viscosity |) → 🗎 94 |
| Dynamic viscosity | → 🗎 94 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------------------|--|---|--|-------------------------------|
| Enthalpy type | The following conditions are met: In the Select gas type parameter, the User- specific gas option is selected. Or In the Select liquid type parameter, the User- specific liquid option is selected. | Define which kind of enthalpy is used. | Heat Calorific value | Heat |
| Calorific value type | The Calorific value type parameter is visible. | Select calculation based on gross calorific value or net calorific value. | Gross calorific value volume Net calorific value volume Gross calorific value mass Net calorific value mass | Gross calorific value mass |
| Reference combustion temperature | The Reference combustion temperature parameter is visible. | Enter reference combustion temperature to calculate the natural gas energy value. <i>Dependency</i> The unit is taken from the Temperature unit parameter | −200 to 450 °C | 20 °C |
| Reference density | The following conditions are met: In the Select gas type parameter, the User-specific gas option is selected. Or In the Select liquid type parameter, the Water option or User-specific liquid option is selected. | Enter fixed value for reference density. <i>Dependency</i> The unit is taken from the Density unit parameter | 0.01 to 15 000 kg/m ³ | 1000 kg/m ³ |
| Reference gross calorific value | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-3 option is selected. | Enter reference gross calorific value of the natural gas. <i>Dependency</i> The unit is taken from the Calorific value unit parameter | Positive floating- point number | 50 000 kJ/Nm³ |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|------------------------------|---|---|--|-------------------------|
| Reference pressure | The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Gas option is selected in the Select medium parameter parameter. | Enter reference pressure for the calulation of the reference density. <i>Dependency</i> The unit is taken from the Pressure unit parameter. | 0 to 250 bar | 1.01325 bar |
| Reference temperature | The following conditions are met: In the Select medium parameter, the Gas option is selected. Or In the Select medium parameter, the Liquid option is selected. | Enter reference temperature for calculating the reference density. <i>Dependency</i> The unit is taken from: Temperature unit parameter | −200 to 450 °C | 0 °C |
| Reference Z-factor | In the Select gas type parameter, the User-specific gas option is selected. | Enter real gas constant Z for gas under reference conditions. | 0.1 to 2 | 1 |
| Linear expansion coefficient | The following conditions are met: The Liquid option is selected in the Select medium parameter. The User-specific liquid option is selected in the Select liquid type parameter. | Enter linear, medium-specific expansion coefficient for calculating the reference density. | 1.0 · 10 ⁻⁶ to 2.0 · 10 ⁻³ | 2.06 · 10 ⁻⁴ |
| Relative density | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-3 option is selected. | Enter a relative density of the natural gas. | 0.55 to 0.9 | 0.664 |
| Specific heat capacity | The following conditions are met: Selected medium: In the Select gas type parameter, the User-specific gas option is selected. Or In the Select liquid type parameter, the User-specific liquid option is selected. In the Enthalpy type parameter, the Heat option is selected. | Enter the specific heat capacity of the medium. <i>Dependency</i> The unit is taken from the Specific heat capacity unit parameter | 0 to 50 kJ/(kgK) | 4.187 kJ/(kgK) |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------------------|--|---|------------------------------------|-----------------|
| Calorific value | The following conditions are met: Selected medium: In the Select gas type parameter, the User-specific gas option is selected. Or In the Select liquid type parameter, the User-specific liquid option is selected. In the Enthalpy type parameter, the Calorific value option is selected. In the Calorific value type parameter, the Gross calorific value volume option or Gross calorific value mass option is selected. | Enter gross calorific value to calculate the energy flow. | Positive floating- point number | 50 000 kJ/kg |
| Z-factor | In the Select gas type parameter, the User-specific gas option is selected. | Enter real gas constant Z for gas under operation conditions. | 0.1 to 2.0 | 1 |
| Dynamic viscosity (Gases) | The following conditions are met: Order code for "Sensor version", Option "Volume" or Option "Volume high temperature" The Gas option or the Steam option is selected in the Select medium parameter. or The User-specific gas option is selected in the Select gas type parameter. | Enter fixed value for dynamic viscosity for a gas/steam. <i>Dependency</i> The unit is taken from the Dynamic viscosity unit parameter. | Positive floating- point number | 0.015 cP |
| Dynamic viscosity (Liquids) | The following conditions are met: Order code for "Sensor version", Option "Volume" or Option "Volume high temperature" The Liquid option is selected in the Select medium parameter parameter. or The User-specific liquid option is selected in the Select liquid type parameter. | Enter fixed value for dynamic viscosity for a liquid. <i>Dependency</i> The unit is taken from the Dynamic viscosity unit parameter. | Positive floating- point number | 1 cP |

Configuring the gas composition

In the **Gas composition** submenu the gas composition for the measuring application can be set.

Navigation "Setup" menu \rightarrow Advanced setup \rightarrow Medium properties \rightarrow Gas composition

| ► Gas composition | ı | |
|-------------------|---------------|---------|
| | Gas mixture | → 🗎 97 |
| | Mol% Ar | → 🗎 97 |
| | Mol% C2H3Cl | → 🗎 97 |
| | Mol% C2H4 | → 🗎 98 |
| | Mol% C2H6 | → 🗎 98 |
| | Mol% C3H8 | → 🗎 98 |
| | Mol% CH4 | → 🗎 98 |
| | Mol% Cl2 | → 🗎 99 |
| | Mol% CO | → 🗎 99 |
| | Mol% CO2 | → 🗎 99 |
| | Mol% H2 | → 🗎 99 |
| | Mol% H2O | → 🗎 100 |
| | Mol% H2S | → 🗎 100 |
| | Mol% HCl | → 🗎 100 |
| | Mol% He | → 🗎 100 |
| | Mol% i-C4H10 | → 🗎 101 |
| | Mol% i-C5H12 | → 🗎 101 |
| | Mol% Kr | → 🗎 101 |
| | Mol% N2 | → 🗎 101 |
| | Mol% n-C10H22 | → 🗎 101 |
| | Mol% n-C4H10 | → 🗎 102 |
| | Mol% n-C5H12 | → 🗎 102 |

| Mol% n-C6H14 | - | → 🗎 102 |
|----------------|---|---------|
| | | |
| Mol% n-C7H16 | | → 🖺 102 |
| | | |
| Mol% n-C8H18 | - | → 🖺 103 |
| | | |
| Mol% n-C9H2O | - | → 🖺 103 |
| | | |
| Mol% Ne | - | → 🖺 103 |
| | | |
| Mol% NH3 | - | → 🖺 103 |
| | | |
| Mol% O2 | - | → 🗎 103 |
| | | |
| Mol% SO2 | - | → 🖺 104 |
| | | |
| Mol% Xe | - | → 🖺 104 |
| | | |
| Mol% other gas | - | → 🖺 104 |
| | | |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-------------|--|---|---|-----------------|
| Gas mixture | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. | Select measured gas mixture. | Hydrogen H2 Helium He Neon Ne Argon Ar Krypton Kr Xenon Xe Nitrogen N2 Oxygen O2 Chlorine Cl2 Ammonia NH3 Carbon monoxide CO Carbon dioxide CO2 Sulfur dioxide SO2 Hydrogen sulfide H2S Hydrogen chloride HCI Methane CH4 Ethane C2H6 Propane C3H8 Butane C4H10 Ethylene C2H4 Vinyl Chloride C2H3CI Others | Methane CH4 |
| Mol% Ar | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Argon Ar option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% C2H3Cl | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Vinyl Chloride C2H3Cl option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------|--|---|---------------------------|-----------------|
| Mol% C2H4 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Ethylene C2H4 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% C2H6 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Ethane C2H6 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mo1% C3H8 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Propane C3H8 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% CH4 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Methane CH4 option is selected. Or In the Select gas type parameter, the Natural gas option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 100 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------|--|---|---------------------------|-----------------|
| Mol% Cl2 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Chlorine Cl2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% CO | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Carbon monoxide CO option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% CO2 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Carbon dioxide CO2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% H2 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Hydrogen H2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the AGA Nx19 option is not selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------|--|---|---------------------------|-----------------|
| Mol% H2O | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% H2S | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Hydrogen sulfide H2S option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% HCl | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Hydrogen chloride HCl option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% He | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Helium He option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213- 2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---------------|---|---|---------------------------|-----------------|
| Mol% i-C4H10 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% i-C5H12 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% Kr | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Krypton Kr option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% N2 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Nitrogen N2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the AGA Nx19 option or the ISO 12213- 2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% n-C10H22 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|--------------|--|---|---------------------------|-----------------|
| Mol% n-C4H10 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Butane C4H10 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213- 2 option is selected. Or In the Select medium parameter, the Liquid option is selected and in the Select medium parameter, the Liquid option is selected and in the Select medium parameter, the Liquid option is selected and in the Select and in the Select medium parameter, the Liquid option is selected and in the Select liquid type parameter, the LPG option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% n-C5H12 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% n-C6H14 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% n-C7H16 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|--------------|--|---|---------------------------|-----------------|
| Mol% n-C8H18 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% n-C9H2O | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% Ne | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Neon Ne option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% NH3 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Ammonia NH3 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% O2 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Oxygen O2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213- 2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------|---|---|---------------------------|-----------------|
| Mol% SO2 | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Sulfur dioxide SO2 option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% Xe | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Xenon Xe option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |
| Mol% other gas | The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Others option is selected. | Enter amount of substance for the gas mixture. | 0 to 100 % | 0 % |

10.5.2 Performing external compensation

The **External compensation** submenu contains parameters which can be used to enter external or fixed values. These values are used for internal calculations.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow External compensation

| ► External compensation | |
|-------------------------|---------|
| External value | → ● 105 |
| Atmospheric pressure | → 🗎 105 |
| Delta heat calculation | → 🗎 105 |
| Fixed density | → 🗎 105 |
| Fixed density | → 🗎 105 |
| Fixed temperature | → ➡ 105 |

→ 🗎 105

→ 🖺 105

Parameter overview with brief description

2nd temperature delta heat

Fixed process pressure

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------------|---|---|--|-------------------------|
| External value | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Assign variable from external device to process variable. For detailed information on the calculation of the measured variables with steam: | Off Pressure Gauge pressure Density 2nd temperature delta heat | Off |
| Atmospheric pressure | In the External value parameter, the Gauge pressure option is selected. | Enter atmospheric pressure value to be used for pressure correction. <i>Dependency</i> The unit is taken from the Pressure unit parameter | 0 to 250 bar | 1.01325 bar |
| Delta heat calculation | The Delta heat calculation parameter is visible. | Calculates the transferred heat of a heat exchanger (= delta heat). | Off Device on cold side Device on warm side | Device on warm side |
| Fixed density | With order code for "Sensor version": Option "Volume" or Option "Volume high temperature" | Enter fixed value for medium density. <i>Dependency</i> The unit is taken from the Density unit parameter. | 0.01 to 15 000 kg/m ³ | 1 000 kg/m ³ |
| Fixed density | With order code for "Sensor version": Option "Volume" or Option "Volume high temperature" | Enter fixed value for medium density. <i>Dependency</i> The unit is taken from the Density unit parameter. | 0.01 to 15 000 kg/m ³ | 5 kg/m ³ |
| Fixed temperature | - | Enter a fixed value for process temperature. <i>Dependency</i> The unit is taken from the Temperature unit parameter | -200 to 450 °C | 20 °C |
| 2nd temperature delta heat | The 2nd temperature delta heat parameter is visible. | Enter 2nd temperature value to calculate the delta heat. <i>Dependency</i> The unit is taken from the Temperature unit parameter | −200 to 450 °C | 20 °C |
| Fixed process pressure | The following conditions are met: Order code for "Sensor version", Option "Mass flow (integrated temperature measurement)" In the External value parameter (→ Pressure option is not selected. | Enter fixed value for process pressure. Dependency The unit is taken from the Pressure unit parameter. For detailed information on the calculation of the measured variables with steam: | 0 to 250 bar abs. | 0 bar abs. |

10.5.3 Carrying out a sensor adjustment

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

Navigation

 $\texttt{"Setup"} \texttt{menu} \rightarrow \texttt{Advanced setup} \rightarrow \texttt{Sensor adjustment}$

| ► Sensor adjustment | |
|----------------------|-----------|
| Inlet configuration |) → 🗎 106 |
| Inlet run |) → 🗎 106 |
| Mating pipe diameter |) → 🗎 106 |
| Installation factor | → 🗎 106 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|----------------------|---|--|---|--------------------------------------|
| Inlet configuration | The inlet run correction feature: Is a standard feature and can only be used in the Prowirl F 200. Can be used for the following pressure ratings and nominal diameters: DN 15 to 150 (NPS 1 to 6) EN (DIN) ASME B16.5, Sch. 40/80 JIS B2220 | Select inlet configuration. | Off Single elbow Double elbow Double elbow 3D Reduction | Off |
| Inlet run | The inlet run correction feature: Is a standard feature and can only be used in the Prowirl F 200. Can be used for the following pressure ratings and nominal diameters: DN 15 to 150 (NPS 1 to 6) EN (DIN) ASME B16.5, Sch. 40/80 JIS B2220 | Define length of the straight inlet run. <i>Dependency</i> The unit is taken from: Length unit parameter | 0 to 20 m | 0 m |
| Mating pipe diameter | - | Enter diameter of mating pipe to enable diameter mismatch correction. Detailed information on diameter mismatch correction: $\rightarrow \cong 107$ <i>Dependency</i> The unit is taken from the Length unit parameter. | 0 to 1 m (0 to 3 ft) Input value = 0: Diameter mismatch correction is disabled. | Country-specific: • 0 m • 0 ft |
| Installation factor | - | Enter factor to adjust for installation conditions. | Positive floating- point number | 1.0 |

Diameter mismatch correction

The measuring device is calibrated according to the ordered process connection. This calibration takes account of the edge at the transition from the mating pipe to the process connection. If the mating pipe used deviates from the ordered process connection, a diameter mismatch correction can compensate for the effects. The difference between the internal diameter of the ordered process connection and the internal diameter of the mating pipe used must be taken into consideration.

The measuring device can correct shifts in the calibration factor which are caused, for example, by a diameter mismatch between the device flange (e.g. ASME B16.5/Sch. 80, DN 50 (2")) and the mating pipe (e.g. ASME B16.5/Sch. 40, DN 50 (2")). Only apply diameter mismatch correction within the following limit values (listed below) for which test measurements have also been performed.

Disc (wafer flange):

- DN 15 ($\frac{1}{2}$): ±15 % of the internal diameter
- DN 25 (1"): ±12 % of the internal diameter
- DN 40 $(1\frac{1}{2})$: ±9 % of the internal diameter
- $DN \ge 50$ (2"): ± 8 % of the internal diameter

If the standard internal diameter of the ordered process connection differs from the internal diameter of the mating pipe, an additional measuring uncertainty of approx. 2 % o.r. must be expected.

Example

Influence of the diameter mismatch without using the correction function:

- Mating pipe DN 100 (4"), Schedule 80
- Device flange DN 100 (4"), Schedule 40
- This installation position results in a diameter mismatch of 5 mm (0.2 in). If the correction function is not used, an additional measuring uncertainty of approx. 2 % o.r. must be expected.
- If the basic conditions are met and the feature is enabled, the additional measuring uncertainty is 1 % o.r.

10.5.4 Configuring the totalizer

In the "Totalizer 1 to n" submenu, you can configure the specific totalizer.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Totalizer 1 to n

| ► Totalizer 1 to n | |
|-------------------------|-----------|
| Assign process variable |) → 🗎 108 |
| Unit totalizer 1 to n |] → 🗎 108 |
| Failure mode |) → 🗎 108 |

| Parameter | Prerequisite | Description | Selection | Factory setting |
|-------------------------|---|---|---|--|
| Assign process variable | - | Select process variable for totalizer. | Off Volume flow Corrected volume flow Mass flow Mass flow * Total mass flow * Condensate mass flow * Energy flow * Heat flow difference * | Totalizer 1: Volume flow Totalizer 2: Mass flow Totalizer 3: Corrected volume flow |
| Unit totalizer 1 to n | A process variable is selected in the Assign process variable parameter ($\rightarrow \bowtie$ 108) of the Totalizer 1 to n submenu. | Select process variable totalizer unit. | Unit choose list | Depends on country: • m ³ • ft ³ |
| Failure mode | A process variable is selected in the Assign process variable parameter ($\rightarrow \bowtie 108$) of the Totalizer 1 to n submenu. | Define totalizer behavior in alarm condition. | StopActual valueLast valid value | Stop |

* Visibility depends on order options or device settings

10.5.5 Carrying out additional display configurations

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

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Display

| ► Display | |
|-----------------------|-----------|
| Format display | → 🗎 110 |
| Value 1 display |] → 🗎 110 |
| 0% bargraph value 1 |] → 🗎 110 |
| 100% bargraph value 1 | → 🗎 110 |
| Decimal places 1 | → 🗎 110 |
| Value 2 display | → 🗎 110 |
| Decimal places 2 |) → 🗎 110 |
| Value 3 display |] → 🗎 110 |
| 0% bargraph value 3 |] → 🗎 110 |
| 100% bargraph value 3 |] → 🗎 110 |
| Decimal places 3 |) → 🗎 111 |
| Value 4 display |] → 🗎 111 |
| Decimal places 4 |] → 🗎 111 |
| Language |] → 🗎 111 |
| Display interval |] → 🗎 111 |
| Display damping |] → 🗎 111 |
| Header |] → 🗎 111 |
| Header text |] → 🗎 111 |
| Separator |] → 🗎 111 |
| Backlight | → 🗎 111 |

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------------|--|--|---|--|
| Format display | A local display is provided. | Select how measured values are shown on the display. | 1 value, max. size 1 bargraph + 1 value 2 values 1 value large + 2 values 4 values | 1 value, max. size |
| Value 1 display | A local display is provided. | Select the measured value that is shown on the local display. | Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Condensate mass flow* Energy flow* Heat flow difference* Reynolds number* Density* Pressure* Specific volume* Degrees of superheat* Totalizer 1 Totalizer 2 Totalizer 3 Current output 1 Current output 2* | Volume flow |
| 0% bargraph value 1 | A local display is provided. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific: • 0 m ³ /h • 0 ft ³ /h |
| 100% bargraph value 1 | A local display is provided. | Enter 100% value for bar graph display. | Signed floating-point number | Depends on country and nominal diameter |
| Decimal places 1 | A measured value is specified in the Value 1 display parameter. | Select the number of decimal places for the display value. | x x.x x.xx x.xxx x.xxx x.xxxx | X.XX |
| Value 2 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \cong 87$) | None |
| Decimal places 2 | A measured value is specified in the Value 2 display parameter. | Select the number of decimal places for the display value. | X X.X X.XX X.XXX X.XXX X.XXXX | x.xx |
| Value 3 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter ($\rightarrow \square 87$) | None |
| 0% bargraph value 3 | A selection was made in the Value 3 display parameter. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific: • 0 m ³ /h • 0 ft ³ /h |
| 100% bargraph value 3 | A selection was made in the Value 3 display parameter. | Enter 100% value for bar graph display. | Signed floating-point number | 0 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|------------------|--|---|---|--|
| Decimal places 3 | A measured value is specified in the Value 3 display parameter. | Select the number of decimal places for the display value. | x x.x x.xx x.xxx x.xxx x.xxxx | x.xx |
| Value 4 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see Value 1 display parameter (→ 🗎 87) | None |
| Decimal places 4 | A measured value is specified in the Value 4 display parameter. | Select the number of decimal places for the display value. | x x.x x.xx x.xxx x.xxx x.xxxx | X.XX |
| Language | A local display is provided. | Set display language. | English Deutsch* Français* Español* Italiano* Nederlands* Portuguesa* Polski* pycский язык (Russian)* Svenska* Türkçe* 中文 (Chinese)* 日本語 (Japanese)* 한국어 (Korean)* tiếng Việt (Vietnamese)* čeština (Czech)* | English (alternatively, the ordered language is preset in the device) |
| Display interval | A local display is provided. | Set time measured values are shown on display if display alternates between values. | 1 to 10 s | 5 s |
| Display damping | A local display is provided. | Set display reaction time to fluctuations in the measured value. | 0.0 to 999.9 s | 0.0 s |
| Header | A local display is provided. | Select header contents on local display. | Device tag Free text | Device tag |
| Header text | The Free text option is selected in the Header parameter. | Enter display header text. | Max. 12 characters, such as letters, numbers or special characters (e.g. @, %, /) | |
| Separator | A local display is provided. | Select decimal separator for displaying numerical values. | . (point) , (comma) | . (point) |
| Backlight | Order code for "Display; operation", option E "SD03 4- line, illum.; touch control + data backup function" | Switch the local display backlight on and off. | DisableEnable | Disable |

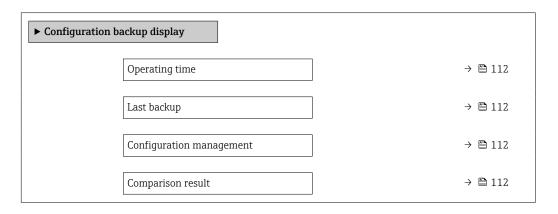
* Visibility depends on order options or device settings

10.5.6 Configuration management

After commissioning, you can save the current device configuration, copy it to another measuring point or restore the previous device configuration. The device configuration is managed via the **Configuration management** parameter.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Configuration backup display



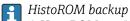
Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface / Selection | Factory setting |
|--------------------------|------------------------------|--|--|-----------------|
| Operating time | - | Indicates how long the device has been in operation. | Days (d), hours (h), minutes (m) and seconds (s) | - |
| Last backup | A local display is provided. | Indicates when the last data backup was saved to the display module. | Days (d), hours (h), minutes (m) and seconds (s) | - |
| Configuration management | A local display is provided. | Select action for managing the device data in the display module. | Cancel Execute backup Restore Duplicate Compare Clear backup data | Cancel |
| Comparison result | A local display is provided. | Comparison between present device data and display backup. | Settings identical Settings not identical No backup available Backup settings corrupt Check not done Dataset incompatible | Check not done |

Function range of "Configuration management" parameter

| Options | Description |
|----------------|--|
| Cancel | No action is executed and the user exits the parameter. |
| Execute backup | A backup copy of the current device configuration is saved from the HistoROM backup to the display module of the device. The backup copy includes the transmitter data of the device. |
| Restore | The complete backup data from the original device is restored. This option may be used only with the original device and not with another device. The comparison function must be used to verify the serial numbers before the restore option can be used. |
| Compare | The device configuration saved in the display module is compared with the current device configuration of the HistoROM backup. |

| Options | Description |
|-------------------|---|
| Duplicate | The transmitter configuration from another device is duplicated to the device using the display module. |
| Clear backup data | The backup copy of the device configuration is deleted from the display module of the device. |



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

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

10.5.7 Using parameters for device administration

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

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Administration

| ► Administration | |
|----------------------|---------|
| ► Define access code | |
| Device reset (0000) | → 🗎 113 |

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. | CancelTo factory defaultsTo delivery settingsRestart device | Cancel |

"Define access code" wizard

Complete this wizard to specify an access code for the Maintenance role.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Administration \rightarrow Define access code \rightarrow Define access code

| ► Define access code | |
|----------------------|-----------|
| Define access code |) → 🗎 114 |
| Confirm access code |] → 🗎 114 |

Parameter overview with brief description

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

10.6 Configuration management

After commissioning, you can save the current device configuration, copy it to another measuring point or restore the previous device configuration. The device configuration is managed via the **Configuration management** parameter.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Configuration backup display

| ► Configuration backup display | | | |
|--------------------------------|---------|--|--|
| Operating time | → 🗎 112 | | |
| Last backup | → 🖺 112 | | |
| Configuration management | → 🗎 112 | | |
| Comparison result | → 🗎 112 | | |

Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface / Selection | Factory setting |
|--------------------------|------------------------------|--|--|-----------------|
| Operating time | - | Indicates how long the device has been in operation. | Days (d), hours (h), minutes (m) and seconds (s) | _ |
| Last backup | A local display is provided. | Indicates when the last data backup was saved to the display module. | Days (d), hours (h), minutes (m) and seconds (s) | - |
| Configuration management | A local display is provided. | Select action for managing the device data in the display module. | Cancel Execute backup Restore Duplicate Compare Clear backup data | Cancel |
| Comparison result | A local display is provided. | Comparison between present device data and display backup. | Settings identical Settings not identical No backup available Backup settings corrupt Check not done Dataset incompatible | Check not done |

| Options | Description |
|-------------------|--|
| Cancel | No action is executed and the user exits the parameter. |
| Execute backup | A backup copy of the current device configuration is saved from the HistoROM backup to the display module of the device. The backup copy includes the transmitter data of the device. |
| Restore | The complete backup data from the original device is restored. This option may be used only with the original device and not with another device. The comparison function must be used to verify the serial numbers before the restore option can be used. |
| Compare | The device configuration saved in the display module is compared with the current device configuration of the HistoROM backup. |
| Duplicate | The transmitter configuration from another device is duplicated to the device using the display module. |
| Clear backup data | The backup copy of the device configuration is deleted from the display module of the device. |

Function range of "Configuration management" parameter 10.6.1



📔 HistoROM backup

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

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

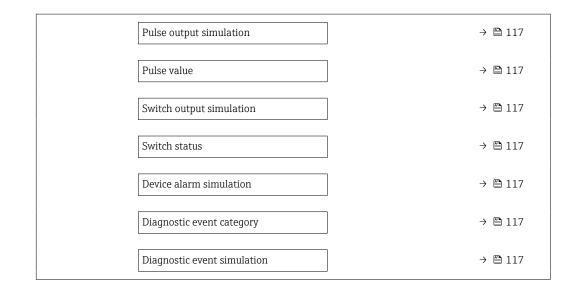
10.7 Simulation

Via the Simulation submenu, it is possible to simulate various process variables in the process and the device alarm mode and verify downstream signal chains (switching valves or closed-control loops). The simulation can be performed without a real measurement (no flow of medium through the device).

Navigation

"Diagnostics" menu → Simulation

| ► Simulation | |
|------------------------------------|---------|
| Assign simulation process variable | → 🗎 116 |
| Process variable value | → 🗎 116 |
| Current input 1 simulation | → 🗎 116 |
| Value current input 1 | → 🗎 116 |
| Current output 1 to n simulation | → 🗎 116 |
| Value current output 1 to n | → 🗎 116 |
| Frequency output simulation | → 🗎 116 |
| Frequency value | → 🗎 116 |



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 Mass flow Flow velocity Volume flow Corrected volume flow Temperature Calculated saturated steam pressure* Total mass flow* Condensate mass flow* Energy flow Heat flow difference* Reynolds number | Off |
| Process variable value | A process variable is selected in the Assign simulation process variable parameter $(\rightarrow \cong 116)$. | Enter the simulation value for the selected process variable. | Depends on the process variable selected | 0 |
| Current input 1 simulation | - | Switch simulation of the current input on and off. | • Off • On | Off |
| Value current input 1 | In the Current input simulation parameter, the On option is selected. | Enter the current value for simulation. | 3.59 to 22.5 mA | 3.59 mA |
| Current output 1 to n simulation | - | Switch the simulation of the current output on and off. | • Off • On | Off |
| Value current output 1 to n | In the Current output 1 to n simulation parameter, the On option is selected. | Enter the current value for simulation. | 3.59 to 22.5 mA | 3.59 mA |
| Frequency output simulation | In the Operating mode parameter, the Frequency option is selected. | Switch the simulation of the frequency output on and off. | • Off • On | Off |
| Frequency value | In the Frequency output simulation parameter, the On option is selected. | Enter the frequency value for the simulation. | 0.0 to 1250.0 Hz | 0.0 Hz |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|-----------------------------|---|--|---|-----------------|
| Pulse output simulation | In the Operating mode parameter, the Pulse option is selected. | Set and switch off the pulse output simulation. For Fixed value option: Pulse width parameter (→ | Off Fixed value Down-counting value | Off |
| Pulse value | In the Pulse output simulation parameter $(\rightarrow \cong 117)$, the Down- counting value option is selected. | Enter the number of pulses for simulation. | 0 to 65535 | 0 |
| Switch output simulation | In the Operating mode parameter, the Switch option is selected. | Switch the simulation of the switch output on and off. | OffOn | Off |
| Switch status | In the Switch output simulation parameter (\rightarrow) 117) Switch output simulation 1 to n parameter Switch output simulation 1 to n parameter, the On option is selected. | Select the status of the status output for the simulation. | OpenClosed | Open |
| Device alarm simulation | - | Switch the device alarm on and off. | OffOn | Off |
| Diagnostic event category | - | Select a diagnostic event category. | SensorElectronicsConfigurationProcess | Process |
| Diagnostic event simulation | - | Select a diagnostic event to simulate this event. | Off Diagnostic event picklist (depends on the category selected) | Off |

* Visibility depends on order options or device settings

10.8 Protecting settings from unauthorized access

The following options exist for protecting the configuration of the measuring device from unintentional modification after commissioning:

- Write protection via access code
- Write protection via write protection switch
- Write protection via keypad lock

10.8.1 Write protection via access code

The effects of the user-specific access code are as follows:

- Via local operation, the parameters for the measuring device configuration are writeprotected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.

Defining the access code via the local display

1. Navigate to the **Enter access code** parameter.

2. Maximum of 16-digit character string comprising numbers, letters and special characters as the access code.

- 3. Enter the access code again in the to confirm.
 - └ The B symbol appears in front of all write-protected parameters.
- Disabling parameter write protection via access code $\rightarrow \cong$ 59.
 - If the access code is lost: Resetting the access code .
 - The user role with which the user is currently logged in is displayed in **Access status display** parameter.
 - Navigation path: Operation → Access status display
 - User roles and their access rights $\rightarrow \implies 59$
- The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view.
- The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

Parameters which can always be modified via the local display

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

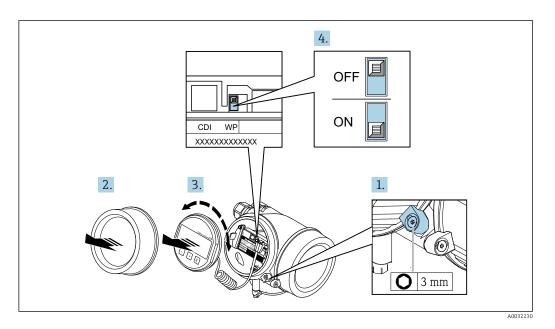
| Parameters for configuring the language | Parameters for configuring the local display | Parameters for configuring the totalizer |
|---|---|---|
| \downarrow | \downarrow | \downarrow |
| Display language | Format display | Control Totalizer |
| | Contrast display | Preset value |
| | Display interval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

10.8.2 Write protection via write protection switch

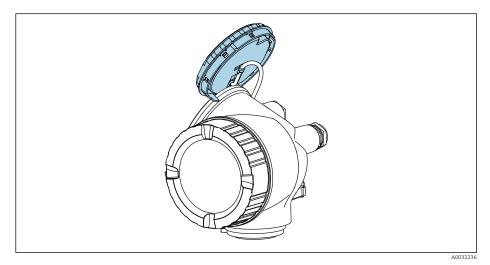
Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):

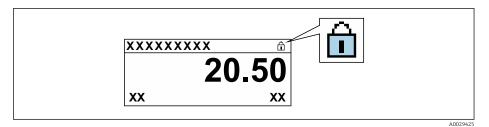
- Via local display
- Via service interface (CDI)
- Via HART protocol



- 1. Loosen the securing clamp.
- 2. Unscrew the electronics compartment cover.
- **3.** Pull out the display module with a gentle rotational movement. To make it easier to access the write protection switch, attach the display module to the edge of the electronics compartment.
 - └ Display module is attached to the edge of the electronics compartment.



- **4.** Setting the write protection switch (WP) on the main electronics module to the **ON** position enables hardware write protection. Setting the write protection switch (WP) on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.
 - └ If the hardware write protection is enabled: The Hardware locked option is displayed in the Locking status parameter . In addition to this, the B symbol appears in the header of the measured value display and in the navigation view in front of the parameters.



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

- 5. Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment in the desired direction until it engages.
- 6. Reassemble the transmitter in the reverse order.

10.9 Application-specific commissioning

10.9.1 Steam application

Select medium

Navigation:

Setup \rightarrow Medium selection

- 1. Open the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Steam** option.
- 3. When pressure measured value is read in 2 :

In the Steam calculation mode parameter, select the Automatic (p-/T- compensated) option.

- If pressure measured value is not read in: In the Steam calculation mode parameter, select the Saturated steam (T-compensated) option.
- In the Steam quality value parameter, enter the steam quality present in the pipe.
 Measuring instrument uses this value to calculate the mass flow of the steam.

Configuring the current output

6. Configure current output $\rightarrow \cong 80$.

10.9.2 Liquid application

User-specific liquid, e.g. heat carrier oil

²⁾ Pressure read in via Current input/HART/

Select medium

Navigation:

Setup \rightarrow Medium selection

1. Call up the **Medium selection** wizard.

- 2. In the **Select medium** parameter, select the **Liquid** option.
- 3. In the **Select liquid type** parameter, select the **User-specific liquid** option.
- 4. In the **Enthalpy type** parameter, select the **Heat** option.
 - Heat option: Non-flammable liquid that serves as a heat carrier.
 Calorific value option: Flammable liquid whose combustion energy is calculated.

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 5. Call up the **Medium properties** submenu.
- 6. In the **Reference density** parameter, enter the reference density of the fluid.
- 7. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
- 8. In the **Linear expansion coefficient** parameter, enter the expansion coefficient of the fluid.
- 9. In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.
- 10. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid.

10.9.3 Gas applications

For accurate mass or corrected volume measurement, it is recommended to use the pressure-/temperature-compensated sensor version. If this sensor version is not available, read in the pressure via the current input/HART. If neither of these two options is possible, the pressure can also be entered as a fixed value in the **Fixed process pressure** parameter.

Flow computer available only with the order code for "Sensor version", option "mass" (integrated temperature measurement)" or option "mass (integrated pressure/ temperature measurement)".

Single gas

Combustion gas, e. g. methane CH₄

Select medium

Navigation:

Setup \rightarrow Medium selection

1. Call up the **Medium selection** wizard.

2. In the **Select medium** parameter, select the **Gas** option.

3. In the **Select gas type** parameter, select the **Single gas** option.

4. In the **Gas type** parameter, select the **Methane CH4** option.

Configuring medium properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

5. Open the **Medium properties** submenu.

6. In the **Reference combustion temperature** parameter, enter the reference combustion temperature of the medium.

Configuring the current output

7. Configure the current output for the "energy flow" process variable $\rightarrow \cong 80$.

Configuring medium properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

8. Open the **Medium properties** submenu.

9. In the **Reference combustion temperature** parameter, enter the reference combustion temperature of the medium.

Gas mixture

Forming gas for steel mills and rolling mills, e.g. $N_{\rm 2}/H_{\rm 2}$

Select medium

Navigation:

Setup \rightarrow Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Gas** option.
- 3. In the **Select gas type** parameter, select the **Gas mixture** option.

Configuring gas composition

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties \rightarrow Gas composition

- 4. Call up the **Gas composition** submenu.
- 5. In the **Gas mixture** parameter, select the **Hydrogen H2** option and the **Nitrogen N2** option.
- 6. In the **Mol% H2** parameter, enter the quantity of hydrogen.
- 7. In the **Mol% N2** parameter, enter the quantity of nitrogen.
 - All quantities must add up to 100 %.
 The density is determined according to NEL 40.

Configuring optional fluid properties for output of corrected volume flow

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 8. Call up the **Medium properties** submenu.
- 9. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
- **10.** In the **Reference temperature** parameter, enter the reference temperature of the fluid.

Air

Select medium

Navigation:

Setup \rightarrow Medium selection

1. Call up the **Medium selection** wizard.

2. In the **Select medium** parameter ($\rightarrow \square$ 76), select the **Gas** option.

- 3. In the **Select gas type** parameter ($\rightarrow \square 76$), select the **Air** option.
 - └ The density is determined according to NEL 40.

4. Enter the value in the **Relative humidity** parameter ($\rightarrow \square 77$).

- └→ The relative humidity is entered as a %. The relative humidity is converted internally to absolute humidity and is then factored into the density calculation according to NEL 40.
- 5. In the **Fixed process pressure** parameter ($\Rightarrow \square 77$), enter the value of the process pressure present.

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

6. Call up the **Medium properties** submenu.

- **7.** In the **Reference pressure** parameter ($\rightarrow \cong$ 93) enter the reference pressure for calculating the reference density.
 - Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.
- 8. In the **Reference temperature** parameter ($\rightarrow \square 93$) enter the temperate for calculating the reference density.

Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries .

Natural gas

Select medium

Navigation:

Setup \rightarrow Medium selection

- 1. Call up the **Medium selection** wizard.
- **2.** In the **Select medium** parameter ($\rightarrow \square$ 76), select the **Gas** option.
- 3. In the **Select gas type** parameter ($\rightarrow \square 76$), select the **Natural gas** option.
- 4. In the **Fixed process pressure** parameter ($\rightarrow \square 77$), enter the value of the process pressure present.
- 5. In the **Enthalpy calculation** parameter ($\rightarrow \cong 78$), select one of the following options:
 - ➡ AGA5 ISO 6976 option (contains GPA 2172)
- **6.** In the **Density calculation** parameter ($\rightarrow \square 78$), select one of the following options.
 - GAGA Nx19 ISO 12213- 2 option (contains AGA8-DC92)
 - **ISO 12213- 3** option (contains SGERG-88, AGA8 Gross Method 1)

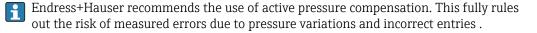
Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 7. Call up the **Medium properties** submenu.
- 8. In the **Calorific value type** parameter, select one of the options.
- 9. n the **Reference gross calorific value** parameter, enter the reference gross calorific value of the natural gas.

- 10. In the **Reference pressure** parameter ($\Rightarrow \square 93$) enter the reference pressure for calculating the reference density.
 - Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.
- 11. In the **Reference temperature** parameter ($\rightarrow \square$ 93) enter the temperate for calculating the reference density.
- 12. In the **Relative density** parameter, enter the relative density of the natural gas.



Ideal gas

The unit "corrected volume flow" is often used to measure industrial gas mixtures, in particular natural gas. To do so, the calculated mass flow is divided by a reference density. To calculate the mass flow, knowledge of the exact composition of the gas is essential. In practice, however, this information is often not available (e. g. as it varies over time). In this case, it can be useful to regard the gas as an ideal gas. This means that only the operating temperature and operating pressure variables as well as the reference temperature and reference pressure variables are needed to calculate the corrected volume flow. The error resulting from this assumption (typically 1 to 5 %) is often considerably smaller than the error caused by inaccurate composition data. This method should not be used for condensing gases (e. g. saturated steam).

Select medium

Navigation:

Setup \rightarrow Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Gas** option.
- 3. In the **Select gas type** parameter, select the **User-specific gas** option.
- 4. For non-flammable gas:

In the **Enthalpy type** parameter, select the **Heat** option.

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 5. Call up the **Medium properties** submenu.
- 6. In the **Reference density** parameter, enter the reference density of the fluid.
- 7. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
- 8. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
- 9. In the **Reference Z-factor** parameter, enter the value **1**.
- **10.** If specific heat capacity is to be measured:

In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.

- **11**. In the **Z-factor** parameter, enter the value **1**.
- **12.** In the **Dynamic viscosity** parameter, enter the viscosity of the fluid under operating conditions.

10.9.4 Calculation of the measured variables

A flow computer can be found in the electronics of the measuring device with order code for "Sensor version", option "mass (integrated temperature measurement)". This computer

can calculate the following secondary measured variables directly from the primary measured variables recorded using the pressure value (entered or external) and/or temperature value (measured or entered).

| Mass flow and c | corrected v | olume | flow |
|-----------------|-------------|-------|------|
|-----------------|-------------|-------|------|

| Medium | Fluid | Standards | Explanation |
|---------------------|---------------|---------------------|---|
| Steam ¹⁾ | Water vapor | IAPWS-IF97/ ASME | For integrated temperature measurement For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via current input/HART |
| | Single gas | NEL40 | For fixed process pressure, pressure measured directly at the meter |
| | Gas mixture | NEL40 | body or if the pressure is read in via current input/HART |
| | Air | NEL40 | |
| | Natural gas | ISO 12213-2 | Contains AGA8-DC92 For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via current input/HART |
| Gas | | AGA NX-19 | For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via current input/HART |
| | | ISO 12213-3 | Contains SGERG-88, AGA8 Gross Method 1 For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via current input/HART |
| | Other gases | Linear equation | Ideal gases For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via current input/HART |
| | Water | IAPWS-IF97/ ASME | - |
| Liquids | Liquefied gas | Tables | Propane and butane mixture |
| | Other liquid | Linear equation | Ideal liquids |

Mass flow calculation

Volume flow × operating density

- Operating density for saturated steam, water and other liquids: depends on the temperature
- Operating density for superheated steam and all other gases: depends on the temperature and process pressure

Corrected volume flow calculation

(Volume flow × operating density)/reference density

- Operating density for water and other liquids: depends on the temperature
- Operating density for all other gases: depends on the temperature and process pressure

Energy flow

| Medium | Fluid | Standards | Explanation | Heat/energy option |
|----------|------------------|---------------------|---|--|
| Steam 1) | - | IAPWS- IF97/ASME | For fixed process pressure or if the pressure is read in via current input/HART | |
| | Single gas | ISO 6976 | Contains GPA 2172 For fixed process pressure or if the pressure is read in via current input/ HART | |
| Gas | Gas mixture | ISO 6976 | Contains GPA 2172 For fixed process pressure or if the pressure is read in via current input/ HART | Heat Gross calorific value ²⁾ in relation to mass |
| Gas | Air | NEL40 | For fixed process pressure or if the pressure is read in via current input/HART | Net calorific value ³⁾ in relation to mass Gross calorific value ²⁾ in relation to correcte volume Net calorific value ³⁾ in relation to corrected volume |
| | Natural gas | ISO 6976 | Contains GPA 2172 For fixed process pressure or if the pressure is read in via current input/ HART | volume |
| | | AGA 5 | - | - |
| | Water | IAPWS- IF97/ASME | - | |
| Liquids | Liquefied gas | ISO 6976 | Contains GPA 2172 | |
| | Other liquid | Linear equation | - | |

- 1) The measuring device is capable of calculating the volume flow, and other measured variables derived from the volume flow, across all steam types with full compensation using the pressure and temperature. To configure device behavior $\rightarrow \cong 104$
- Gross calorific value: combustion energy + condensation energy of the flue gas (gross calorific value > net calorific value)
- 3) Net calorific value: only combustion energy

Mass flow and energy flow calculation

NOTICE

The process pressure (p) in the process pipe is required to calculate the process variables and the limit values of the measuring range.

Steam is calculated based on the following factors:

- Fully compensated calculation of density using the "pressure" and "temperature" measured variables
- Calculation based on overheated steam until saturation point is reached Configuration of diagnostic behavior of the **△S871 Near steam saturation limit** diagnostic message**Assign behavior of diagnostic no. 871** parameter set to **Off** option (factory setting) as standard → **□** 146

Optional configuration of diagnostic behavior to the **Alarm** option or **Warning** option $\Rightarrow \triangleq 145$ option.

At 2 K above saturation, activation of the \triangle **S871 Near steam saturation limit** diagnostic message.

- The smaller of the following two pressure values is always used to calculate the density:
 Pressure measured directly at meter body or pressure read in via current input/HART
- Saturated steam pressure, which is derived from the saturated steam line (IAPWS-IF97/ASME)
- Depending on setting in the **Steam calculation mode** parameter ($\rightarrow \square 77$)
 - If **Saturated steam (T-compensated)** option is selected, the measuring device only calculates on the saturated steam curve using temperature compensation.
 - If Automatic (p-/T-compensated) option is selected, the device calculates using full compensation either along the saturation line or in the superheated region, depending on the steam state.

For detailed information on how to perform external compensation, see $\rightarrow \cong 104$.

Calculated value

The unit calculates the mass flow, heat flow, energy flow, density and specific enthalpy from the measured volume flow and the measured temperature and/or the pressure based on international standard IAPWS-IF97/ASME.

Formulae for calculation:

- Mass flow: $\dot{m} = \dot{v} \cdot \rho$ (T, p)
- Heat flow: $\dot{Q} = \dot{v} \cdot \rho (T, p) \cdot h_D (T, p)$

 \dot{m} = Mass flow

- \dot{Q} = Heat flow
- \dot{v} = Volume flow (measured)
- h_D = Specific enthalpy
- T = Process temperature (measured)
- p = Process pressure
- $\rho = \text{Density}^{3}$

Pre-programmed gases

The following gases are pre-programmed in the flow computer:

| Hydrogen ¹⁾ | Helium 4 | Neon | Argon |
|------------------------|--------------------------------|-------------------------------|-----------------------|
| Krypton | Xenon | Nitrogen | Oxygen |
| Chlorine | Ammonia | Carbon monoxide ¹⁾ | Carbon dioxide |
| Sulfur dioxide | Hydrogen sulfide ¹⁾ | Hydrogen chloride | Methane ¹⁾ |

³⁾ From steam data as per IAPWS-IF97 (ASME), for the measured temperature and the specified pressure

| Ethane ¹⁾ | Propane ¹⁾ | Butane ¹⁾ | Ethylene (ethene) ¹⁾ |
|----------------------|--------------------------------|--------------------------------|---------------------------------|
| Vinyl chloride | Mixtures of up to 8 components | s of these gases ¹⁾ | |

1) The energy flow is calculated as per ISO 6976 (contains GPA 2172) or AGA5 - in relation to the net calorific value or gross calorific value .

Energy flow calculation

Volume flow × operating density × specific enthalpy

- Operating density for saturated steam and water: depends on the temperature
- Operating density for superheated steam, natural gas ISO 6976 (contains GPA 2172), natural gasAGA5: depends on the temperature and pressure

Heat flow difference

- Between saturated steam upstream from a heat exchanger and condensate downstream from the heat exchanger (second temperature read in via current input/HART) in accordance with IAPWS-IF97/ASME
- Between warm and cold water (second temperature read in via current input/HART) in accordance with IAPWS-IF97/ASME

Vapor pressure and steam temperature

The measuring device can perform the following in saturated steam measurements between the feed line and return line of any heating liquid (second temperature read in via current input/HART and Cp value entered:

- Calculation of saturation pressure of steam from the measured temperature and output in accordance with IAPWS-IF97/ASME
- Calculation of saturation temperature of steam from the preset pressure and output in accordance with IAPWS-IF97/ASME

11 Operation

11.1 Reading off the device locking status

Device active write protection: Locking status parameter

Operation \rightarrow Locking status

| Function scop | e of the "Locking | status" parameter |
|---------------|-------------------|-------------------|
| | | |

| Options | Description |
|--------------------|--|
| None | The access authorization displayed in the Access status display parameter applies $\rightarrow \textcircled{B}$ 59. Only appears on local display. |
| Hardware locked | The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters (e.g. via local display or operating tool) $\rightarrow \bigoplus 118$. |
| SIL locked | The SIL mode is enabled. This locks write access to the parameters (e.g. via local display or operating tool). |
| Temporarily locked | Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset, etc.). Once the internal processing has been completed, the parameters can be changed once again. |

11.2 Adjusting the operating language

Petailed information:

- To configure the operating language $\rightarrow \implies 70$
- For information on the operating languages supported by the measuring device $\rightarrow \ \textcircled{}$ 188

11.3 Configuring the display

Detailed information:

- On the basic settings for the local display \rightarrow \cong 86
- On the advanced settings for the local display $\rightarrow \cong 109$

11.4 Reading off measured values

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

Navigation

"Diagnostics" menu → Measured values → Process variables

| ► Measured values | |
|---------------------|---------|
| ► Process variables | → 🗎 130 |
| ► Totalizer | → 🗎 132 |
| ► Input values | → 🗎 132 |
| ► Output values | → 🗎 133 |

11.4.1 Process variables

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

Navigation

"Diagnostics" menu \rightarrow Measured values \rightarrow Process variables

| ► Process variabl | es | | |
|-------------------|-------------------------------------|---|---------|
| | Volume flow | | → 🖺 130 |
| | Corrected volume flow |] | → 🗎 130 |
| | Mass flow |] | → 🗎 131 |
| | Flow velocity | | → 🗎 131 |
| | Temperature | | → 🗎 131 |
| | Calculated saturated steam pressure | | → 🖺 131 |
| | Energy flow | | → 🗎 131 |
| | Heat flow difference | | → 🗎 131 |
| | Reynolds number | | → 🗎 131 |
| | Density |] | → 🗎 131 |
| | Specific volume |] | → 🗎 131 |
| | Pressure |] | → 🗎 131 |
| | Compressibility factor | | → 🗎 132 |
| | Degrees of superheat |] | → 🗎 132 |

Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface |
|-----------------------|--------------|---|---------------------------------|
| Volume flow | - | Displays the volume flow that is currently measured. | Signed floating-point number |
| | | Dependency The unit is taken from: Volume flow unit parameter (→ $$ 73) | |
| Corrected volume flow | - | Displays the corrected volume flow that is currently calculated. | Signed floating-point number |
| | | Dependency The unit is taken from the Corrected volume flow unit parameter $(\rightarrow \cong 73).$ | |

| Parameter | Prerequisite | Description | User interface |
|-------------------------------------|--|---|-----------------------------------|
| Mass flow | - | Displays the mass flow that is currently calculated. Dependency The unit is taken from the Mass flow unit parameter ($\rightarrow \square$ 73). | Signed floating-point number |
| Flow velocity | - | Displays the flow velocity that is currently calculated. Dependency The unit is taken from: Velocity unit parameter ($\rightarrow \equiv 75$) | Signed floating-point number |
| Temperature | - | Displays the temperature that is currently measured. <i>Dependency</i> The unit is taken from: Temperature unit parameter (→ 🗎 74) | Signed floating-point number |
| Calculated saturated steam pressure | The following conditions are met: Order code for "Sensor version", "Mass (integrated temperature measurement)" option The Steam option is selected in the Select medium parameter (→ 76). | Displays the saturated steam pressure that is currently calculated. <i>Dependency</i> The unit is taken from: Pressure unit parameter ($\rightarrow \square 74$) | Signed floating-point number |
| Energy flow | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Displays the energy flow that is currently calculated. <i>Dependency</i> The unit is taken from: Energy flow unit parameter (→ 🗎 74) | Signed floating-point number |
| Heat flow difference | The following conditions are met: Order code for "Sensor version" "Mass (integrated temperature measurement)" option In Select gas type parameter (→ ^(⇒) 76), one of the following options is selected: Single gas Gas mixture Natural gas User-specific gas | Displays the heat flow difference that is currently calculated. <i>Dependency</i> The unit is taken from: Energy flow unit parameter (→ 🗎 74) | Signed floating-point number |
| Reynolds number | With order code for "Sensor version": "Mass (integrated temperature measurement)" option | Displays the Reynolds number that is currently calculated. | Signed floating-point number |
| Density | With order code for "Sensor version": Option "Mass (integrated temperature measurement)" | Displays the density currently measured. <i>Dependency</i> The unit is taken from the Density unit parameter. | Positive floating-point number |
| Specific volume | With order code for "Sensor version": Option "Mass (integrated temperature measurement)" | Displays the current value for the specific volume. Dependency The unit is taken from the Specific volume unit parameter. | Positive floating-point number |
| Pressure | One of the following conditions is met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" or The Pressure option is selected in the External value parameter parameter. | Displays the current process pressure. <i>Dependency</i> The unit is taken from the Pressure unit parameter. | 0 to 250 bar |

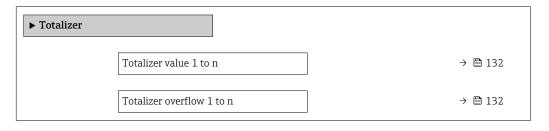
| Parameter | Prerequisite | Description | User interface |
|------------------------|---|---|----------------|
| Compressibility factor | The following conditions are met: Order code for "Sensor version" Option "Mass (integrated temperature measurement)" | Displays the compressibility factor currently calculated. | 0 to 2 |
| | The Gas option or the Steam option is selected in the Select medium parameter. | | |
| Degrees of superheat | In the Select medium parameter, the Steam option is selected. | Displays the degree of superheating currently calculated. | 0 to 500 K |

11.4.2 "Totalizer" submenu

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

Navigation

"Diagnostics" menu → Measured values → Totalizer



Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface |
|---------------------------|---|---|---------------------------------|
| Totalizer value 1 to n | One of the following options is selected in the Assign process variable parameter (→ 108) of the Totalizer 1 to n submenu: • Volume flow • Corrected volume flow • Mass flow • Total mass flow • Condensate mass flow • Energy flow • Heat flow difference | Displays the current totalizer counter value. | Signed floating-point number |
| Totalizer overflow 1 to n | One of the following options is selected in the Assign process variable parameter (→ 🗎 108) of the Totalizer 1 ton submenu: • Volume flow • Corrected volume flow • Mass flow • Total mass flow [*] • Condensate mass flow [*] • Energy flow [*] • Heat flow difference [*] | Displays the current totalizer overflow. | Integer with sign |

* Visibility depends on order options or device settings

11.4.3 Input values

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

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

Navigation

"Diagnostics" menu \rightarrow Measured values \rightarrow Input values

| ► Input values | | | |
|----------------|--------------------|---|---------|
| | Measured current 1 |] | → 🗎 133 |
| | Measured values 1 |] | → 🗎 133 |

Parameter overview with brief description

| Parameter | Description | User interface |
|--------------------|--|------------------------------|
| Measured current 1 | Displays the current value of the current input. | 3.59 to 22.5 mA |
| Measured values 1 | Displays the current input value. <i>Dependency</i> The display depends on the option selected in the External value parameter. | Signed floating-point number |

11.4.4 Output variables

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

Navigation

"Diagnostics" menu \rightarrow Measured values \rightarrow Output values

| ► Output values | |
|--------------------|---------|
| Output current 1 | |
| Measured current 1 | → 🗎 133 |
| Terminal voltage 1 | → 🗎 134 |
| Output current 2 | |
| Pulse output | → 🗎 134 |
| Output frequency | → 🗎 134 |
| Switch status | → 🗎 134 |

Parameter overview with brief description

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

| Parameter | Prerequisite | Description | User interface |
|--------------------|---|---|---|
| Terminal voltage 1 | - | Displays the current terminal voltage that is applied at the output. | 0.0 to 50.0 V |
| Output current 2 | - | Displays the current value currently calculated for the current output. | 3.59 to 22.5 mA |
| Pulse output | The Pulse option is selected in the Operating mode parameter parameter. | Displays the pulse frequency currently output. | Positive floating-point number |
| Output frequency | In the Operating mode parameter, the Frequency option is selected. | Displays the value currently measured for the frequency output. | 0 to 1250 Hz |
| Switch status | The Switch option is selected in the Operating mode parameter. | Displays the current switch output status. | Open Closed |

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu ($\rightarrow \square 71$)
- Advanced settings using the Advanced setup submenu ($\rightarrow \square 90$)

11.6 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:

- Control Totalizer
- Reset all totalizers

Navigation

"Operation" menu \rightarrow Totalizer handling

| ► Totalizer handling | | |
|--------------------------|-----------|--|
| Control Totalizer 1 to n | → 🗎 135 | |
| Preset value 1 to n |) → 🗎 135 | |
| Reset all totalizers |) → 🗎 135 | |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|--------------------------|---|---|--|--|
| Control Totalizer 1 to n | A process variable is selected in the Assign process variable parameter ($\rightarrow \supseteq 108$) of the Totalizer 1 to n submenu. | Control totalizer value. | Totalize Reset + hold Preset + hold Reset + totalize Preset + totalize Hold | Totalize |
| Preset value 1 to n | A process variable is selected in the Assign process variable parameter ($\rightarrow \bigoplus 108$) of the Totalizer 1 to n submenu. | Specify start value for totalizer. Dependency The unit of the selected process variable is defined in the Unit totalizer parameter (→ □ 108) for the totalizer. | Signed floating-point number | Depends on country: • 0 m ³ • 0 ft ³ |
| Reset all totalizers | - | Reset all totalizers to 0 and start. | CancelReset + totalize | Cancel |

Parameter overview with brief description

11.6.1 Function scope of "Control Totalizer" parameter

| Options | Description |
|---------------------------------|---|
| Totalize | The totalizer is started or continues running. |
| Reset + hold | The totaling process is stopped and the totalizer is reset to 0. |
| Preset + hold ¹⁾ | The totaling process is stopped and the totalizer is set to its defined start value from the Preset value parameter. |
| Reset + totalize | The totalizer is reset to 0 and the totaling process is restarted. |
| Preset + totalize ¹⁾ | The totalizer is set to the defined start value in the Preset value parameter and the totaling process is restarted. |

1) Visible depending on the order options or device settings

11.6.2 Function range of "Reset all totalizers" parameter

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

11.7 Displaying the measured value history

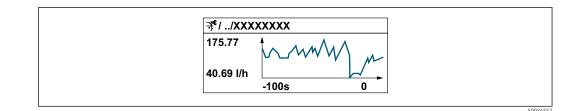
The **Extended HistoROM** application package must be enabled in the device (order option) for the **Data logging** submenu to appear. This contains all the parameters for the measured value history.

Data logging is also available via:

Plant Asset Management Tool FieldCare $\rightarrow \blacksquare 62$.

Function scope

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



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

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

Navigation

"Diagnostics" menu \rightarrow Data logging

| ► Data logging | | | |
|---------------------|-----|---|---------|
| Assign channel 1 | |] | → 🖺 137 |
| Assign channel 2 | | | → 🗎 137 |
| Assign channel 3 | | | → 🗎 137 |
| Assign channel 4 | |] | → 🗎 137 |
| Logging interval | | | → 🖺 137 |
| Clear logging data | | | → 🖺 137 |
| Data logging | |] | → 🖺 138 |
| Logging delay | |] | → 🗎 138 |
| Data logging contro | 1 |] | → 🗎 138 |
| Data logging status | |] | → 🗎 138 |
| Entire logging dura | ion | | → 🖺 138 |

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|--------------------|--|--|---|-----------------|
| Assign channel 1 | The Extended HistoROM application package is available. | Assign process variable to logging channel. | Off Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Steam quality* Total mass flow* Condensate mass flow* Energy flow* Heat flow difference* Reynolds number* Current output 1 Current output 2* Density* Pressure* Specific volume* Degrees of superheat* Vortex frequency Electronic temperature | Off |
| Assign channel 2 | The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter. | Assign a process variable to logging channel. | For the picklist, see Assign channel 1 parameter $(\rightarrow \square 137)$ | Off |
| Assign channel 3 | The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter. | Assign a process variable to logging channel. | For the picklist, see Assign channel 1 parameter $(\rightarrow \square 137)$ | Off |
| Assign channel 4 | The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter. | Assign a process variable to logging channel. | For the picklist, see Assign channel 1 parameter (→ 🗎 137) | Off |
| Logging interval | The Extended HistoROM application package is available. | Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory. | 1.0 to 3 600.0 s | 1.0 s |
| Clear logging data | The Extended HistoROM application package is available. | Clear the entire logging data. | CancelClear data | Cancel |

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|-------------------------|---|--|--|-----------------|
| Data logging | - | Select the type of data logging. | Overwriting Not overwriting | Overwriting |
| Logging delay | In the Data logging parameter, the Not overwriting option is selected. | Enter the time delay for measured value logging. | 0 to 999 h | 0 h |
| Data logging control | In the Data logging parameter, the Not overwriting option is selected. | Start and stop measured value logging. | NoneDelete + startStop | None |
| Data logging status | In the Data logging parameter, the Not overwriting option is selected. | Displays the measured value logging status. | DoneDelay activeActiveStopped | Done |
| Entire logging duration | In the Data logging parameter, the Not overwriting option is selected. | Displays the total logging duration. | Positive floating- point number | 0 s |

* Visibility depends on order options or device settings

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

| Error | Possible causes | Remedial action |
|---|--|--|
| Local display is dark, but signal output is within the valid range | The cable of the display module is not plugged in correctly. | Insert the plug correctly into the main electronics module and display module. |
| Local display dark and no output signals | Supply voltage does not match the voltage specified on the nameplate. | Apply the correct supply voltage $\rightarrow \square$ 38. |
| Local display dark and no output signals | Supply voltage has incorrect polarity. | Reverse polarity of supply voltage. |
| Local display dark and no output signals | No contact between connecting cables and terminals. | Ensure electrical contact between the cable and the terminal. |
| Local display dark and no output signals | Terminals are not plugged into the I/O electronics module correctly. | Check terminals. |
| Local display dark and no output signals | I/O electronics module is defective. | Order spare part → 🗎 158. |
| Local display dark and output signals in failure current | Sensor short-circuit, electronics module short- circuit | 1. Contact service organization. |
| Local display cannot be read, but signal output is within the valid range | Display is set too bright or too dark. | Set the display brighter by simultaneously pressing |
| Local display is dark, but signal output is within the valid range | Display module is defective. | Order spare part $\rightarrow \square$ 158. |
| Backlighting of local display is red | Diagnostic event with "Alarm" diagnostic behavior has occurred. | Take remedial measures $\rightarrow \square 146$ |
| Text on local display appears in a language that cannot be understood. | The selected operating language cannot be understood. | Press = + |
| Message on local display: "Communication Error" "Check Electronics" | Communication between the display module and the electronics is interrupted. | Check the cable and the connector between the main electronics module and display module. Order spare part → [●] 158. |

For output signals

| Error | Possible causes | Remedial action |
|---|--|---|
| Signal output outside the valid range | Main electronics module is defective. | Order spare part $\rightarrow \square$ 158. |
| Signal output outside the valid current range (< 3.6 mA or > 22 mA) | I/O electronics module is defective. | Order spare part $\rightarrow \square$ 158. |
| Device shows correct value on local display, but signal output is incorrect, though in the valid range. | Parameter configuration error | Check and adjust parameter configuration. |
| Device measures incorrectly. | Configuration error or device is operated outside the application. | Check and correct parameter configuration. Observe limit values specified in the "Technical Data". |

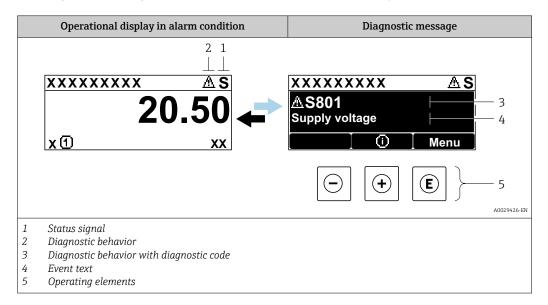
For access

| Fault | Possible causes | Remedial action |
|--|---|---|
| Write access to parameters is not possible. | Hardware write protection is enabled. | Set the write protection switch on the main electronics module to the OFF position $\rightarrow \cong 118$. |
| Write access to parameters is not possible. | Current user role has limited access authorization. | 1. Check user role → 🗎 59. 2. Enter correct customer-specific access code → 🗎 59. |
| Connection via HART protocol is not possible. | Missing or incorrectly installed communication resistor | Install the communication resistor (250 $\Omega)$ correctly. Observe the maximum load . |
| Connection via HART protocol is not possible. | Commubox Incorrectly connected. Incorrectly configured. Driver is not installed correctly. The USB port on the PC is incorrectly configured. | Refer to the documentation on Commubox FXA195 HART: Technical Information TI00404F |
| Connection via service interface is not possible. | The USB port on the PC is incorrectly configured.The driver is not installed correctly. | Refer to the documentation on Commubox FXA291: Technical Information TI00405C |
| Web browser frozen and operation no longer possible | Data transfer is active. | Wait until data transfer or current action is finished. |
| | Connection lost | Check cable connection and power supply. Refresh the web browser and restart if necessary. |
| Display of web browser content is difficult to read or incomplete. | Web browser version used is not optimal. | Use correct web browser version . Empty the web browser cache. Restart the web browser. |
| | Unsuitable view settings. | Change the font size/display ratio of the Web browser. |

12.2 Diagnostic information on local display

12.2.1 Diagnostic message

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



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

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:

- Via parameter $\rightarrow \triangleq 150$
- Via submenus →
 [™]
 [™]
 151

Status signals

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

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

- F = Failure
- C = Function Check
- S = Out of Specification
- M = Maintenance Required

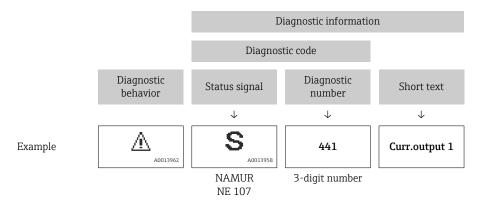
| Symbol | Meaning |
|--------|--|
| F | Failure A device error has occurred. The measured value is no longer valid. |
| С | Function check The device is in the service mode (e.g. during a simulation). |
| S | Out of specification The device is being operated: • Outside its technical specification limits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

Diagnostic behavior

| Symbol | Meaning |
|--------|--|
| 8 | Alarm Measurement is interrupted. Signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. For local display with touch control: the background lighting changes to red. |
| Δ | Warning Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated. |

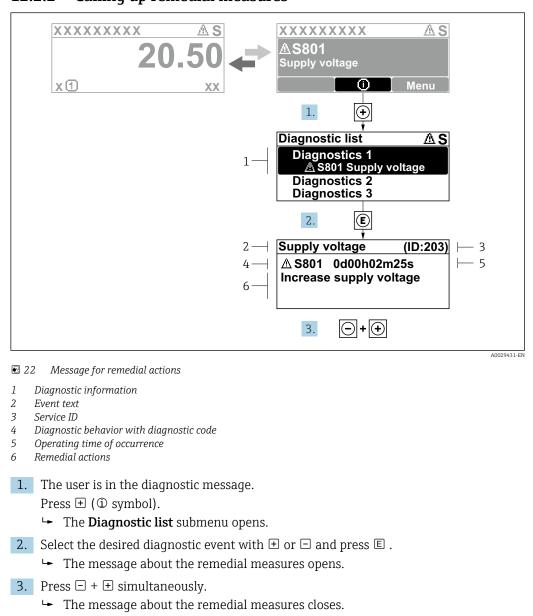
Diagnostic information

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



Operating elements

| Operating key | Meaning |
|---------------|--|
| + | Plus key In menu, submenu Opens the message about the remedial measures. |
| E | Enter key In menu, submenu Opens the operating menu. |



12.2.2 Calling up remedial measures

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

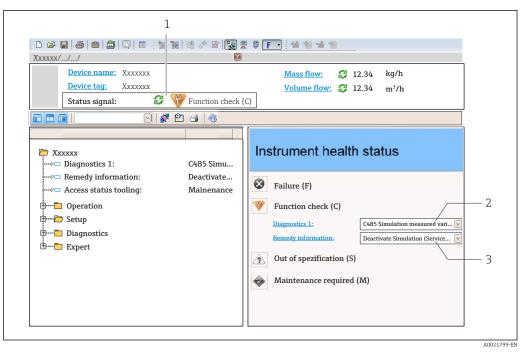
1. Press E.

- └ The message for the remedial measures for the selected diagnostic event opens.
- 2. Press + + simultaneously.
 - └ The message for the remedial measures closes.

12.3 Diagnostic information in FieldCare or DeviceCare

12.3.1 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 $\rightarrow \square 141$
- 2 Diagnostic information $\rightarrow \square 142$
- 3 Remedial actions with service ID

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:

- Via parameter $\rightarrow \triangleq 150$
- Via submenu → 🖺 151

Status signals

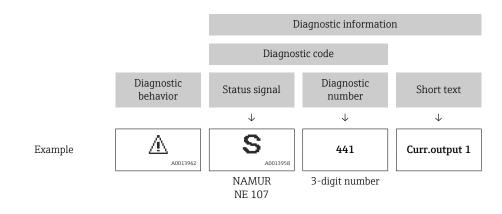
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

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

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

Diagnostic information

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



12.3.2 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.

12.4 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 specific diagnostic information in the **Diagnostic behavior** submenu.

 $\mathsf{Expert} \to \mathsf{System} \to \mathsf{Diagnostic} \ \mathsf{handling} \to \mathsf{Diagnostic} \ \mathsf{behavior}$

| ਤ੍ਰ• //Ever | nt level |
|-------------|----------|
| Event r | no. 044 |
| | Warning |
| Event r | no. 274 |
| Event r | no. 801 |

■ 23 Using the example of the local display

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

| Op | ptions | Description |
|-----|--------|---|
| Ala | arm | The device stops measurement. The signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. For local display with touch control: the background lighting changes to red. |
| Wa | arning | The device continues to measure. The signal outputs and totalizers are not affected. A diagnostic message is generated. |

| Options | Description |
|--------------------|---|
| Logbook entry only | The device continues to measure. The diagnostic message is only displayed in the Event logbook submenu (Event list submenu) and is not displayed in alternating sequence with the operational display. |
| Off | The diagnostic event is ignored, and no diagnostic message is generated or entered. |

12.4.2 Adapting the status signal

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

Expert \rightarrow Communication \rightarrow Diagnostic event category

Available status signals

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

| Symbol | Meaning |
|----------------------|---|
| F 40013956 | Failure A device error has occurred. The measured value is no longer valid. |
| C 40013959 | Function check The device is in service mode (e.g. during a simulation). |
| S A0013958 | Out of specification The device is being operated: Outside its technical specification limits (e.g. outside the process temperature range) Outside of the configuration carried out by the user (e.g. maximum flow in parameter 20 mA value) |
| A0013957 | Maintenance required Maintenance is required. The measured value remains valid. |
| N | Has no effect on the condensed status. |
| A0023076 | |

12.5 Overview of diagnostic information

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

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information $\rightarrow \cong 145$

In the case of some items of diagnostic information, the diagnostic behavior can be changed. Adapting the diagnostic information

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|----------------------|---------------------------------|---|---|---|
| Diagnostic of se | ensor | | | |
| 004 | Sensor defective | Check plug connections Change pre-amplifier Change DSC sensor | F | Alarm |
| 022 | Temperature sensor defective | Check plug connections Change pre-amplifier Change DSC sensor | F | Alarm ¹⁾ |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|----------------------|-------------------------------------|--|---|---|
| 046 | Sensor limit exceeded | Check plug connections Change pre-amplifier Change DSC sensor | S | Warning |
| 062 | Sensor connection defective | Check plug connections Change pre-amplifier Change DSC sensor | F | Alarm |
| 082 | Data storage | Check module connections Contact service | F | Alarm |
| 083 | Memory content | Restart device Restore S-Dat data Change sensor | F | Alarm |
| 114 | Sensor leaky | Change DSC sensor | F | Alarm |
| 122 | Temperature sensor defective | Check plug connections Change pre-amplifier Change DSC sensor | М | Warning ¹⁾ |
| 170 | Pressure cell connection defective | Check plug connections Replace pressure cell | F | Alarm |
| 171 | Ambient temperature too low | Increase ambient temperature | S | Warning |
| 172 | Ambient temperature too high | Reduce ambient temperature | S | Warning |
| 173 | Sensor range exceeded | Check process cond. Increase system pressure | S | Warning |
| 174 | Pressure cell electronics defective | Replace pressure cell | F | Alarm |
| 175 | Pressure cell deactivated | Enable pressure cell | М | Warning |
| Diagnostic of e | electronic | | | |
| 242 | Software incompatible | Check software Flash or change main electronics module | F | Alarm |
| 252 | Modules incompatible | Check if correct electronic modul is plugged Replace electronic module | F | Alarm |
| 261 | Electronic modules | Restart device Check electronic modules Change I/O Modul or main electronics | F | Alarm |
| 262 | Module connection | Check module connections Change electronic modules | F | Alarm |
| 270 | Main electronic failure | Change main electronic module | F | Alarm |
| 271 | Main electronic failure | 1. Restart device 2. Change main electronic module | F | Alarm |
| 272 | Main electronic failure | 1. Restart device | F | Alarm |
| 272 | ECC settings faulty | 2. Contact service | F | Alarm |
| 273 | Main electronic failure | Emergency operation via display Change main electronics | F | Alarm |
| 275 | I/O module defective | Change I/O module | F | Alarm |
| 276 | I/O module faulty | 1. Restart device | F | Alarm |
| 276 | I/O module faulty | 2. Change I/O module | F | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|----------------------|----------------------------------|--|---|---|
| 277 | Electronics defective | Change pre-amplifier Change main electronic module | F | Alarm |
| 282 | Data storage | Restart device Contact service | F | Alarm |
| 283 | Memory content | Transfer data or reset device Contact service | F | Alarm |
| 302 | Device verification active | Device verification active, please wait. | С | Warning |
| 311 | Electronic failure | Maintenance required! 1. Do not perform reset 2. Contact service | М | Warning |
| 350 | Pre-amplifier defective | Change pre-amplifier | F | Alarm ¹⁾ |
| 351 | Pre-amplifier defective | Change pre-amplifier | F | Alarm |
| 370 | Pre-amplifier defective | Check plug connections Check cabel connection of remote version Change pre-amplifier or main electronic module | F | Alarm |
| 371 | Temperature sensor defective | Check plug connections Change pre-amplifier Change DSC sensor | М | Warning ¹⁾ |
| Diagnostic of c | configuration | 1 | J | 1 |
| 410 | Data transfer | Check connection Retry data transfer | F | Alarm |
| 412 | Processing download | Download active, please wait | С | Warning |
| 431 | Trim 1 to n | Carry out trim | С | Warning |
| 437 | Configuration incompatible | Restart device Contact service | F | Alarm |
| 438 | Dataset | Check data set file Check device configuration Up- and download new configuration | М | Warning |
| 441 | Current output 1 to n | Check process Check current output settings | S | Warning ¹⁾ |
| 442 | Frequency output | Check process Check frequency output settings | S | Warning ¹⁾ |
| 443 | Pulse output | Check process Check pulse output settings | S | Warning ¹⁾ |
| 444 | Current input 1 | Check process Check current input settings | S | Warning ¹⁾ |
| 453 | Flow override | Deactivate flow override | С | Warning |
| 484 | Failure mode simulation | Deactivate simulation | С | Alarm |
| 485 | Measured variable simulation | Deactivate simulation | С | Warning |
| 486 | Current input 1 simulation | Deactivate simulation | С | Warning |
| 491 | Current output 1 to n simulation | Deactivate simulation | С | Warning |
| 492 | Simulation frequency output | Deactivate simulation frequency output | С | Warning |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|----------------------|--|--|---|---|
| 493 | Simulation pulse output | Deactivate simulation pulse output | С | Warning |
| 494 | Switch output simulation | Deactivate simulation switch output | С | Warning |
| 495 | Diagnostic event simulation | Deactivate simulation | С | Warning |
| 538 | Flow computer configuration incorrect | Check input value (pressure, temperature) | S | Warning |
| 539 | Flow computer configuration incorrect | Check input value (pressure, temperature) Check allowed values of the medium properties | S | Alarm |
| 540 | Flow computer configuration incorrect | Check entered reference value using the document Operating Instructions | S | Warning |
| 570 | Inverted delta heat | Check configuration of mounting location (parameter Installation direction) | F | Alarm |
| Diagnostic of p | process | | | |
| 801 | Supply voltage too low | Increase supply voltage | F | Alarm ¹⁾ |
| 803 | Current loop | 1. Check wiring 2. Change I/O module | F | Alarm |
| 828 | Ambient temperature too low | Increase ambient temperature of pre-amplifier | S | Warning ¹⁾ |
| 829 | Ambient temperature too high | Reduce ambient temperature of pre- amplifier | S | Warning ¹⁾ |
| 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⁾ |
| 841 | Flow velocity too high | Reduce flow velocity | S | Warning ¹⁾ |
| 842 | Process limit | Low flow cut off active! 1. Check low flow cut off configuration | S | Warning |
| 844 | Sensor range exceeded | Reduce flow velocity | S | Warning ¹⁾ |
| 870 | Measuring inaccuracy increased | Check process Increase flow volume | S | Warning ¹⁾ |
| 871 | Near steam saturation limit | Check process conditions | S | Warning ¹⁾ |
| 872 | Wet steam detected | 1. Check process 2. Check plant | S | Warning ¹⁾ |
| 873 | Water detected | Check process (water in piping) | S | Warning ¹⁾ |
| 874 | X% spec invalid | Check pressure, temperature Check flow velocity Check for flow fluctuation | S | Warning ¹⁾ |
| 882 | Input signal | Check input configuration Check external device or process conditions | F | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|----------------------|---|---|---|---|
| 945 | Sensor range exceeded | Check immediately process conditions (pressure-temperature rating) | S | Warning ¹⁾ |
| 946 | Vibration detected | Check installation | S | Warning |
| 947 | Vibration exceeded | Check installation | S | Alarm ¹⁾ |
| 948 | Signal quality bad | Check process conditions: wet gas, pulsation Check installation: vibration | S | Warning |
| 972 | Degrees of superheat limit excceeded | Controll process conditions Install pressure transmitter or enter correct fixed pressure value | S | Warning ¹⁾ |

1) Diagnostic behavior can be changed.

12.5.1 Operating conditions for displaying the following diagnostics information

Operating conditions for displaying the following diagnostics information:

- 871 Near steam saturation limit diagnostic message: The process temperature is less than 2K from the saturated steam line.
 - Diagnostics information 872: The measured steam quality has dropped below the configured limit value for the steam quality (limit value: Expert → System → Diagnostic handling → Diagnostic limits → Steam quality limit).
 - Diagnostics information 873: The process temperature is ≤ 0 °C.
 - Diagnostics information 972: The degree of superheat has exceeded the configured limit value (limit value: Expert → System → Diagnostic handling → Diagnostic limits → Degrees of superheat limit).

12.5.2 Emergency mode in event of temperature compensation

- Change temperature measurement: PT1+PT2 to the PT1 option, PT2 option or the Off option.
 - └→ If the Off option is selected, the measuring device calculates by using the fixed process pressure.

12.6 Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:

- Via local display $\rightarrow \triangleq 143$
- Via "DeviceCare" operating tool $\rightarrow \cong 145$

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu $\rightarrow \cong 151$.

Navigation

"Diagnostics" menu

| ିପ୍ Diagnostics | |
|-----------------------------|-----------|
| Actual diagnostics |) → 🗎 151 |
| Previous diagnostics | → 🗎 151 |
| Operating time from restart |) → 🗎 151 |
| Operating time |) → 🖺 151 |

Parameter overview with brief description

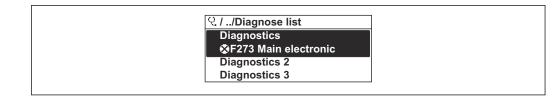
| Parameter | Prerequisite | Description | User interface |
|-----------------------------|--|--|--|
| Actual diagnostics | A diagnostic event has occurred. | Shows the current occured diagnostic event along with its diagnostic information. | Symbol for diagnostic behavior, diagnostic code and short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

12.7 Diagnostics list

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

Navigation path

 $\text{Diagnostics} \rightarrow \text{Diagnostic list}$



24 Using the example of the local display

To call up the measures to rectify a diagnostic event:

- Via local display $\rightarrow \square 143$
- Via "DeviceCare" operating tool →
 ¹⁴⁵

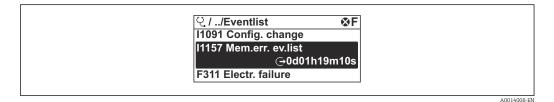
12.8 Event logbook

12.8.1 Reading out the event logbook

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

Navigation path

Diagnostics menu \rightarrow **Event logbook** submenu \rightarrow Events list



25 Using the example of the local display

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

The event history includes entries for:

- Diagnostic events →
 [™]
 [™]
 146
- Information events $\rightarrow \triangleq 153$

In addition to the operating time when the event occurred, each event is also assigned a symbol that indicates whether the event has occurred or is finished:

- Diagnostics event
 - \mathfrak{S} : Occurrence of the event
 - \bigcirc : End of the event
- Information event

 \odot : Occurrence of the event

To call up the measures to rectify a diagnostic event:

- Via local display $\rightarrow \triangleq 143$
- Via "FieldCare" operating tool $\rightarrow \square 145$

For filtering the displayed event messages $\rightarrow \cong 152$

12.8.2 Filtering the event logbook

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

Navigation path

Diagnostics \rightarrow Event logbook \rightarrow 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) | |
| I1079 | Sensor changed | |
| I1089 | Power on | |
| I1090 | Configuration reset | |
| I1091 | Configuration changed | |
| 11092 | HistoROM backup deleted | |
| I1110 | Write protection switch changed | |
| I1137 | Electronic changed | |
| I1151 | History reset | |
| I1154 | Reset terminal voltage min/max | |
| I1155 | Reset electronic temperature | |
| I1156 | Memory error trend | |
| I1157 | Memory error event list | |
| I1185 | Display backup done | |
| I1186 | Restore via display done | |
| I1187 | Settings downloaded with display | |
| I1188 | Display data cleared | |
| I1189 | Backup compared | |
| I1227 | Sensor emergency mode activated | |
| I1228 | Sensor emergency mode failed | |
| I1256 | Display: access status changed | |
| I1264 | Safety sequence aborted | |
| I1335 | Firmware changed | |
| I1397 | Fieldbus: access status changed | |
| I1398 | CDI: access status changed | |
| I1444 | Device verification passed | |
| I1445 | Device verification failed | |
| I1459 | I/O module verification failed | |
| I1461 | Sensor verification failed | |
| I1512 | Download started | |
| I1513 | Download finished | |

| Info number | Info name | |
|-------------|--------------------------------------|--|
| I1514 | Upload started | |
| I1515 | Upload finished | |
| I1552 | Failed: Main electronic verification | |
| I1553 | Failed: Pre-amplifier verification | |
| I1554 | Safety sequence started | |
| I1555 | Safety sequence confirmed | |
| I1556 | Safety mode off | |

12.9 Resetting the device

The entire device configuration or some of the configuration can be reset to a defined state with the **Device reset** parameter ($\Rightarrow \triangleq 113$).

12.9.1 Function scope of the "Device reset" parameter

| Options | Description |
|----------------------|--|
| Cancel | No action is executed and the user exits the parameter. |
| To factory defaults | Every parameter is reset to the factory setting. |
| To delivery settings | Every parameter for which a customer-specific default setting was ordered is reset to the customer-specific value. All other parameters are reset to the factory setting. This option is not visible if no customer-specific settings have been ordered. |
| Restart device | The restart resets every parameter with data stored in volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged. |

12.10 Device information

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

Navigation

"Diagnostics" menu \rightarrow Device information

| ► Device information | |
|-----------------------|---------|
| Device tag | → 🗎 155 |
| Serial number | → 🗎 155 |
| Firmware version | → 🗎 155 |
| Device name | → 🗎 155 |
| Order code | → 🗎 155 |
| Extended order code 1 | → 🗎 155 |

| Extended order code 2 | → 🗎 155 |
|-----------------------|---------|
| Extended order code 3 | → 🗎 155 |
| ENP version | → 🗎 155 |
| Device revision | → 🗎 156 |
| Device ID | → 🗎 156 |
| Device type | → 🗎 156 |
| Manufacturer ID | → 🗎 156 |
| | |

Parameter overview with brief description

| Parameter | Description | User interface | Factory setting |
|-----------------------|--|---|-----------------|
| Device tag | tag Shows name of measuring point. Max. 32 ch letters, nur characters | | Prowirl |
| Serial number | Shows the serial number of the measuring device. | Max. 11-digit character string comprising letters and numbers. | - |
| Firmware version | Shows the device firmware version installed. | Character string in the format xx.yy.zz | - |
| Device name | Shows the name of the transmitter. The name can be found on the nameplate of the transmitter. | Max. 32 characters such as letters or numbers. | Prowirl |
| Order code | Shows the device order code. The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field. | Character string composed of letters, numbers and certain punctuation marks (e.g. /). | - |
| Extended order code 1 | Shows the 1st part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field. | Character string | - |
| Extended order code 2 | Shows the 2nd part of the extended order code. 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. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field. | Character string | - |
| ENP version | Shows the version of the electronic nameplate (ENP). | Character string | 2.02.00 |

| Parameter | Description | User interface | Factory setting |
|-----------------|---|----------------------------|---------------------------|
| Device revision | Shows the device revision with which the device is registered with the HART Communication Foundation. | 2-digit hexadecimal number | 0x03 |
| Device ID | Shows the device ID for identifying the device in a HART network. | 6-digit hexadecimal number | - |
| Device type | Shows the device type with which the measuring device is registered with the HART Communication Foundation. | Hexadecimal number | 0x0038 (for Prowirl 200) |
| Manufacturer ID | Shows the manufacturer ID device is registered with the HART Communication Foundation. | 2-digit hexadecimal number | 0x11 (for Endress+Hauser) |

12.11 Firmware history

| Release date | Firmware version | Order code for "Firmware version" | Firmware changes | Documentation type | Documentation |
|-----------------|---------------------|---|---|------------------------|----------------------|
| 04.2025 | 01.03.zz | Option 72 | No firmware modification. | Operating Instructions | BA01685D/06/EN/03.24 |
| 01.2018 | 01.03.zz | Option 72 | Support for "mass vortex" order option Upgrade to Heartbeat Technology application package Permanent activation of natural gas, air and industrial gases application packages Extension of low flow cut off Extension of measuring range for steam Extension of two-phase measurement | Operating Instructions | BA01685D/06/EN/01.18 |

It is possible to flash the firmware to the current version or an existing previous version via the service interface.

- For the compatibility of the firmware version with the previous version, the installed device description files and operating tools, observe the information about the device in the "Manufacturer's information" document.
- The manufacturer's information is available:
 - In the Download Area of the Endress+Hauser Web site: www.endress.com \rightarrow Downloads
 - Specify the following details:
 - Product root: e.g. 7F2C The product root is the first part of the order code: see the nameplate on the device.
 - Text search: Manufacturer's information
 - Media type: Documentation Technical Documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

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

13.1.2 Interior cleaning

NOTICE

The use of unsuitable equipment or cleaning liquids can damage the transducer.

Do not use pigs to clean the pipe.

13.1.3 Replacing seals

Replacing sensor seals

NOTICE

Seals in contact with fluid must always be replaced!

• Only Endress+Hauser sensor seals may be used: replacement seals

Replacing housing seals

NOTICE

When using the device in a dusty atmosphere:

• only use the associated Endress+Hauser housing seals.

- 1. Replace defect seals only with original seals from Endress+Hauser.
- 2. The housing seals must be clean and undamaged when inserted into their grooves.
- **3.** Dry, clean or replace the seals if necessary.

13.2 Measuring and test equipment

Endress+Hauser offers a variety of measuring and testing equipment, such as Netilion or device tests.

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

List of some of the measuring and testing equipment: $\rightarrow \square 163$

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

14.1.1 Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:

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

14.1.2 Notes for repair and conversion

For repair and conversion of a measuring device, observe the following notes:

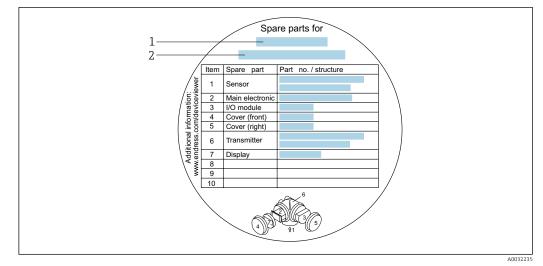
- Use only original Endress+Hauser spare parts.
- Carry out the repair according to the Installation Instructions.
- Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- Document all repairs and conversions and enter the details in Netilion Analytics.

14.2 Spare parts

Some interchangeable measuring device components are listed on an overview sign in the connection compartment cover.

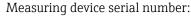
The spare part overview sign contains the following information:

- A list of the most important spare parts for the measuring device, including their ordering information.
- The URL to the *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.



26 Example for "Spare part overview sign" in connection compartment cover

- 1 Measuring device name
- 2 Measuring device serial number



- Is located on the device nameplate and the spare part overview sign.
- Can be read out via the Serial number parameter (→
 ^(→)
 ^(→)

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

14.4 Return

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

- 1. Refer to the web page for information: https://www.endress.com/support/return-material
 - → Select the region.
- 2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

14.5 Disposal

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

14.5.1 Removing the measuring device

1. Switch off the device.

WARNING

Danger to persons from process conditions!

- ► Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive media.
- 2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring device

WARNING

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

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

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

15 Accessories

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

15.1 Device-specific accessories

15.1.1 For the transmitter

| Accessories Description | |
|---|---|
| Prowirl 200 transmitter | Transmitter for replacement or storage. Use the order code to define the following specifications: • Approvals • Output, input • Display/operation • Housing • Software Installation Instructions EA01056D (Order number: 7X2CXX) |
| Remote display FHX50 | FHX50 housing for accommodating a display module . FHX50 housing suitable for: SD02 display module (push buttons) SD03 display module (touch control) Length of connecting cable: up to max. 60 m (196 ft) (cable lengths available for order: 5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)) The measuring instrument can be ordered with the FHX50 housing and a display module. The following options must be selected in the separate order codes: Order code for measuring instrument, feature 030: Option L or M "Prepared for FHX50 display" Order code for FHX50 housing, feature 050 (device version): Option A "Prepared for FHX50 display" Order code for FHX50 housing, depends on the desired display module in feature 020 (display, operation): Option C: for an SD02 display module (push buttons) Option E: for an SD02 display module (touch control) The FHX50 housing can also be ordered as a retrofit kit. The measuring instrument display module is used in the FHX50 housing: Feature 050 (measuring instrument version): option B "Not prepared for FHX50 display" |
| | (Order number: FHX50) |
| Overvoltage protection for 2-wire devices | Ideally, the overvoltage protection module should be ordered directly with the device. See product structure, feature 610 "Accessory mounted", option NA "Overvoltage protection". Separate order necessary only if retrofitting. |
| | OVP10: For 1-channel devices (feature 020, option A): OVP20: For 2-channel devices (feature 020, options B, C, E or G) |
| | Special Documentation SD01090F |
| | (Order number OVP10: 71128617) (Order number OVP20: 71128619) |

| Accessories | Description | |
|---------------------------------------|---|--|
| Protective cover | The protective cover is used to protect against direct sunlight, precipitation and ice It can be ordered together with the device via the product structure: Order code for "Accessories enclosed" option PB "Protective cover" | |
| | Special Documentation SD00333F | |
| | (Order number: 71162242) | |
| Transmitter holder (pipe mounting) | To secure the remote version to the pipe DN 20 to 80 (3/4 to 3") Order code for "Accessory enclosed", option PM | |

15.1.2 For the sensor

| Accessories | Description | |
|------------------|---|--|
| Mounting set | Mounting set for disc (wafer version) comprising: • Tie rods • Seals • Nuts • Washers Installation Instructions EA00075D (Order number: DK7D) | |
| Flow conditioner | Is used to shorten the necessary inlet run. (Order number: DK7ST) Dimensions of flow conditioner | |

15.2 Communication-specific accessories

| Accessories | Description |
|--------------------------------|---|
| Commubox FXA195 HART | For intrinsically safe HART communication with FieldCare via the USB interface. |
| 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. |
| HART loop converter HMX50 | Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. • Technical Information TI00429F • Operating Instructions BA00371F |
| Wireless HART adapter SWA70 | Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. (I) Operating Instructions BA00061S |
| Fieldgate FXA42 | Transmission of the measured values of connected 4 to 20 mA analog measuring instruments, as well as digital measuring instruments • Technical Information TI01297S • Operating Instructions BA01778S • Product page: www.endress.com/fxa42 |

| Field Xpert SMT50 | The Field Xpert SMT50 tablet PC for device configuration enables mobile plant asset management in non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. |
|-------------------|--|
| | Technical Information TI01555S Operating Instructions BA02053S Product page: www.endress.com/smt50 |
| Field Xpert SMT70 | The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. |
| | Technical Information TI01342S Operating Instructions BA01709S Product page: www.endress.com/smt70 |
| Field Xpert SMT77 | The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. |

15.3 Service-specific accessories

| Accessories | Description |
|-------------|--|
| Applicator | Software for selecting and sizing Endress+Hauser measuring instruments: Choice of measuring instruments for industrial requirements Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. Graphic display of the calculation results Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator |
| Netilion | lloT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem,Endress+Hauser allows you to optimize your plant performance, digitize workflows, share knowledge, and enhance collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant. www.netilion.endress.com |
| FieldCare | FDT-based plant asset management tool from Endress+Hauser. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. |
| DeviceCare | Tool to connect and configure Endress+Hauser field devices. |

15.4 System components

| Accessories | Description | |
|-------------------------------------|---|--|
| Memograph M graphic data manager | The Memograph M graphic data manager provides information on all the relevan measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick. | |
| | Technical Information TI00133R Operating Instructions BA00247R | |
| RN221N | Active barrier with power supply for safe separation of 4-20 mA standard sign circuits. Offers bidirectional HART transmission. | |
| | Technical Information TI00073R Operating Instructions BA00202R | |
| RNS221 | Supply unit for powering two 2-wire measuring devices solely in the non- hazardous area. Bidirectional communication is possible via the HART communication jacks. | |
| | Technical Information TI00081R Brief Operating Instructions KA00110R | |

16 Technical data

16.1 Application

The measuring device is intended for the flow measurement of liquids, gas and steam.

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 | Vortex meters work on the principle of the Karman vortex street. | |
|---------------------|--|--|
| Measuring system | The device consists of a transmitter and a sensor. | |
| | Two device versions are available: Compact version - transmitter and sensor form a mechanical unit. Remote version - transmitter and sensor are mounted in separate locations. | |
| | For information on the structure of the measuring instrument $ ightarrow$ 🗎 12 | |

16.3 Input

Measured variable

Direct measured variables

| Order code for "Sensor version; DSC sensor; measuring tube" | | |
|---|-------------------------------------|-------------------|
| Option | Description | Measured variable |
| AA | Volume; 316L; 316L | Volume flow |
| BA | Volume high-temperature; 316L; 316L | |

| Order code for "Sensor version; DSC sensor; measuring tube" | | |
|---|---|---|
| Option | Description | Measured variable |
| CA | Mass; 316L; 316L (integrated temperature measurement) | Volume flowTemperature |

Calculated measured variables

| Order code for "Sensor version; DSC sensor; measuring tube" | | |
|---|-------------------------------------|--|
| Option | Description | Measured variable |
| AA | Volume; 316L; 316L | Under constant process conditions: |
| BA | Volume high-temperature; 316L; 316L | Mass flow ¹⁾ Corrected volume flow |
| | | The totalized values for: • Volume flow • Mass flow • Corrected volume flow |

1) A fixed density must be entered for calculating the mass flow (Setup menu \rightarrow Advanced setup submenu \rightarrow External compensation submenu \rightarrow Fixed density parameter).

| Order code for "Sensor version; DSC sensor; measuring tube" | | |
|---|---|---|
| Option | Description | Measured variable |
| CA | Mass; 316L; 316L (integrated temperature measurement) | Corrected volume flow Mass flow Calculated saturated steam pressure Energy flow Heat flow difference Specific volume Degrees of superheat |

| Order co | Order code for "Sensor version; DSC sensor; measuring tube" | | |
|----------|---|--|--|
| Option | Description | Measured variable | |
| AA | Volume; 316L; 316L | Under constant process conditions: | |
| AB | Volume; Alloy C22; 316L | Mass flow ¹⁾ Corrected volume flow | |
| AC | Volume; Alloy C22; Alloy C22 | The totalized values for: | |
| BA | Volume high-temperature; 316L; 316L | Volume flowMass flow | |
| BB | Volume high-temperature; Alloy C22; 316L | Corrected volume flow | |

1) A fixed density must be entered for calculating the mass flow (Setup menu \rightarrow Advanced setup submenu \rightarrow External compensation submenu \rightarrow Fixed density parameter).

| Order co | Order code for "Sensor version; DSC sensor; measuring tube" | | |
|----------|---|---|--|
| Option | Description | Measured variable | |
| CA | Mass; 316L; 316L (integrated temperature measurement) | Corrected volume flow | |
| СВ | Mass; Alloy C22; 316L (integrated temperature measurement) | Mass flow Calculated saturated steam pressure Energy flow | |
| CC | Mass; Alloy C22; Alloy C22 (integrated temperature measurement) | Heat flow difference Specific volume Degrees of superheat | |
| DA | Mass steam; 316L; 316L (integrated pressure/temperature measurement) | - Degrees of supericat | |
| DB | Mass gas/liquid; 316L; 316L (integrated pressure/ temperature measurement) | | |

Measuring range

The measuring range is dependent on the nominal diameter, the fluid and environmental influences.

The following specified values are the largest possible flow measuring ranges (Q_{min} to Q_{max}) for each nominal diameter. Depending on the fluid properties and environmental influences, the measuring range may be subject to additional restrictions. Additional restrictions apply to both the lower range value and the upper range value.

Flow measuring ranges in SI units

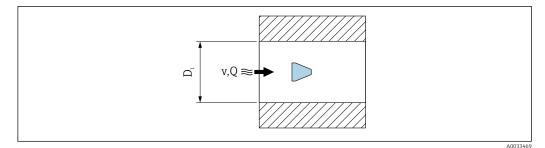
| DN [mm] | Liquids [m ³ /h] | Gas/steam [m³/h] |
|------------|--------------------------------|---------------------|
| 15 | 0.06 to 4.9 | 0.3 to 25 |
| 25 | 0.18 to 15 | 0.9 to 125 |
| 40 | 0.45 to 37 | 2.3 to 308 |
| 50 | 0.75 to 62 | 3.8 to 821 |
| 80 | 1.7 to 138 | 8.5 to 1843 |

| DN [mm] | Liquids [m ³ /h] | Gas/steam [m³/h] |
|------------|--------------------------------|---------------------|
| 100 | 2.9 to 239 | 15 to 3 192 |
| 150 | 6.7 to 545 | 33 to 7262 |

Flow measuring ranges in US units

| DN | Liquids | Gas/steam |
|------|------------------------|-------------|
| [in] | [ft ³ /min] | [ft³/min] |
| 1/2 | 0.035 to 2.9 | 0.18 to 15 |
| 1 | 0.11 to 8.8 | 0.54 to 74 |
| 11/2 | 0.27 to 22 | 1.3 to 181 |
| 2 | 0.44 to 36 | 2.2 to 483 |
| 3 | 1 to 81 | 5 to 1085 |
| 4 | 1.7 to 140 | 8.7 to 1879 |
| 6 | 3.9 to 320 | 20 to 4272 |

Flow velocity



D_i Internal diameter of measuring tube (corresponds to dimension K)

- Velocity in mating pipe
- Q Flow

The internal diameter of measuring tube D_{i} is denoted in the dimensions as dimension K.

For detailed information, see the Technical Information \rightarrow 🖺 193

Calculation of flow velocity:

$$v [m/s] = \frac{4 \cdot Q [m^{3}/h]}{\pi \cdot D_{i} [m]^{2}} \cdot \frac{1}{3600 [s/h]}$$
$$v [ft/s] = \frac{4 \cdot Q [ft^{3}/min]}{\pi \cdot D_{i} [ft]^{2}} \cdot \frac{1}{60 [s/min]}$$

Lower range value

Reynolds number

A restriction applies to the lower range value due to the turbulent flow profile, which only occurs with Reynolds numbers greater than 5 000. The Reynolds number is dimensionless and indicates the ratio of the inertia force of a fluid to its viscous force when flowing and is used as a characteristic variable for pipe flows. In the case of pipe flows with Reynolds

numbers less than 5 000, periodic vortices are no longer generated and flow rate measurement is no longer possible.

The Reynolds number is calculated as follows:

$$Re = \frac{4 \cdot Q [m^{3}/s] \cdot \rho [kg/m^{3}]}{\pi \cdot D_{i} [m] \cdot \mu [Pa \cdot s]}$$
$$Re = \frac{4 \cdot Q [ft^{3}/s] \cdot \rho [lbm/ft^{3}]}{\pi \cdot D_{i} [ft] \cdot \mu [lbf \cdot s/ft^{2}]}$$

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Re Reynolds number

Q Flow

- *D_i* Internal diameter of measuring tube (corresponds to dimension K)
- μ Dynamic viscosity
- ρ Density

The Reynolds number 5 000, together with the density and viscosity of the fluid and the nominal diameter, is used to calculate the corresponding flow rate.

$$\begin{aligned} Q_{\text{Re}=5000} \left[\text{m}^{3}/\text{h} \right] &= \frac{5000 \cdot \pi \cdot \text{D}_{\text{i}} \left[\text{m} \right] \cdot \mu \left[\text{Pa} \cdot \text{s} \right]}{4 \cdot \rho \left[\text{kg/m}^{3} \right]} \cdot 3600 \left[\text{s/h} \right] \\ Q_{\text{Re}=5000} \left[\text{ft}^{3}/\text{h} \right] &= \frac{5000 \cdot \pi \cdot \text{D}_{\text{i}} \left[\text{ft} \right] \cdot \mu \left[\text{lbf} \cdot \text{s/ft}^{2} \right]}{4 \cdot \rho \left[\text{lbm/ft}^{3} \right]} \cdot 60 \left[\text{s/min} \right] \end{aligned}$$

| Q _{Re = 5000} | Flow rate is dependent on the Reynolds number |
|------------------------|--|
| D_i | Internal diameter of measuring tube (corresponds to dimension K) |
| μ | Dynamic viscosity |
| ρ | Density |

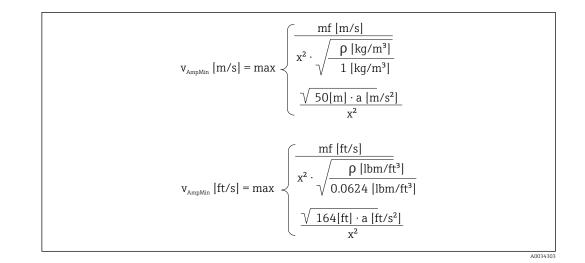
Minimum measurable flow velocity based on signal amplitude

The measuring signal must have a certain minimum signal amplitude so that the signals can be evaluated without any errors. Using the nominal diameter, the corresponding flow can also be derived from this amplitude.

The minimum signal amplitude depends on the setting for the sensitivity of the DSC sensor, the steam quality \mathbf{x} and the force of the vibrations present \mathbf{a} .

The value \mathbf{mf} corresponds to the lowest measurable flow velocity without vibration (no wet steam) for a density of 1 kg/m³ (0.0624 lbm/ft^3).

The value **mf** can be set in the range of 20 to 6 m/s (6 to 1.8 ft/s) (factory setting 12 m/s (3.7 ft/s)) with the **Sensitivity** parameter (value range 1 to 9, factory setting 5).



 v_{AmpMin} Minimum measurable flow velocity based on signal amplitude

| mf | Sensitivity |
|----|---------------|
| X | Steam quality |
| ρ | Density |

Minimum measurable flow rate based on signal amplitude

$$Q_{AmpMin} [m^{3}/h] = \frac{v_{AmpMin} [m/s] \cdot \pi \cdot (D_{i} [m])^{2}}{4} \cdot 3600 [s/h]$$
$$Q_{AmpMin} [ft^{3}/min] = \frac{v_{AmpMin} [ft/s] \cdot \pi \cdot (D_{i} [ft])^{2}}{4} \cdot 60 [s/min]$$

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| <i>Q_{AmpMin}</i> | Minimum measurable flow rate based on signal amplitude |
|---------------------------|--|
| V _{AmpMin} | Minimum measurable flow velocity based on signal amplitude |
| D_i | Internal diameter of measuring tube (corresponds to dimension K) |
| ρ | Density |

Effective lower range value

The effective lower range value Q_{Low} is determined using the largest of the three values $Q_{min},\,Q_{Re\,=\,5000}$ and $Q_{AmpMin}.$

| $Q_{Low} [m^3/h] = max \begin{cases} \begin{cases} \\ \\ \end{cases} \end{cases}$ | $ \begin{bmatrix} Q_{min} [m^{3}/h] \\ Q_{Re=5000} [m^{3}/h] \\ Q_{AmpMin} [m^{3}/h] \end{bmatrix} $ |
|---|---|
| $Q_{Low} [ft^3/min] = max \begin{cases} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $ | $ \begin{bmatrix} Q_{min} [ft^3/min] \\ Q_{Re=5000} [ft^3/min] \\ Q_{AmpMin} [ft^3/min] \end{bmatrix} $ |

| Q _{Low} | Effective lower range value |
|---------------------------|--|
| Q _{min} | Minimum measurable flow rate |
| Q _{Re = 5000} | Flow rate is dependent on the Reynolds number |
| <i>Q_{AmpMin}</i> | Minimum measurable flow rate based on signal amplitude |

The Applicator is available for calculation purposes.

Upper range value

Maximum measurable flow rate based on signal amplitude

The measuring signal amplitude must be below a certain limit value to ensure that the signals can be evaluated without error. This results in a maximum permitted flow rate Q_{AmpMax} .

$$Q_{AmpMax} [m^{3}/h] = \frac{URV [m/s] \cdot \pi \cdot D_{i} [m]^{2}}{4 \cdot \sqrt{\frac{\rho [kg/m^{3}]}{1 [kg/m^{3}]}}} \cdot 3600 [s/h]$$

$$Q_{AmpMax} [ft^{3}/min] = \frac{URV [ft/s] \cdot \pi \cdot D_{i} [ft]^{2}}{4 \cdot \sqrt{\frac{\rho [lbm/ft^{3}]}{0.0624 [lbm/ft^{3}]}}} \cdot 60 [s/min]$$
A0034316

 $Q_{AmpMax} \quad Maximum\ measurable\ flow\ rate\ based\ on\ signal\ amplitude$

D_i Internal diameter of measuring tube (corresponds to dimension K)

- ρ Density
- *URV* Limit value for determining the maximum flow rate:
 - DN 15 to 40: URV = 350
 - DN 50 to 300: URV = 600
 - NPS ½ to 1½: URV = 1148
 - NPS 2 to 12: URV = 1969

Restricted upper range value is dependent on Mach number

For gas applications, an additional restriction applies to the upper range value with regard to the Mach number in the measuring instrument, which must be less than 0.3. The Mach number Ma describes the ratio of the flow velocity v to the sound velocity c in the fluid.

$$Ma = \frac{v [m/s]}{c [m/s]}$$
$$Ma = \frac{v [ft/s]}{c [ft/s]}$$

- Ma Mach number
- v Flow velocity
- c Speed of sound

The corresponding flow rate can be derived using the nominal diameter.

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$$Q_{Ma=0.3} [m^{3}/h] = \frac{0.3 \cdot c [m/s] \cdot \pi \cdot D_{i} [m]^{2}}{4} \cdot 3600 [s/h]$$
$$Q_{Ma=0.3} [ft^{3}/min] = \frac{0.3 \cdot c [ft/s] \cdot \pi \cdot D_{i} [ft]^{2}}{4} \cdot 60 [s/min]$$

 $Q_{Ma=0.3}$ Restricted upper range value is dependent on Mach number

- Speed of sound С
- D_i Internal diameter of measuring tube (corresponds to dimension K)
- Density ρ

Effective upper range value

The effective upper range value Q_{High} is determined using the smallest of the three values Q_{max} , Q_{AmpMax} and $Q_{Ma=0.3}$.

| $Q_{\text{High}} [m^{3}/h] = \min \begin{cases} Q_{\text{max}} [m^{3}/h] \\ Q_{\text{AmpMax}} [m^{3}/h] \\ Q_{\text{Ma}=0.3} [m^{3}/h] \end{cases}$ | |
|---|-------|
| $Q_{High} [ft^{3}/min] = min \begin{cases} Q_{max} [ft^{3}/min] \\ Q_{AmpMax} [ft^{3}/min] \\ Q_{Ma=0.3} [ft^{3}/min] \end{cases}$ | |
| A00 | 34331 |

Q_{High} Effective upper range value

Q_{max} Maximum measurable flow rate

Q_{AmpMax} Maximum measurable flow rate based on signal amplitude

 $Q_{Ma=0.3}$ Restricted upper range value is dependent on Mach number

For liquids, the occurrence of cavitation may also restrict the upper range value.



The Applicator is available for calculation purposes.

Operable flow range The value, which is typically up to 49: 1, may vary depending on the operating conditions (ratio between upper range value and lower range value)

Input signal

Current input

| Current input | 4-20 mA (passive) |
|--------------------------|--|
| Resolution | 1 μΑ |
| Voltage drop | Typically: 2.2 to 3 V for 3.6 to 22 mA |
| Maximum voltage | ≤ 35 V |
| Possible input variables | PressureTemperatureDensity |

External measured values

To increase the measurement accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring instrument:

- Operating pressure to increase measurement accuracy (Endress+Hauser recommends the use of a pressure measuring instrument for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase measurement accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow
- Various pressure measuring devices can be ordered as accessories from Endress+Hauser.

If the device does not have temperature compensation, it is recommended that external pressure measurement values be read in so that the following measured variables can be calculated:

- Energy flow
- Mass flow
- Corrected volume flow

Current input

The measured values are written from the automation system to the measuring device via the current input $\rightarrow \cong 171$.

HART protocol

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

- HART protocol
- Burst mode

16.4 Output

Output signal

Current output

| Current output 1 | 4-20 mA HART (passive) |
|----------------------------------|--|
| Current output 2 | 4-20 mA (passive) |
| Resolution | < 1 µA |
| Damping | Configurable: 0.0 to 999.9 s |
| Assignable measured variables | Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated saturated steam pressure Total mass flow Energy flow Heat flow difference |

Pulse/frequency/switch output

| Function | Can be configured as pulse, frequency or switch output |
|----------|--|
| Version | Passive, open collector |

| Maximum input values | DC 35 V 50 mA |
|----------------------------------|---|
| Voltage drop | For ≤ 2 mA: 2 V For 10 mA: 8 V |
| Residual current | ≤ 0.05 mA |
| Pulse output | |
| Pulse width | Configurable: 5 to 2 000 ms |
| Maximum pulse rate | 100 Impulse/s |
| Pulse value | Configurable |
| Assignable measured variables | Mass flow Volume flow Corrected volume flow Total mass flow Energy flow Heat flow difference |
| Frequency output | |
| Output frequency | Configurable: 0 to 1000 Hz |
| Damping | Configurable: 0 to 999 s |
| Pulse/pause ratio | 1:1 |
| Assignable measured variables | Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure Total mass flow Energy flow Heat flow difference Pressure |
| Switch output | |
| Switching behavior | Binary, conductive or non-conductive |
| Switching delay | Configurable: 0 to 100 s |
| Number of switching cycles | Unlimited |
| Assignable functions | Off On Diagnostic behavior Limit value Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure Total mass flow Energy flow Heat flow difference Pressure Reynolds number Totalizer 1-3 Status Status of low flow cut off |

Signal on alarm

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

Current output

Current output 4-20 mA

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

Pulse/frequency/switch output

| Pulse output | |
|------------------|--|
| Failure mode | No pulses |
| Frequency output | |
| Failure mode | Choose from: • Actual value • 0 Hz • Definable value between: 0 to 1 250 Hz |
| Switch output | |
| Failure mode | Choose from: • Current status • Open • Closed |

Local display

| Plain text display | With information on cause and remedial measures | |
|--------------------|---|--|
| Backlight | Additionally for device version with SD03 local display: red lighting indicates a device error. | |

Status signal as per NAMUR recommendation NE 107 H

Interface/protocol

- Via digital communication: HART protocol
- Via service interface Endress+Hauser Common Data Interface (CDI)

| | Plain text display With information on cause and remedial measures | |
|---------------------|--|--|
| | | |
| Load | → 🖺 36 | |
| T (1) ((| | |
| Low flow cut off | The switch points for | r low flow cut off are preset and can be configured. |
| Galvanic isolation | All inputs and output | ts are galvanically isolated from one another. |
| Galvallic Isolation | All inputs and outpu | as are gaivanically isolated from one allother. |

Protocol-specific data

| Manufacturer ID | 0x11 |
|---------------------------------------|---|
| Device type ID | 0x0038 |
| HART protocol revision | 7 |
| Device description files (DTM, DD) | Information and files at: www.endress.com \rightarrow Download Area |
| HART load | Min. 250 Ω Max. 500 Ω |
| System integration | For information on system integration, see → 🗎 65 • Measured variables via HART protocol • Burst Mode functionality |

16.5 Power supply

Terminal assignment

→ 🗎 33

Supply voltage

Transmitter

An external power supply is required for each output.

The following supply voltage values apply for the outputs available:

Supply voltage for a compact version without a local display ¹⁾

| Order code for "Output; input" | Minimum terminal voltage ²⁾ | Maximum Terminal voltage |
|---|---|-----------------------------|
| Option A: 4-20 mA HART | ≥ DC 12 V | DC 35 V |
| Option B : 4-20 mA HART, pulse/ frequency/switch output | ≥ DC 12 V | DC 35 V |
| Option C : 4-20 mA HART + 4-20 mA analog | ≥ DC 12 V | DC 30 V |
| Option D : 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input ³⁾ | ≥ DC 12 V | DC 35 V |

1) In event of external supply voltage of the power supply unit with load

2) The minimum terminal voltage increases if local operation is used: see the following table

3) Voltage drop 2.2 to 3 V for 3.59 to 22 mA

Increase of minimum terminal voltage with local operation

| Order code for "Display; operation" | Increase in minimum Terminal voltage |
|--|---|
| Option C : Local operation SD02 | + DC 1 V |
| Option E : Local operation SD03 with lighting (backlighting not used) | + DC 1 V |
| Option E : Local operation SD03 with lighting (backlighting used) | + DC 3 V |

| Power consumption | Transmitter | | | |
|------------------------|--|---|--|--|
| | Order code for "Output; input" | Maximum power consumption | | |
| | Option A: 4-20 mA HART | 770 mW | | |
| | Option B: 4-20 mA HART, pulse/ frequency/switch output | Operation with output 1: 770 mW Operation with output 1 and 2: 2 770 mW | | |
| | Option C: 4-20 mA HART + 4-20 mA analog | Operation with output 1: 660 mWOperation with output 1 and 2: 1320 mW | | |
| | Option D: 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input | Operation with output 1: 770 mW Operation with output 1 and 2: 2770 mW Operation with output 1 and input: 840 mW Operation with output 1, 2 and input: 2840 mW | | |
| Current consumption | Current output | | | |
| | For every 4-20 mA current output o | r current output: 3.6 to 22.5 mA | | |
| | If the option Defined value is selected in the Failure mode parameter : 3.59 to 22.5 mA | | | |
| | Current input | | | |
| | 3.59 to 22.5 mA | | | |
| | Internal current limiting: max. | 26 mA | | |
| Power supply failure | Totalizers stop at the last value measured. Depending on the device version, the configuration is retained in the device memory or in the pluggable data memory (HistoROM DAT). Error messages (incl. total operated hours) are stored. | | | |
| Electrical connection | → 🗎 38 | | | |
| Potential equalization | → 🗎 44 | | | |
| Terminals | For device version without integrated overvoltage protection: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG) For device version with integrated overvoltage protection: screw terminals for wire cross sections 0.2 to 2.5 mm² (24 to 14 AWG) | | | |
| Cable entries | The type of cable entry available depends on the specific device version. | | | |
| | Cable gland (not for Ex d) $M20 \times 1.5$ | | | |
| | Thread for cable entry ■ NPT ½" | | | |
| | ■ G ½" ■ M20 × 1.5 | | | |
| Cable specification | → 🗎 31 | | | |

Overvoltage protection

The device can be ordered with integrated overvoltage protection: Order code for "Accessory mounted", option NA "Overvoltage protection"

| Input voltage range | Values correspond to supply voltage specifications $\rightarrow \textcircled{B} 35^{1)}$ |
|--|--|
| Resistance per channel | 2 · 0.5 Ω max. |
| DC sparkover voltage | 400 to 700 V |
| Trip surge voltage | < 800 V |
| Capacitance at 1 MHz | < 1.5 pF |
| Nominal discharge current (8/20 μs) | 10 kA |
| Temperature range | -40 to +85 °C (-40 to +185 °F) |

1) The voltage is reduced by the amount of the internal resistance $I_{min} \cdot R_i$

Depending on the temperature class, restrictions apply to the ambient temperature for device versions with overvoltage protection .



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

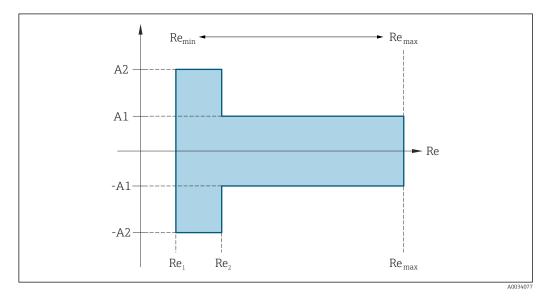
16.6 Performance characteristics

| Reference operating conditions | Error limits following ISO/DIN 11631 +20 to +30 °C (+68 to +86 °F) 2 to 4 bar (29 to 58 psi) Calibration system traceable to national standards Calibration with the process connection corresponding to the particular standard |
|--------------------------------|--|
| | To obtain measured errors, use the <i>Applicator</i> sizing tool $\rightarrow \square$ 163 |

Maximum measurement error

Base accuracy

o.r. = of reading



| Reynolds numbers | Incompressible | Compressible | |
|------------------|----------------|--------------|--|
| Reynolds humbers | Standard | Standard | |
| Re1 | 5 000 | | |
| Re ₂ | 20 000 | | |

Volume flow

| Medium type | | Incompressible | Compressible ¹⁾ |
|---|----|----------------|----------------------------|
| Reynolds number range Measurement error | | Standard | Standard |
| Re ₁ to Re ₂ | A2 | < 10 % | < 10 % |
| Re ₂ to Re _{max} | A1 | < 0.75 % | < 1.0 % |

1) Accuracy specifications valid up to 75 m/s (246 ft/s)

Temperature

- Saturated steam and liquids at room temperature if T > 100 °C (212 °F) applies: < 1 °C (1.8 °F)
- Gas:
- < 1 % o.r. [K]

Rise time 50 % (stirred under water, following IEC 60751): 8 s

Mass flow saturated steam

| Process pressure [bar abs.] | Flow velocity [m/s (ft/s)] | Reynolds number range | Measurement error | Standard |
|--------------------------------|-------------------------------|---|----------------------|----------|
| > 4.76 | 20 to 50 (66 to 164) | Re_2 to Re_{\max} | A1 | < 1.7 % |
| > 3.62 | 10 to 70 (33 to 230) | Re ₂ to Re _{max} | A1 | < 2 % |

Mass flow of superheated steam/gases $^{4)}$ $^{5)}$

| Process pressure [bar abs. (psi abs.)] | Reynolds number range | Measurement error | Standard ¹⁾ |
|---|--------------------------------------|-------------------|------------------------|
| < 40 (580) | Re_2 to Re_{max} | A1 | < 1.7 % |
| < 120 (1740) | Re ₂ to Re _{max} | A1 | < 2.6 % |

1) The use of a Cerabar S is required for the measurement errors listed in the following section. The measurement error used to calculate the error in the measured pressure is 0.15 %.

Water mass flow

| Reynolds number range | Measurement error | Standard |
|------------------------------------|-------------------|----------|
| $Re = Re_2$ | A1 | < 0.85 % |
| Re ₁ to Re ₂ | A2 | < 10 % |

⁴⁾ Single gas, gas mixture, air: NEL40; natural gas: ISO 12213-2 contains AGA8-DC92, AGA NX-19, ISO 12213-3 contains SGERG-88 and AGA8 Gross Method 1

⁵⁾ The measuring instrument is calibrated with water and has been verified under pressure on gas calibration rigs.

Mass flow (user-specific liquids)

To specify the system accuracy, Endress+Hauser requires information about the type of liquid and its operating temperature or information in table form about the dependency between the liquid density and the temperature.

Example

- Acetone is to be measured at fluid temperatures from +70 to +90 °C (+158 to +194 °F).
- For this purpose, the **Reference temperature** parameter (7703) (here 80 °C (176 °F)), **Reference density** parameter (7700) (here 720.00 kg/m³) and **Linear expansion coefficient** parameter (7621) (here 18.0298 × 10⁻⁴ 1/°C) must be entered in the transmitter.
- The overall system uncertainty, which is less than 0.9 % for the example above, is comprised of the following measurement uncertainties: uncertainty of volume flow measurement, uncertainty of temperature measurement, uncertainty of the density-temperature correlation used (including the resulting uncertainty of density).

Mass flow (other media)

Depends on the selected fluid and the pressure value, which is specified in the parameters. Individual error analysis must be performed.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

| Accuracy | ±10 µA |
|----------|--------|

Pulse/frequency output

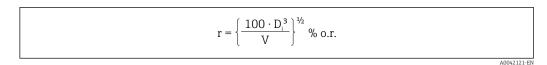
o.r. = of reading

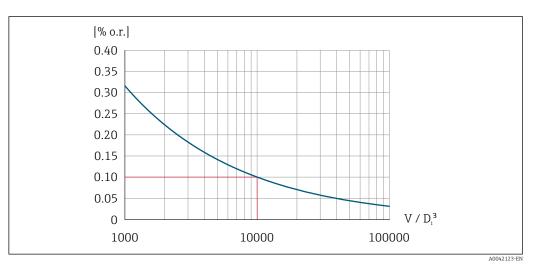
Accuracy

Max. ±100 ppm o.r.

Repeatability

o.r. = of reading





E 27 Repeatability = 0.1 % o.r. with a measured volume $[m^3]$ of V = 10000 $\cdot D_i^3$

| | | improved if the measured volume is increased. Repeatability is not ut a statistical variable that is dependent on the boundary | |
|----------------------|---|---|--|
| Response time | If all the configurable functions for filter times (flow damping, display damping, current output time constant, frequency output time constant, status output time constant) are set to 0, in the event of vortex frequencies of 10 Hz and higher a response time of max(T _v , 100 ms) can be expected. | | |
| | | ng frequencies < 10 Hz, the response time is > 100 ms and can be rage vortex period duration of the flowing fluid. | |
| Influence of ambient | Current output | | |
| temperature | o.r. = of reading | | |
| | Additional error, in relation to the span of 16 mA: | | |
| | Temperature coefficient at zero point (4 mA) | 0.02 %/10 K | |
| | Temperature coefficient with span (20 mA) | 0.05 %/10 K | |

o.r. = of reading

| Temperature coefficien | Max. ±100 ppm o.r. | |
|------------------------|--------------------|--|
|------------------------|--------------------|--|

16.7 Installation

| Installation requirements | → ➡ 20 | | |
|------------------------------|---|--|--|
| | 16.8 Environment | | |
| Ambient temperature range | → 🗎 23 | | |
| | 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 | All components apart from the display modules: -50 to +80 °C (-58 to +176 °F) | | |
| | Display modules | | |
| | -40 to +80 °C (-40 to +176 °F) | | |
| | Remote display FHX50: –40 to +80 °C (–40 to +176 °F) | | |

| Relative humidity | The device is suitable for use in outdoor and indoor areas with a relative humidity of 5 to 95%. |
|--|---|
| Climate class | DIN EN 60068-2-38 (test Z/AD) |
| Degree of protection | Transmitter Standard: IP66/67, Type 4X enclosure, suitable for pollution degree 4 When the housing is open: IP20, Type 1 enclosure, suitable for pollution degree 2 Display module: IP20, Type 1 enclosure, suitable for pollution degree 2 |
| | Sensor IP66/67, Type 4X enclosure, suitable for pollution degree 4 |
| Vibration-resistance and | Vibration sinusoidal, in accordance with IEC 60068-2-6 |
| shock resistance | Order code for "Housing", option B "GT18 dual compartment, 316L, compact" 2 to 8.4 Hz, 3.5 mm peak 8.4 to 500 Hz, 1 g peak |
| | Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or optior J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote" • 2 to 8.4 Hz, 7.5 mm peak • 8.4 to 500 Hz, 2 g peak |
| | Vibration broad-band random, according to IEC 60068-2-64 |
| | Order code for "Housing", option B "GT18 dual compartment, 316L, compact" • 10 to 200 Hz, 0.003 g ² /Hz • 200 to 500 Hz, 0.001 g ² /Hz • Total: 0.93 g rms |
| | Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote") 10 to 200 Hz, 0.01 g ² /Hz 200 to 500 Hz, 0.003 g ² /Hz Total: 1.67 g rms |
| | Half-sine shocks according to IEC 60068-2-27 |
| | Order code for "Housing", option B "GT18 dual compartment, 316L, compact" 6 ms 30 g Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote") 6 ms 50 g |
| | Rough handling shocks according to IEC 60068-2-31 |
| Electromagnetic compatibility (EMC) | As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21), NAMUR Recommendation 21 (NE 21) is fulfilled when installed in accordance with NAMUR Recommendation 98 (NE 98) As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4 |
| | Details are provided in the Declaration of Conformity. |
| | This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments. |

Medium temperature range

16.9

DSC sensor 1)

Process

Order code for "Sensor version; DSC sensor; measuring tube"

Option Description Medium temperature range AA Volume; 316L; 316L -40 to +260 °C (-40 to +500 °F), stainless steel Volume high-temperature; 316L; 316L -200 to +400 °C (-328 to +750 °F), stainless steel ΒA CA Mass; 316L; 316L -200 to +400 °C (-328 to +750 °F), stainless steel 1) Capacitance sensor Seals Order code for "DSC sensor seal" Option Description Medium temperature range Graphite -200 to +400 °C (-328 to +752 °F) А В –15 to +175 °C (+5 to +347 °F) Viton С -200 to +260 °C (-328 to +500 °F) Gylon D –20 to +275 °C (–4 to +527 °F) Kalrez For an overview of the pressure-temperature ratings for the process connections, see Pressure-temperature the Technical Information ratings Nominal pressure of sensor The following overpressure resistance values apply to the sensor shaft in the event of a membrane rupture: Sensor version; DSC sensor; measuring tube Overpressure, sensor shaft in [bar a] Volume 200 Volume high-temperature 200 200 Mass (integrated temperature measurement) Pressure loss For a precise calculation, use the Applicator $\rightarrow \triangleq 163$. 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 data:

- Including the transmitter:
 - Order code for "Housing", option C "GT20, two-chamber, aluminum, coated, compact" 1.8 kg (4.0 lb):
 - Order code for "Housing", option B "GT18 two-chamber, 316L, compact"4.5 kg (9.9 lb):
- Excluding packaging material

Weight in SI units

| DN | | | |
|------|---|---|--|
| [mm] | Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" ¹⁾ | Order code for "Housing", option B "GT18 two-chamber, 316L, compact" ¹⁾ | |
| 15 | 3.1 | 5.8 | |
| 25 | 3.3 | 6.0 | |
| 40 | 3.9 | 6.6 | |
| 50 | 4.2 | 6.9 | |
| 80 | 5.6 | 8.3 | |
| 100 | 6.6 | 9.3 | |
| 150 | 9.1 | 11.8 | |

1) For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

| Weight [lbs] | |
|---|---|
| Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" ¹⁾ | Order code for "Housing", option B "GT18 two-chamber, 316L, compact" ¹⁾ |
| 6.9 | 12.9 |
| 7.4 | 13.3 |
| 8.7 | 14.6 |
| 9.4 | 15.3 |
| 12.4 | 18.4 |
| 14.6 | 20.6 |
| 20.2 | 26.1 |
| | Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" 1) 6.9 7.4 8.7 9.4 12.4 14.6 |

1) For high-temperature/low-temperature version: values +0.4 lbs

Transmitter remote version

Wall-mount housing

Dependent on the material of wall-mount housing:

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote"2.4 kg (5.2 lb):
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote"6.0 kg (13.2 lb):

Sensor remote version

Weight data:

- Including sensor connection housing:
 - Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote"0.8 kg (1.8 lb):
 - Order code for "Housing", option K "GT18 two-chamber, 316L, remote"2.0 kg (4.4 lb):
- Excluding the connecting cable
- Excluding packaging material

Weight in SI units

| DN | Weight [kg] | |
|------|---|---|
| [mm] | sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" ¹⁾ | sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" ¹⁾ |
| 15 | 2.1 | 3.3 |
| 25 | 2.3 | 3.5 |
| 40 | 2.9 | 4.1 |
| 50 | 3.2 | 4.4 |
| 80 | 4.6 | 5.8 |
| 100 | 5.6 | 6.8 |
| 150 | 8.1 | 9.3 |

1) For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

| DN | Weight [lbs] | |
|------|---|---|
| [in] | sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" ¹⁾ | sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" ¹⁾ |
| 1/2 | 4.5 | 7.3 |
| 1 | 5.0 | 7.8 |
| 1½ | 6.3 | 9.1 |
| 2 | 7.0 | 9.7 |
| 3 | 10.0 | 12.8 |
| 4 | 12.3 | 15.0 |
| 6 | 17.3 | 20.5 |

1) For high-temperature/low-temperature version: values +0.4 lbs

Accessories

Flow conditioner

Weight in SI units

| DN ¹⁾ [mm] | Pressure rating | Weight [kg] |
|--------------------------|-----------------|----------------|
| 15 | PN 10 to 40 | 0.04 |
| 25 | PN 10 to 40 | 0.1 |
| 40 | PN 10 to 40 | 0.3 |

| DN ¹⁾ [mm] | Pressure rating | Weight [kg] |
|--------------------------|----------------------|----------------|
| 50 | PN 10 to 40 | 0.5 |
| 80 | PN 10 to 40 | 1.4 |
| 100 | PN10 to 40 | 2.4 |
| 150 | PN 10/16 PN 25/40 | 6.3 7.8 |

1) EN (DIN)

| DN ¹⁾ [mm] | Pressure rating | Weight [kg] |
|--------------------------|------------------------|----------------|
| 15 | Class 150 Class 300 | 0.03 0.04 |
| 25 | Class 150 Class 300 | 0.1 |
| 40 | Class 150 Class 300 | 0.3 |
| 50 | Class 150 Class 300 | 0.5 |
| 80 | Class 150 Class 300 | 1.2 1.4 |
| 100 | Class 150 Class 300 | 2.7 |
| 150 | Class 150 Class 300 | 6.3 7.8 |

1) ASME

| DN ¹⁾ [mm] | Pressure rating | Weight [kg] |
|--------------------------|-----------------|----------------|
| 15 | 20K | 0.06 |
| 25 | 20K | 0.1 |
| 40 | 20K | 0.3 |
| 50 | 10K 20K | 0.5 |
| 80 | 10K 20K | 1.1 |
| 100 | 10K 20K | 1.80 |
| 150 | 10K 20K | 4.5 5.5 |

1) JIS

Weight in US units

| DN ¹⁾ [in] | Pressure rating | Weight [lbs] |
|--------------------------|------------------------|-----------------|
| 1/2 | Class 150 Class 300 | 0.07 0.09 |
| 1 | Class 150 Class 300 | 0.3 |

| DN ¹⁾ [in] | Pressure rating | Weight [lbs] |
|--------------------------|------------------------|-----------------|
| 11/2 | Class 150 Class 300 | 0.7 |
| 2 | Class 150 Class 300 | 1.1 |
| 3 | Class 150 Class 300 | 2.6 3.1 |
| 4 | Class 150 Class 300 | 6.0 |
| 6 | Class 150 Class 300 | 14.0 16.0 |

1) ASME

Materials

Transmitter housing

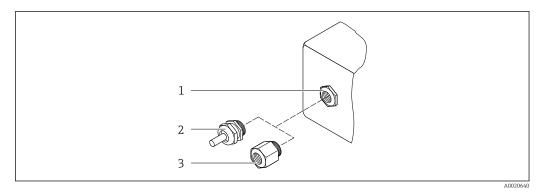
Compact version

- Order code for "Housing", option B "GT18 two-chamber, 316L, compact": Stainless steel, CF3M
- Order code for "Housing", option C "GT20, two-chamber, aluminum, coated, compact": Aluminum, AlSi10Mg, coated
- Window material: glass

Remote version

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote": Aluminum, AlSi10Mg, coated
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote": For maximum corrosion resistance: Stainless steel, CF3M
- Window material: glass

Cable entries/cable glands



🖻 28 Possible cable entries/cable glands

- 1 Internal thread M20 × 1.5
- 2 Cable gland M20 × 1.5
- 3 Adapter for cable entry with internal thread G ¹/₂" or NPT ¹/₂"

Order code for "Housing", option B "GT18 dual compartment, 316L, compact" option K "GT18 dual compartment, 316L, remote"

| Cable entry/cable gland | Type of protection | Material |
|--|---|--------------------------------|
| Cable gland M20 × 1.5 | Non-hazardous area Ex ia Ex ic Ex nA, Ex ec Ex tb | Stainless steel ,1.4404 |
| Adapter for cable entry with internal thread G ½" | Non-hazardous area and hazardous area (except for XP) | Stainless steel, 1.4404 (316L) |
| Adapter for cable entry with internal thread NPT ½" | Non-hazardous area and hazardous area | |

Order code for "Housing": option C "GT20 dual compartment, aluminum, coated, compact", option J "GT20 dual compartment, aluminum, coated remote"

| Cable entry/cable gland | Type of protection | Material |
|---|--|---------------------|
| Cable gland M20 × 1.5 | Non-hazardous areaEx iaEx ic | Plastic |
| | Adapter for cable entry with internal thread G ½" | Nickel-plated brass |
| Adapter for cable entry with internal thread NPT ½" | Non-hazardous area and hazardous area (except for XP) | Nickel-plated brass |
| Thread NPT ½" via adapter | Non-hazardous area and hazardous area | |

Connecting cable for remote version

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor connection housing

The material of the sensor connection housing is dependent on the material selected for the transmitter housing.

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote": Coated aluminum AlSi10Mg
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote": Stainless cast steel, 1.4408 (CF3M) Compliant with:
 - NACE MR0175
 - NACE MR0103

Measuring tubes

DN 15 to 150 (1/2 to 6"), pressure ratings PN 10/16/25/40, Class 150/300 , and JIS 10K/20K

- Stainless cast steel, CF3M/1.4408
- Complies with:
 - NACE MR0175-2003
 - NACE MR0103-2003

DSC sensor

Order code for "Sensor version; DSC sensor; measuring tube", option AA, BA, CA

Pressure ratings PN 10/16/25/40, Class 150/300, as well as JIS 10K/20K:

Parts in contact with medium (marked as "wet" on the DSC sensor flange):Stainless steel 1.4404 and 316 and 316L

- Compliant with:
 - NACE MR0175/ISO 15156-2015
 - NACE MR0103/ISO 17945-2015

Parts not in contact with medium: Stainless steel 1.4301 (304)

Seals

- Graphite
 - Sigraflex foil ZTM (BAM-certified for oxygen applications)
- FPM (VitonTM)
- Kalrez 6375TM
- Gylon 3504TM (BAM-certified for oxygen applications)

Housing support

Stainless steel, 1.4408 (CF3M)

Screws for DSC sensor

- Order code for "Sensor version", option AA "Stainless steel, A4-80 according to ISO 3506-1 (316)"
- Order code for "Sensor version", option BA, CA Stainless steel, A2 as per ISO 3506-1 (304)

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

Flow conditioner

- Stainless steel, multiple certifications, 1.4404 (316, 316L)
- Compliant with:
 - NACE MR0175-2003
 - NACE MR0103-2003

16.11 Operability

Languages

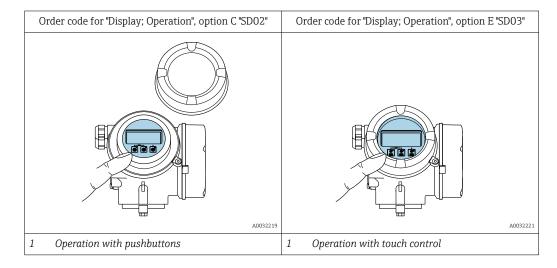
Can be operated in the following languages:

- Via local display: English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Swedish, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech
 Via "FieldCare" operating tool:
- English, German, French, Spanish, Italian, Chinese, Japanese

Onsite operation

Via display module

Two display modules are available:



Display elements

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

Operating elements

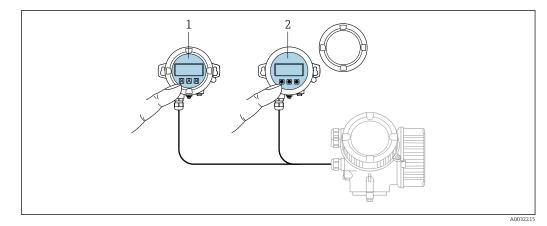
- External operation via touch control (3 optical keys) without opening the housing: \boxdot , \boxdot , \boxdot
- Operating elements also accessible in the various zones of the hazardous area

Additional functionality

- Data backup function
- The device configuration can be saved in the display module.
- Data comparison function The device configuration saved in the display module can be compared to the current device configuration.
- Data transfer function The transmitter configuration can be transmitted to another device using the display module.

Via remote display FHX50

The remote display FHX50 can be ordered as an optional extra $\rightarrow \square$ 161.



☑ 29 FHX50 operating options

1 SD02 display and operating module, push buttons: cover must be opened for operation

2 SD03 display and operating module, optical buttons: operation possible through cover glass

Display and operating elements

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

| Remote operation | → 🖺 60 | |
|-------------------|--|--|
| Service interface | → 🗎 61 | |
| | 16.12 Certificates and approvals | |
| | Current certificates and approvals for the product are available at <u>www.endress.com</u> on the relevant product page: | |
| | 1. Select the product using the filters and search field. | |
| | 2. Open the product page. | |
| | 3. Select Downloads . | |
| CE mark | The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied. | |
| | Endress+Hauser confirms successful testing of the device by affixing to it the CE mark. | |
| UKCA marking | The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark. | |
| | Contact address Endress+Hauser UK: Endress+Hauser Ltd. Floats Road Manchester M23 9NF United Kingdom www.uk.endress.com | |
| RCM marking | 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. |
|---------------------------------|--|
| Functional safety | The measuring instrument can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture; order code for "Additional approval", option LA) and SIL 3 (multi-channel architecture with homogeneous redundancy) and is independently evaluated and certified in accordance with IEC 61508. |
| | The following types of monitoring in safety equipment are possible: |
| | Functional safety manual with information for the SIL device |
| Pressure Equipment Directive | With the marking a) PED/G1/x (x = category) or b) PESR/G1/x (x = category) on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential |
| | Safety Requirements" a) specified in Annex I of the Pressure Equipment Directive 2014/68/EU or |
| | b) Schedule 2 of Statutory Instruments 2016 No. 1105. Devices not bearing this marking (without PED or PESR) are designed and manufactured according to sound engineering practice. They meet the requirements of a) Art. 4 Para. 3 of the Pressure Equipment Directive 2014/68/EU or b) Part 1, Para. 8 of Statutory Instruments 2016 No. 1105. The scope of application is indicated |
| | a) in diagrams 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU or b) Schedule 3, Para. 2 of Statutory Instruments 2016 No. 1105. |
| Experience | The Prowirl 200 measuring system is the successor model of the Prowirl 72 and Prowirl 73. |
| External standards and | • EN 60529 |
| guidelines | Degrees of protection provided by enclosure (IP code) DIN ISO 13359 |
| | Measurement of conductive liquid flow in closed conduits - Flanged-type electromagnetic flowmeters - Overall length |
| | ISO 12764:2017 Measurement of fluid flow in closed conduits – Flow rate measurement by means of vortex shedding flowmeters inserted in circular cross-section conduits running full EN (10.1) |
| | EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements EN 61326-1/-2-3 |
| | EN 01520-17-2-5 EMC requirements for electrical equipment for measurement, control and laboratory use NAMUR NE 21 |
| | Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment NAMUR NE 32 |
| | |
| | Data retention in the event of a power failure in field and control instruments with microprocessors |
| | - |

NAMUR NE 105

| | NAMOR NE 105 Specifications for integrating fieldbus devices in engineering tools for field devices NAMUR NE 107 Self-monitoring and diagnosis of field devices NAMUR NE 131 Requirements for field devices for standard applications ETSI EN 300 328 Guidelines for 2.4 GHz radio components. EN 301489 Electromagnetic compatibility and radio spectrum matters (ERM). |
|--------------------------|---|
| | 16.13 Application packages |
| | Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements. |
| | The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com. |
| | Detailed information on the application packages: Special Documentation $\rightarrow \cong 194$ |
| Diagnostic functionality | Order code for "Application package", option EA "Extended HistoROM" |
| | Comprises extended functions concerning the event log and the activation of the measured value memory. |
| | Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries. |
| | Data logging (line recorder): Memory capacity for up to 1000 measured values is activated. 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server. |
| | For detailed information, see the Operating Instructions for the device. |
| Heartbeat Technology | Order code for "Application package", option EB "Heartbeat Verification" |
| | Heartbeat Verification Meets the requirement for traceable verification in accordance with DIN ISO 9001:2008 Clause 7.6 a) "Control of monitoring and measuring equipment". Functional testing in the installed state without interrupting the process. Traceable verification results on request, including a report. Simple testing process via local operation or other operating interfaces. Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. Extension of calibration intervals according to operator's risk assessment. Detailed information on Heartbeat Technology: Special Documentation → 🖺 194 |

16.14 Accessories

Overview of accessories available to order $\rightarrow \implies 161$

16.15 Documentation

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

- Device Viewer (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- Endress+Hauser Operations app: Enter serial number from nameplate or scan matrix code on nameplate.

Standard Documentation **Brief Operating Instructions**

Brief Operating Instructions for the sensor

| Measuring device | Documentation code |
|------------------|--------------------|
| Prowirl D 200 | KA01322D |

Brief Operating Instructions for the transmitter

| Measuring instrument | Documentation code |
|----------------------|--------------------|
| Prowirl 200 | KA01326D |

Technical Information

| Measuring device | Documentation code |
|------------------|--------------------|
| Prowirl D 200 | TI01332D |

Description of Device Parameters

| Measu | uring instrument | Documentation code |
|--------|------------------|--------------------|
| Prowir | ÷1 200 | GP01109D |

Supplementary devicen

Safety instructions

| dependent | documentation |
|-----------|---------------|
|-----------|---------------|

| Contents | Documentation code |
|-----------------------------------|--------------------|
| ATEX/IECEx Ex d | XA01635D |
| ATEX/IECEx Ex ia | XA01636D |
| ATEX/IECEx Ex ec, Ex ic | XA01637D |
| _C CSA _{US} XP | XA01638D |
| _c CSA _{US} IS | XA01639D |
| EAC Ex d | XA01684D |
| EAC Ex ia | XA01782D |
| EAC Ex ec, Ex ic | XA01685D |
| INMETRO Ex d | XA01642D |
| INMETRO Ex ia | XA01640D |
| INMETRO Ex ec, Ex ic | XA01641D |

| Contents | Documentation code |
|--------------------|--------------------|
| JPN Ex d | XA01766D |
| NEPSI Ex d | XA01643D |
| NEPSI Ex ia | XA01644D |
| NEPSI Ex ec, Ex ic | XA01645D |
| UKEX Ex d | XA02630D |
| UKEX Ex ia | XA02631D |
| UKEX Ex ec, Ex ic | XA02632D |

Functional Safety Manual

| Contents | Documentation code |
|---------------------|--------------------|
| Proline Prowirl 200 | SD02025D |

Special Documentation

| Contents | Documentation code |
|---|--------------------|
| Information on the Pressure Equipment Directive | SD01614D |
| Heartbeat Technology | SD02029D |
| Protective cover | SD00333F |

Installation Instructions

| Contents | Note |
|---|---|
| Installation instructions for spare part sets and accessories | Access the overview of all the available spare part sets via <i>Device Viewer</i> → ⁽¹⁾ 158 Accessories available for order with Installation Instructions → ⁽²⁾ 161 |

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