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Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Proline Prosonic Flow I 400

Ultrasonic time-of-flight flowmeter
Modbus RS485

Endress+Hauser
People for Process Automation

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

Table of contents

1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

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

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

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

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

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current
⏚	**Ground connection** 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 other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: potential equalization 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.
	LED Light emitting diode is off.

Symbol	Meaning
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is flashing.

1.2.4 Tool symbols

Symbol	Meaning
	Torx screwdriver
	Phillips head screwdriver
	Open-ended wrench

1.2.5 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**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
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.6 Symbols in graphics

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

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

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *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 documentation may be available depending on the device version ordered:

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** These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** 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. The Safety Instructions are a constituent part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
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

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

2 Safety instructions

2.1 Requirements for the personnel

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

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

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

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

Measuring devices for use in explosive atmospheres, in hygienic applications or where there is a high risk of pressures, are labeled accordingly on the nameplate.

To ensure that the measuring device is in proper condition during the operation period:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Refer to the nameplate to check whether the ordered instrument can be operated for the intended application in areas requiring specific approvals (e. g. explosion protection, pressure equipment safety).
- Use the measuring device 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 device permanently against corrosion from environmental influences.

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

Residual risks

⚠ CAUTION

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.
- Use suitable protective equipment.

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

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

2.6 IT security

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

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

2.7 Device-specific IT security

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

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 🖹 11	Not enabled	On an individual basis following risk assessment
Access code (also applies to web server login or FieldCare connection) → 🖹 11	Not enabled (0000)	Assign a customized access code during commissioning

Function/interface	Factory setting	Recommendation
WLAN (order option in display module)	Enabled	On an individual basis following risk assessment
WLAN security mode	Enabled (WPA2-PSK)	Do not change
WLAN passphrase (Password) → 🖹 11	Serial number	Assign an individual WLAN passphrase during commissioning
WLAN mode	Access point	On an individual basis following risk assessment
Web server → 🖹 12	Enabled	On an individual basis following risk assessment
CDI-RJ45 service interface→ 🖹 12	–	On an individual basis following risk assessment

2.7.1 Protecting access via hardware write protection

Write access to the parameters of the device via the local display 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.

2.7.2 Protecting access via a password

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

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

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 (→ 🖹 114).

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

WLAN passphrase: Operation as WLAN access point

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface (→ 🖹 63), which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter (→ 🖹 110).

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" → 114.

2.7.3 Access via web server

The integrated web server can be used to operate and configure the device via a web browser → 56. The connection is established via the service interface (CDI-RJ45) or the WLAN interface.

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

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.

Detailed information on the device parameters:
"Description of device parameters" document → 169.

2.7.4 Access via service interface (CDI-RJ45)

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

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

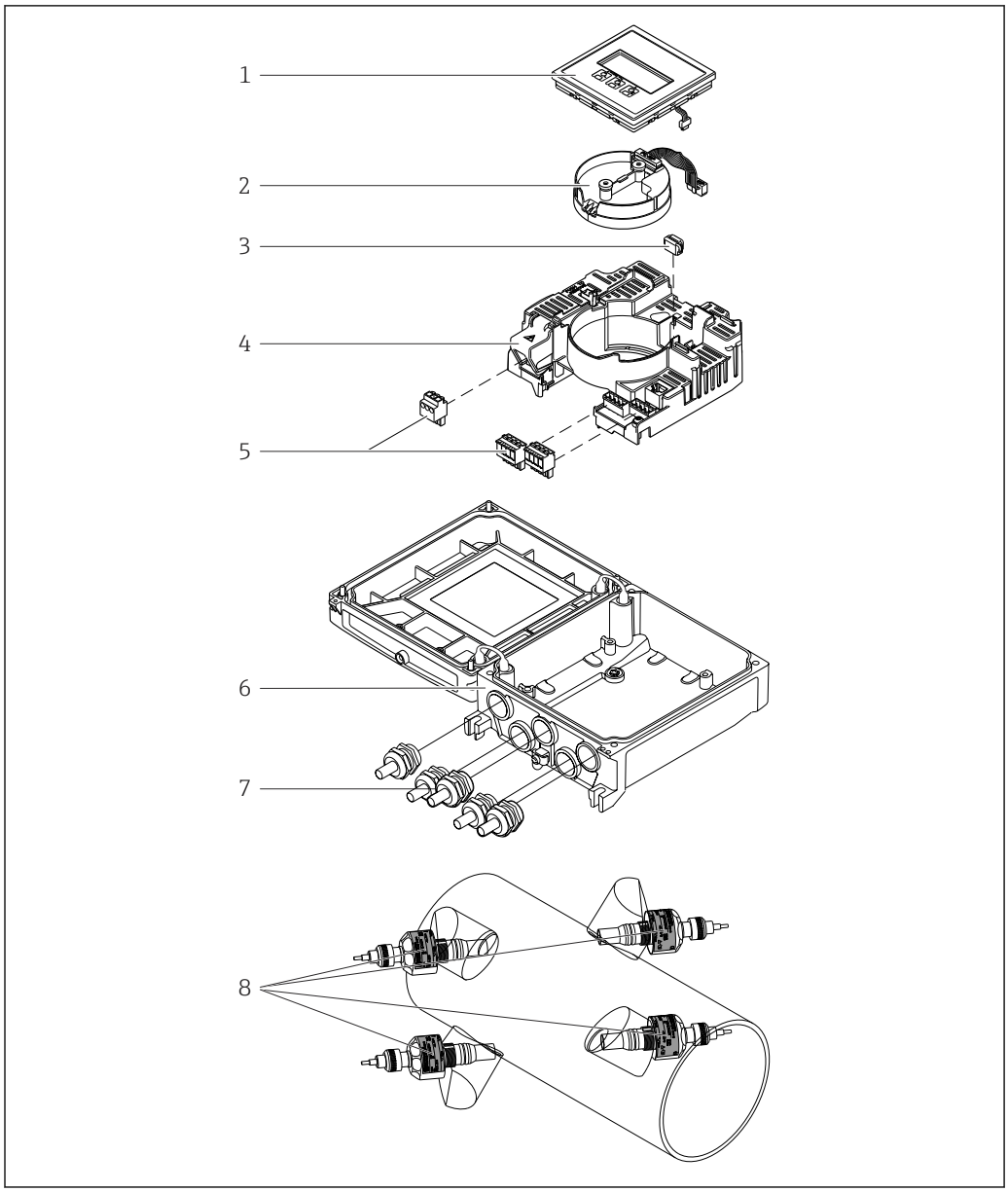
3 Product description

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

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

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

3.1 Product design

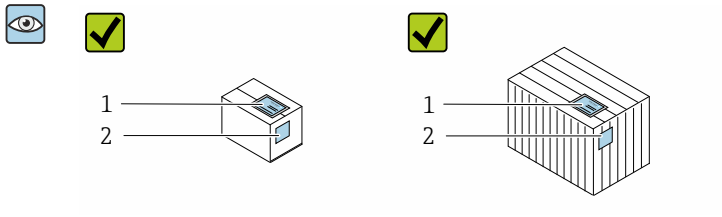


1 *Important components*

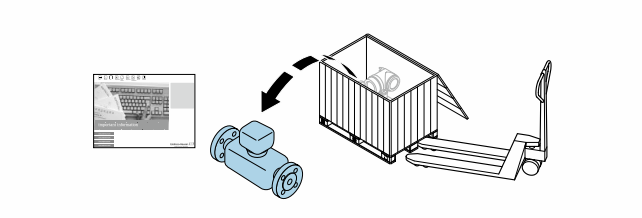
1 *Display module*
2 *Intelligent sensor electronics module*
3 *HistoROM DAT (plug-in memory)*
4 *Main electronics module*
5 *Terminals (screw terminals, some available as plug-in terminals) or fieldbus connectors*
6 *Transmitter housing*
7 *Cable glands*
8 *Sensor (2 versions)*

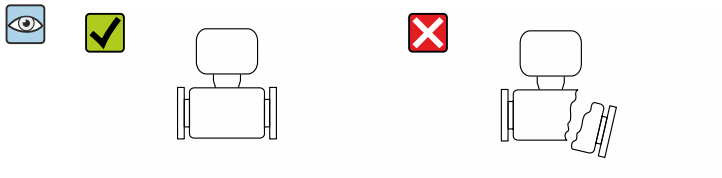
4 Incoming acceptance and product identification

4.1 Incoming acceptance

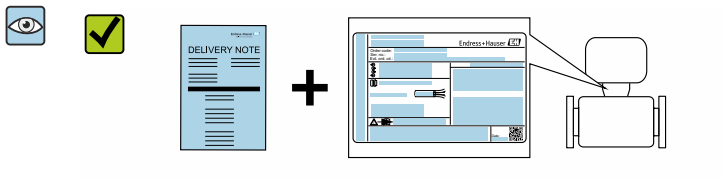


Are the order codes on the delivery note (1) and the product sticker (2) identical?





Are the goods undamaged?



Does the data on the nameplate match the order specifications on the delivery note?

Is the envelope present with accompanying documents?

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

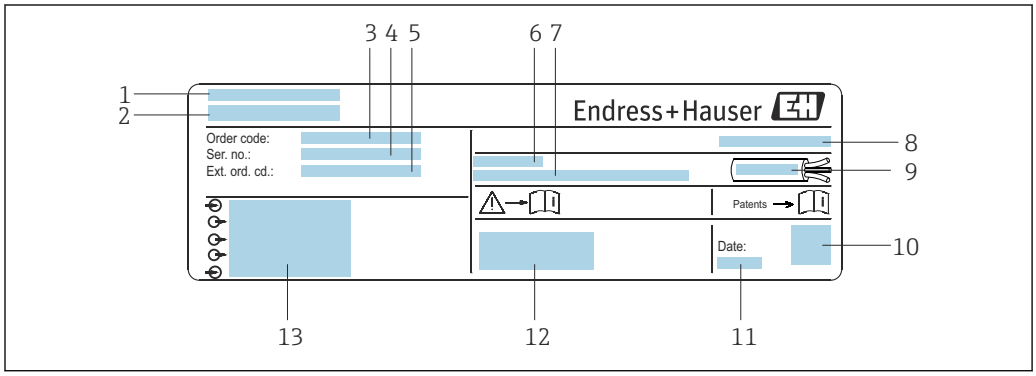
4.2 Product identification

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.

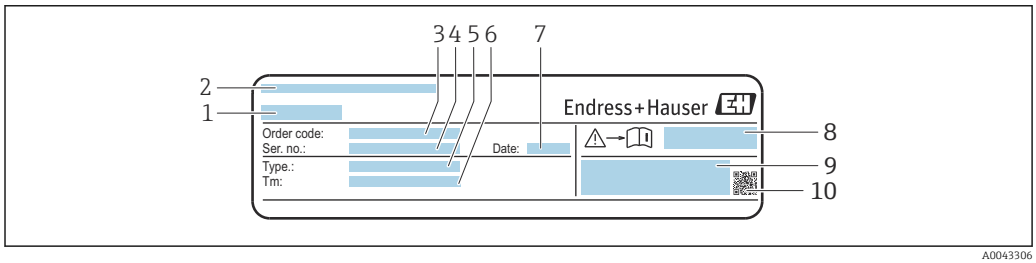
4.2.1 Transmitter nameplate



2 *Example of a transmitter nameplate*

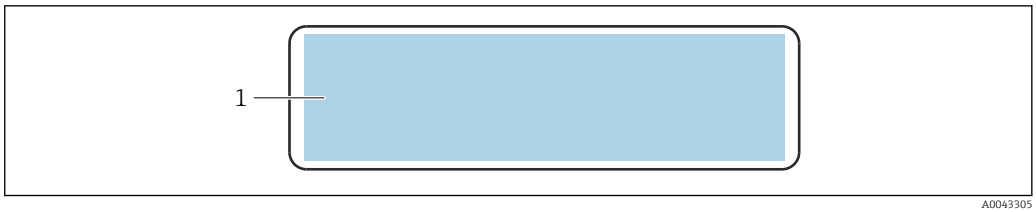
1 *Manufacturer address/certificate holder*
2 *Name of the transmitter*
3 *Order code*
4 *Serial number*
5 *Extended order code*
6 *Permitted ambient temperature (T_a)*
7 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
8 *Degree of protection*
9 *Permitted temperature range for cable*
10 *2-D matrix code*
11 *Date of manufacture: year-month*
12 *CE mark, RCM mark*
13 *Electrical connection data, e.g. available inputs and outputs, supply voltage*

4.2.2 Sensor nameplate



3 *Example of sensor nameplate, "front"*

1 *Name of sensor*
2 *Manufacturer address/certificate holder*
3 *Order code*
4 *Serial number*
5 *Model*
6 *Medium temperature range*
7 *Date of manufacture: year-month*
8 *Document number of safety-related supplementary documentation*
9 *Additional information*



4 Example of sensor nameplate, "back"

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

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

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

4.2.3 Symbols on the device

Symbol	Meaning
	**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 device 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.
- ▶ Protect from direct sunlight. Avoid unacceptably high surface temperatures.
- ▶ Store in a dry and dust-free place.
- ▶ Do not store outdoors.

Storage temperature → 🖹 160

5.2 Transporting the product

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

5.2.1 Transporting with a fork lift

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

5.3 Packaging disposal

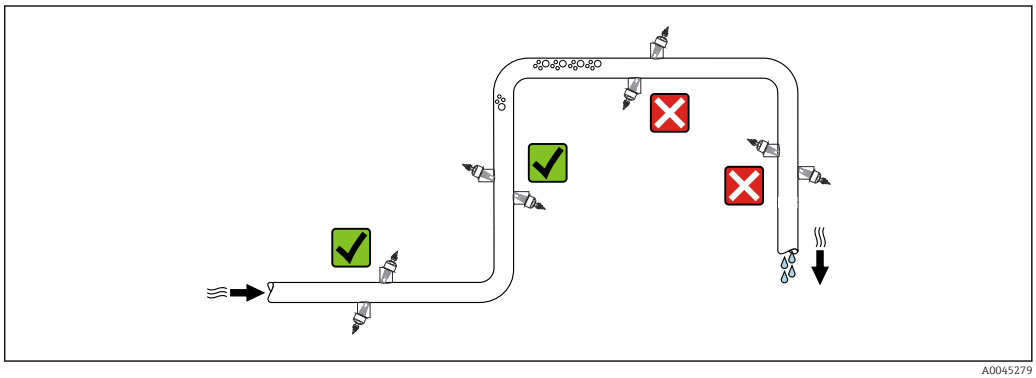
All packaging materials are environmentally friendly and 100% recyclable:
- Outer packaging of device
  Stretch wrap made of polymer in accordance with EU Directive 2002/95/EC (RoHS)
- Packaging
  - Wood crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
  - Cardboard box in accordance 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 Mounting procedure

6.1 Mounting requirements

6.1.1 Mounting position

Mounting location



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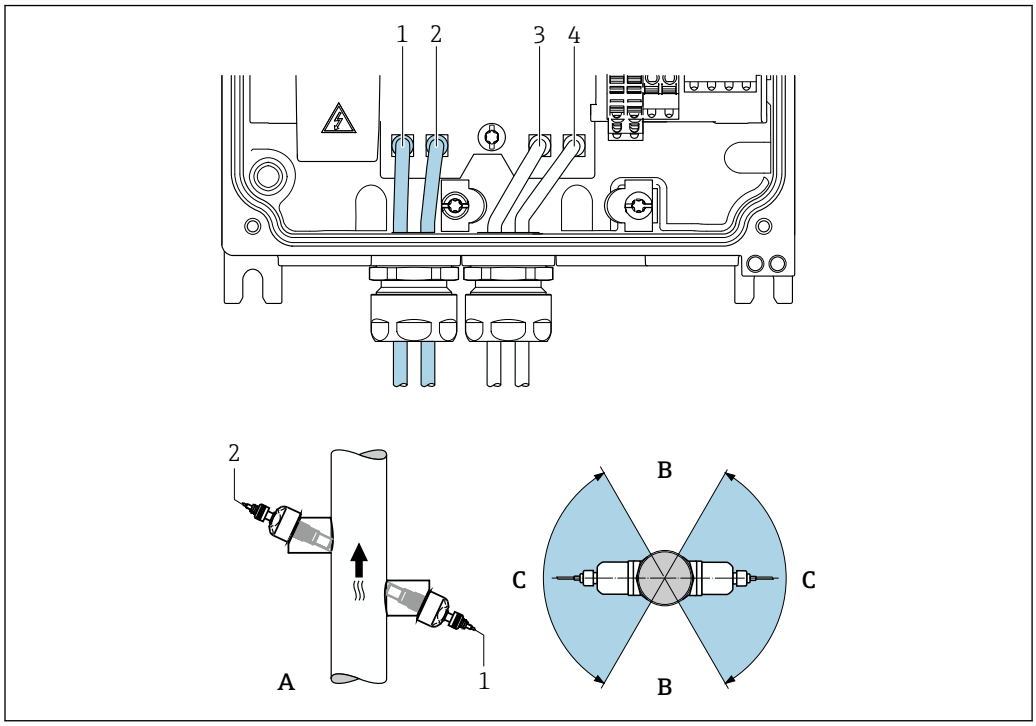
To prevent measuring errors arising from accumulation of gas bubbles in the measuring pipe, avoid the following mounting locations in the piping:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Orientation



5 Orientation views

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

Vertical

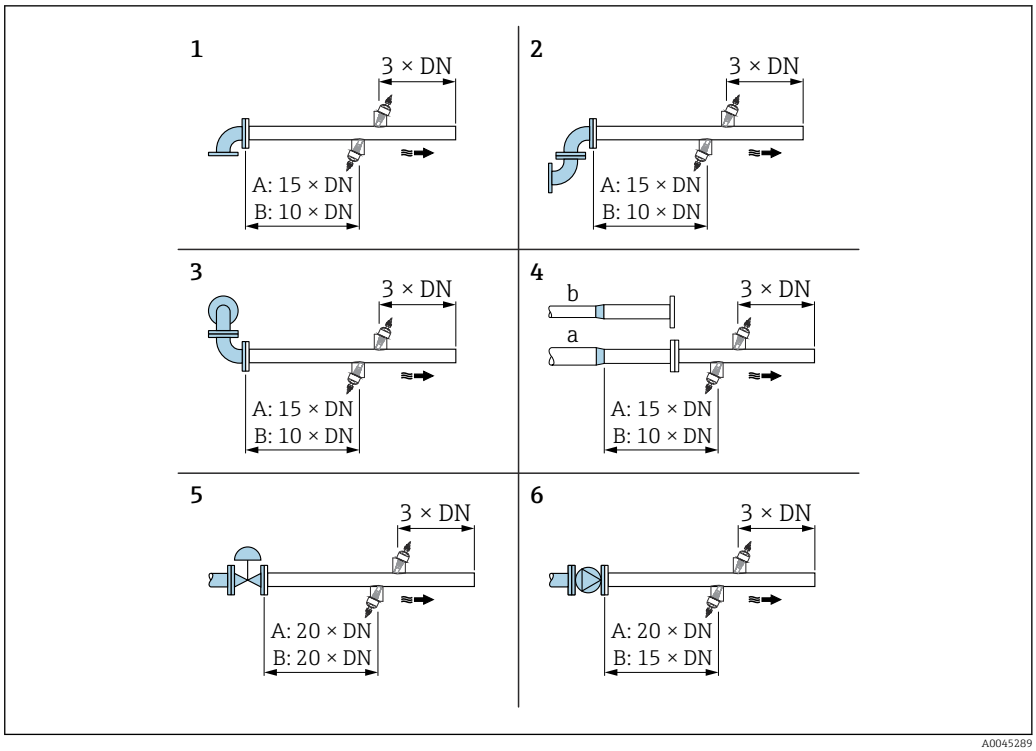
Recommended orientation with upward flow direction (view A) With this orientation, entrained solids sink and gases rise away from the sensor area when the medium is not flowing. In addition, the pipe can be completely drained and protected against the buildup of deposits.

Horizontal

In the recommended installation range with a horizontal orientation (View B), gas and air accumulations at the top of the pipe and inteference from deposit buildup at the bottom of the pipe can influence the measurement to a lesser degree.

Inlet and outlet runs

If possible, install the sensors upstream of assemblies such as valves, T-pieces, elbows, and pumps. If this is not possible, the specified measurement accuracy of the measuring device is achieved by observing the specified minimum inlet and outlet runs with optimum sensor configuration. If there are several flow obstructions, the longest specified inlet run must be taken into account.



6 *Minimum inlet and outlet runs with different flow obstructions (A: single-path measurement, B: two-path measurement)*

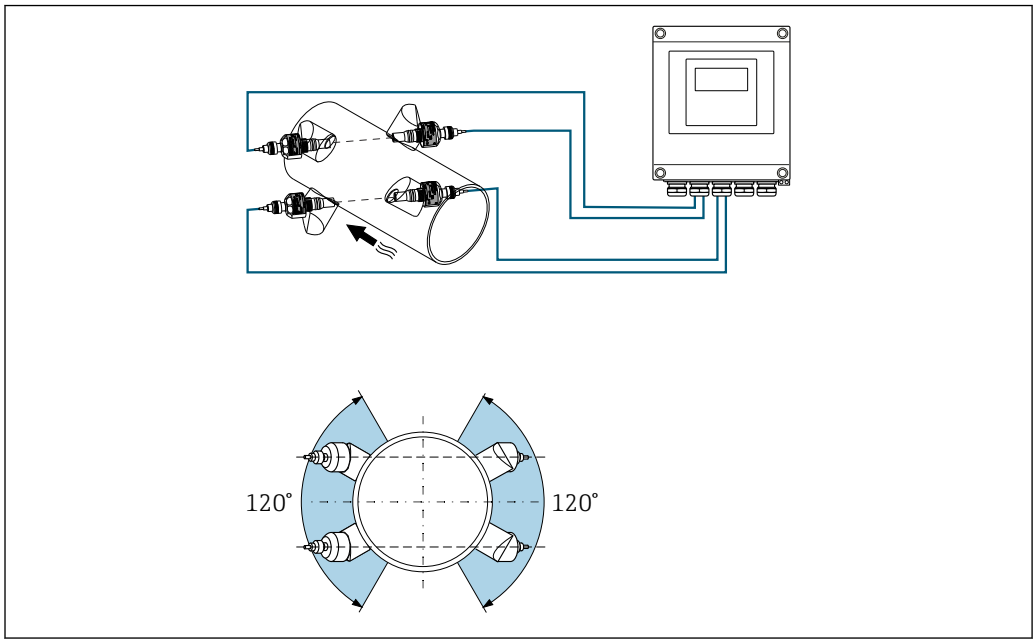
1 Pipe bend
2 Two pipe bends (on one plane)
3 Two pipe bends (on two planes)
4a Reduction
4b Extension
5 Control valve (2/3 open)
6 Pump

Measuring mode

Single-path measurement

→ 6, 21

Two-path measurement



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

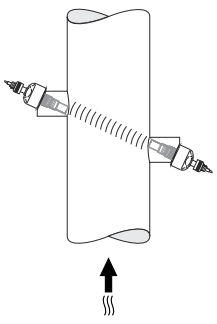
Installation dimensions

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

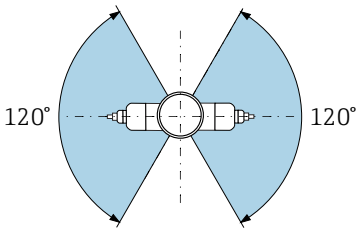
6.1.2 Sensor set selection and arrangement

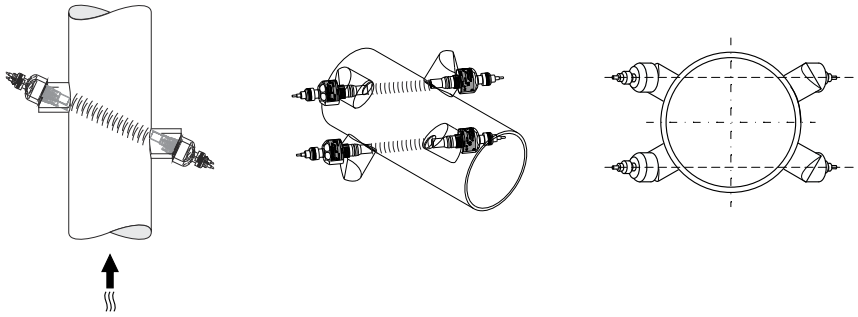
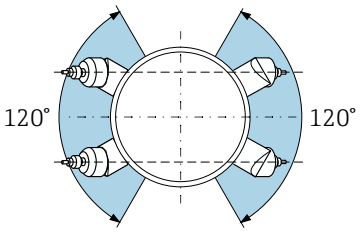
If mounting horizontally, always mount the sensor set so that it is offset at an angle of ±30° to the top of the measuring pipe to avoid incorrect measurements caused by gas pockets or bubbles at the top of the pipe.

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

Single-path measurement (1 sensor set)
Vertical mounting
 A0044939

1) Do not swap the sensors of the two sensor sets, as this can affect the measurement performance.

Single-path measurement (1 sensor set)
Horizontal mounting
 A0044304

Two-path measurement (2 sensor sets)
Vertical mounting
 A0044940
Horizontal mounting
 A0044942

6.1.3 Environmental and process requirements

Ambient temperature range

Transmitter	−40 to +60 °C (−40 to +140 °F)
Readability of the local display	−20 to +60 °C (−4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.

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

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

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

Medium pressure range

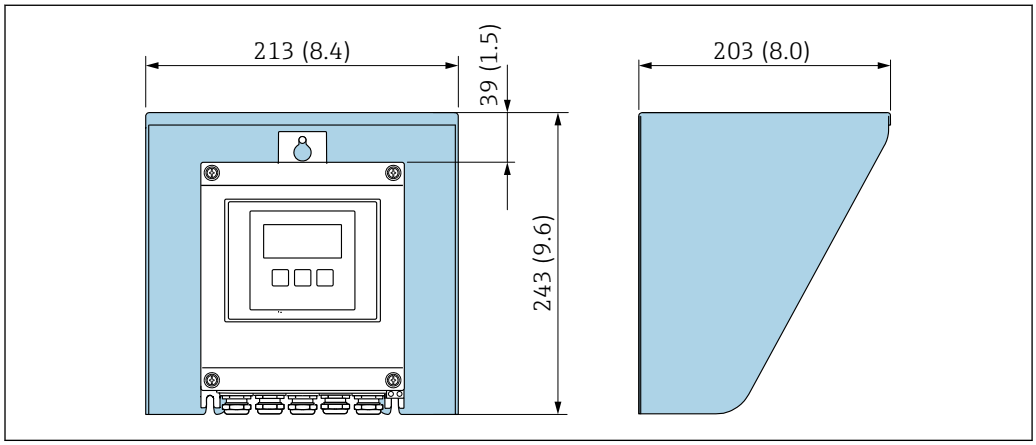
Maximum nominal pressure PN 16 (16 bar (232 psi))

6.1.4 Special mounting instructions

Display guard

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

Weather protection cover



8 Weather protection cover; engineering unit mm (in)

6.2 Mounting the measuring device

6.2.1 Required tools

For transmitter

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

For sensor

For mounting on the measuring tube: Use a suitable mounting tool.

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove stick-on label on the electronics compartment cover.

6.2.3 Mounting the sensor

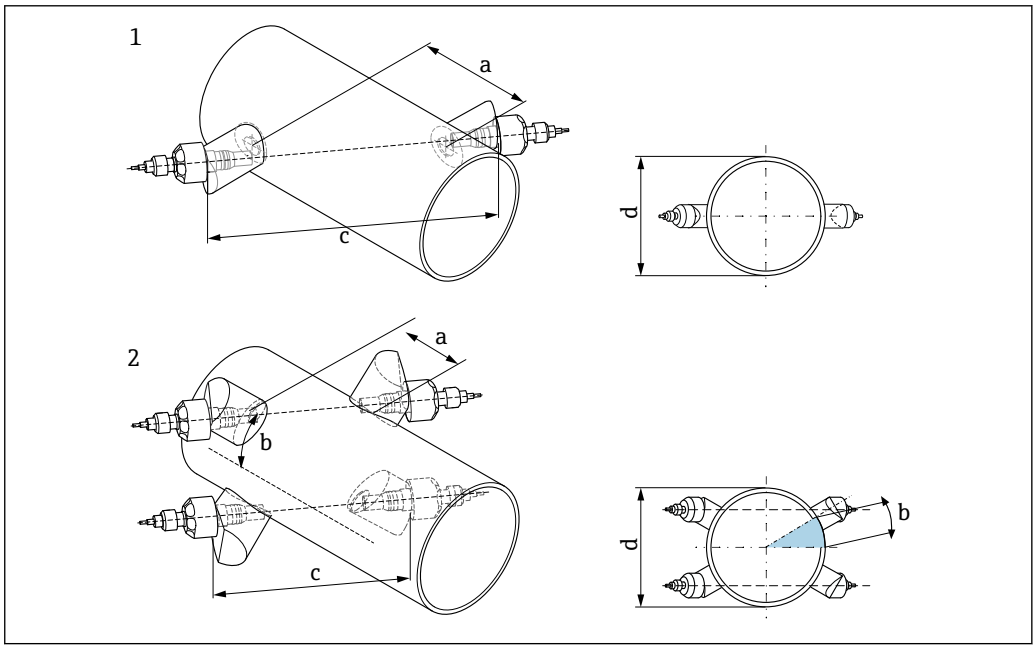
Sensor configuration and settings

DN 200 to 4000 (8 to 160")	
Single-path version [mm (in)]	**Two-path version [mm (in)]**
Sensor distance [1]	Sensor distance [1]
Path length → 9, 25	Path length → 9, 25 Arc length → 9, 25

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

Determining the mounting positions of the sensor

Description of installation



9 *Terminology Description of installation*

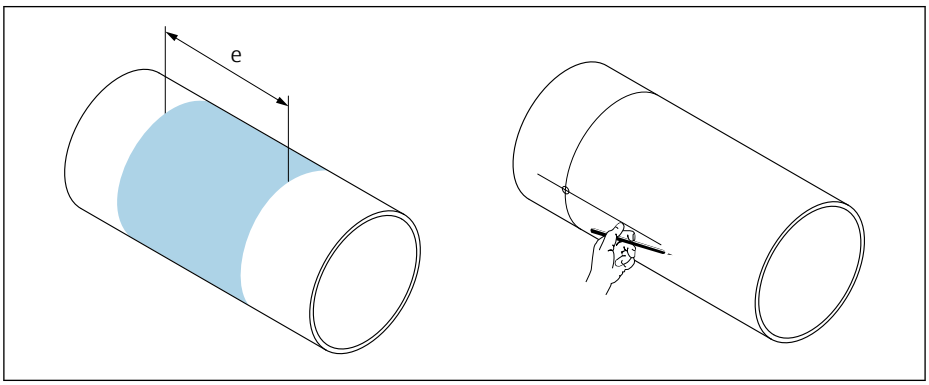
1 Single-path version
2 Two-path version
a Sensor distance
b Arc length
c Path length
d External diameter of measuring pipe

Detailed information:

Sensor holder for single-path version

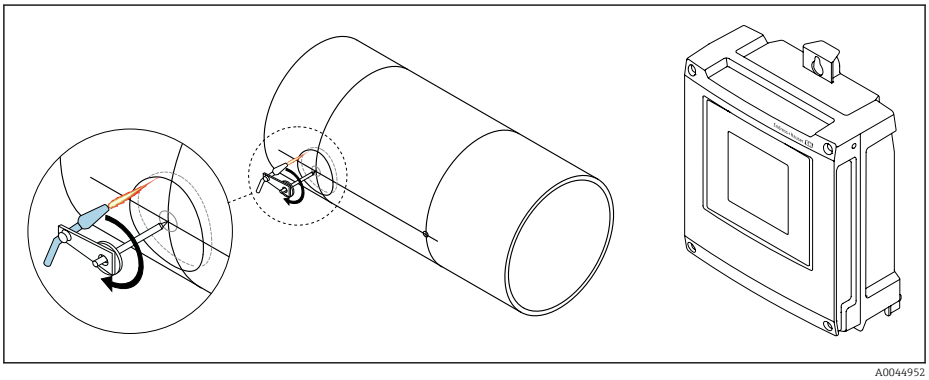
Procedure:

1. Determine mounting area (e) on measuring pipe section (space required at measuring point approx. 1x diameter of measuring pipe).
2. Mark the center line on the measuring pipe at the mounting location and mark the first the drill hole (drill hole diameter: 65 mm (2.56 in)). The center line marking should extend beyond the hole to be drilled.



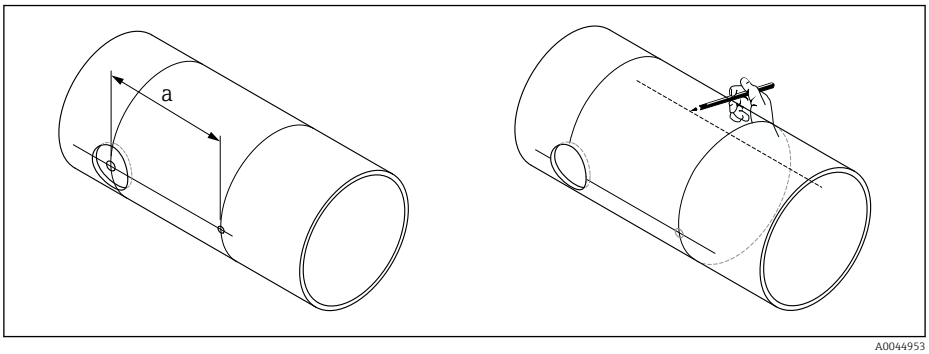
A0044951

3. Cut the first drill hole using a plasma cutter, for example. Measure the wall thickness of the measuring pipe, if not already known.
4. Determine the sensor distance → 25.



A0044952

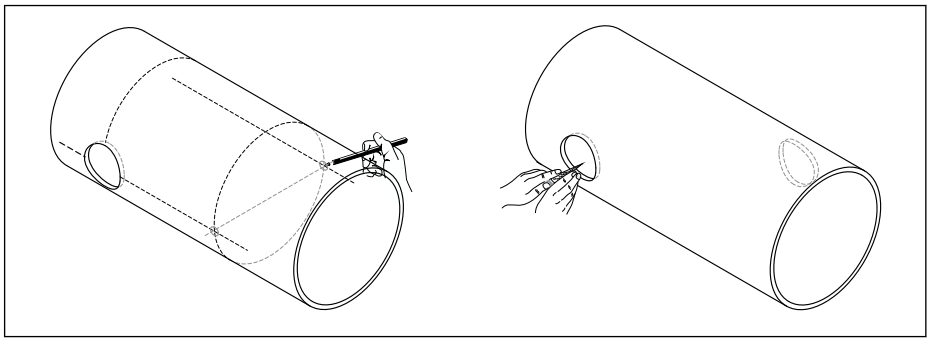
5. Mark the sensor distance (a) starting from the center line of the first drill hole.
6. Project and draw the center line onto the rear of the measuring pipe.



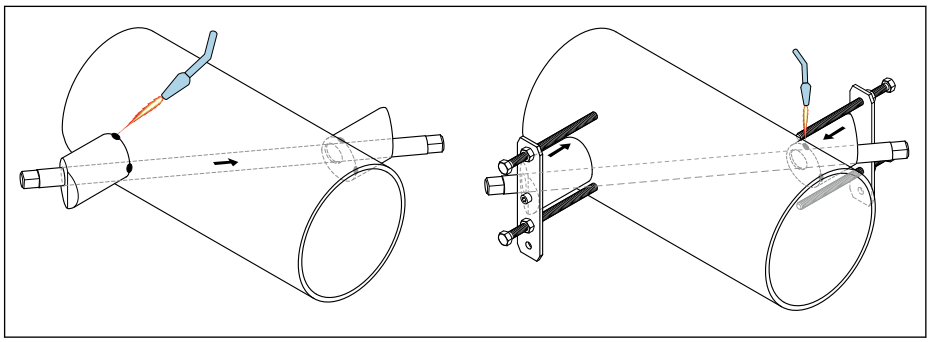
A0044953

7. Mark the drill hole on the rear center line.

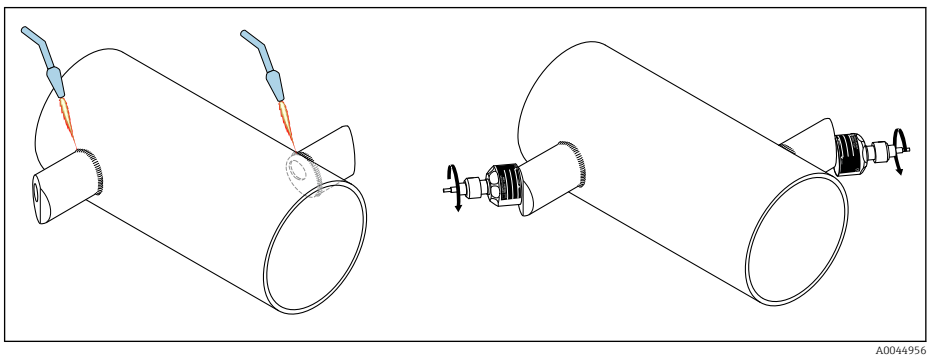
8. Cut out the second drill hole and prepare holes for welding in the sensor holders (deburr, clean).


A0044954

9. Insert sensor holders into both drill holes. To adjust the welding depth, both sensor holders can be secured with the special tool for regulating the insertion depth and then aligned using the path rod. The senor holder must be flush with the inside of the measuring pipe.
10. Spot-weld both sensor holders. To align the path rod, screw both guide bushes into the sensor holders.


A0044955

11. Weld in both sensor holders.
12. Check the distances between the drill holes again and determine the path length → 25.
13. Manually screw the sensors into the sensor holders. If using a tool, tighten with max. 30 Nm.
14. Insert the sensor cable plugs into the openings provided and manually tighten the plugs as far as they will go.

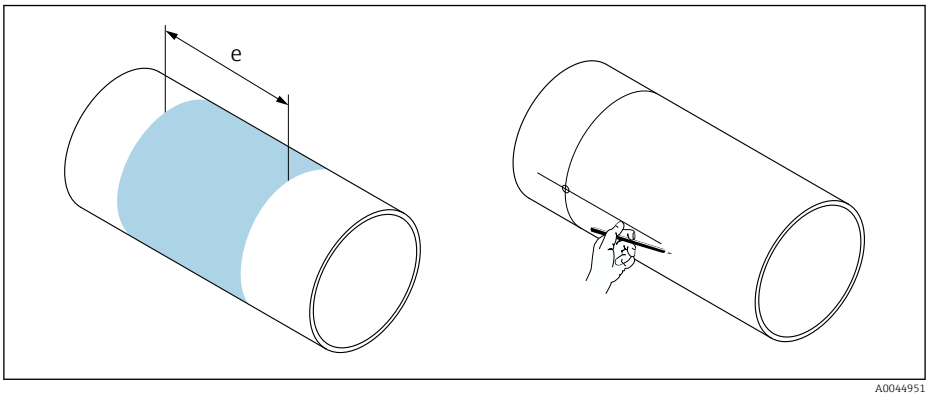

A0044956

Sensor holder for two-path version

Procedure:

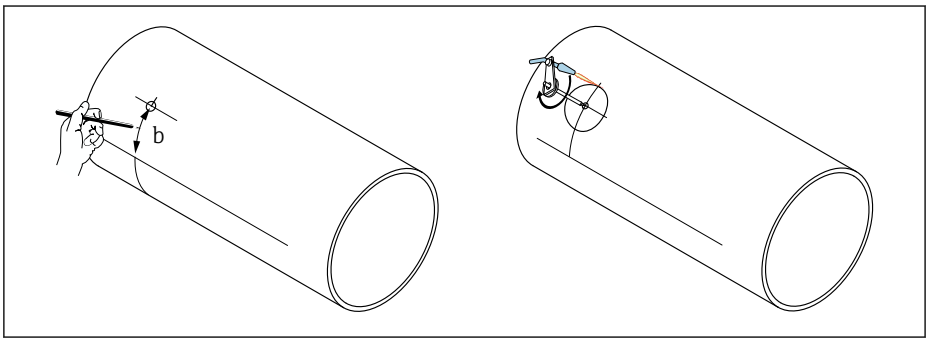
1. Determine mounting area (e) on measuring pipe section (space required at measuring point approx. 1x diameter of measuring pipe).

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



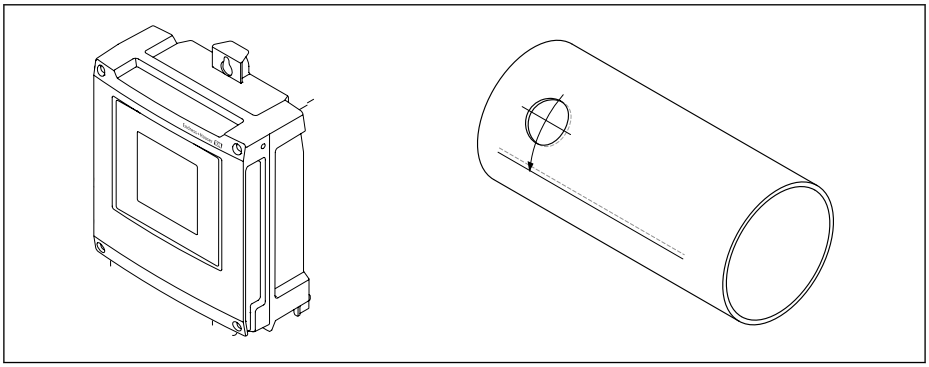
A0044951

3. Draw the length of the arc (b) at the mounting position of the sensor holder from the center line out to one side. Base the arc length on approx. 1/12 of the circumference of the measuring pipe. Mark the first drill hole (drill hole diameter: 81 to 82 mm (3.19 to 3.23 in)). Extend the center line beyond the hole to be drilled.
4. Cut the first drill hole using a plasma cutter, for example. Measure the wall thickness of the measuring pipe, if not already known.



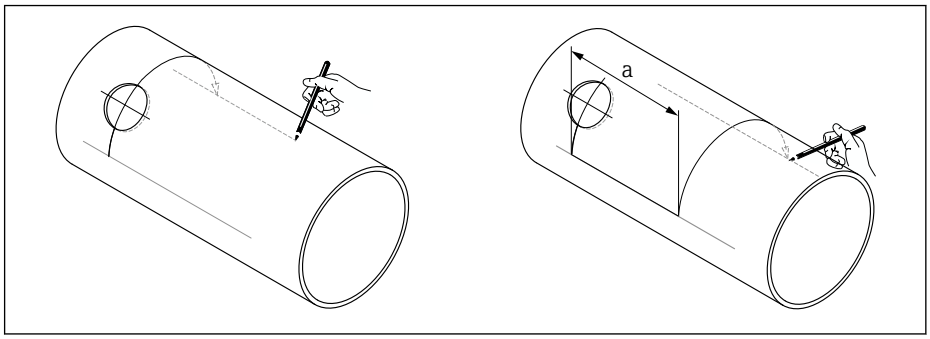
A0044957

5. Determine the sensor distance and arc length → 25.
6. Use the arc length that was determined to correct the center line.


A0044958

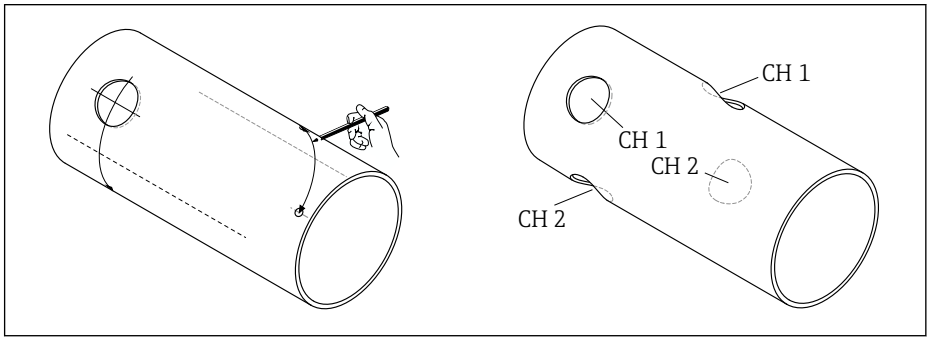
7. Project and draw the corrected center line onto the opposite side of the measuring pipe (half of measuring pipe circumference).

8. Mark the sensor distance on the center line and project it onto the center line on the rear of the pipe.



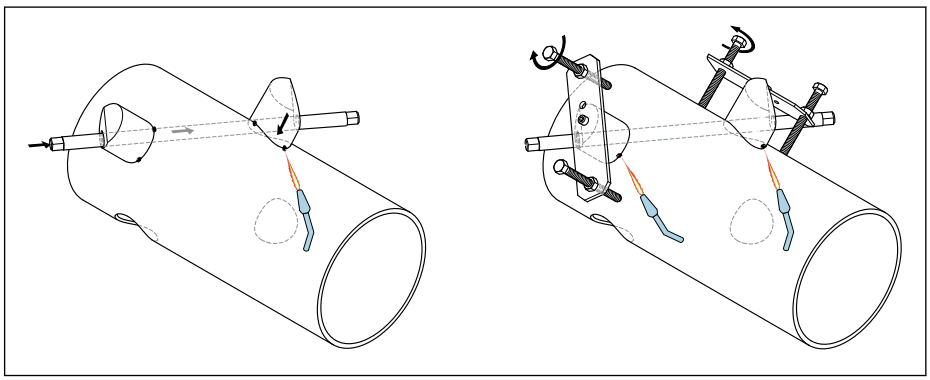
A0044959

9. Draw the length of the arc from the center line out to both sides and mark the drill holes.
10. Create drill holes and prepare them for welding in the sensor holders (deburr, clean). Drill holes for the sensor holders are paired together (CH 1 - CH 1 and CH 2 - CH 2).



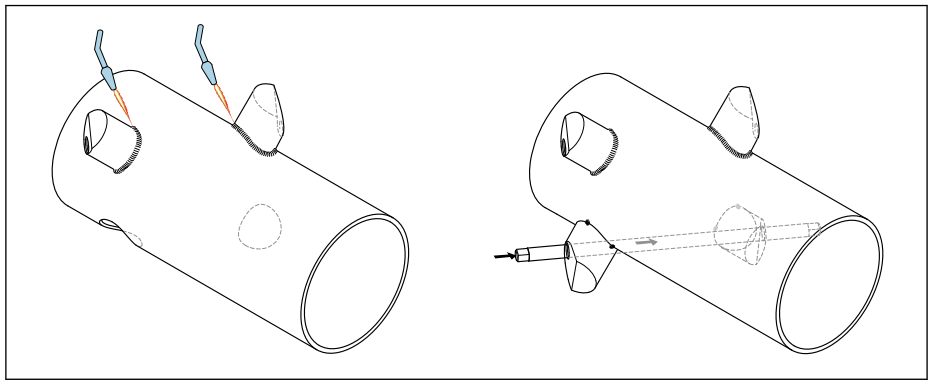
A0044960

11. Insert the sensor holders into the first two drill holes and align them using the path rod (alignment tool). Spot-weld with the welding device and then weld both sensor holders together. To align the path rod, screw both guide bushes into the sensor holders.

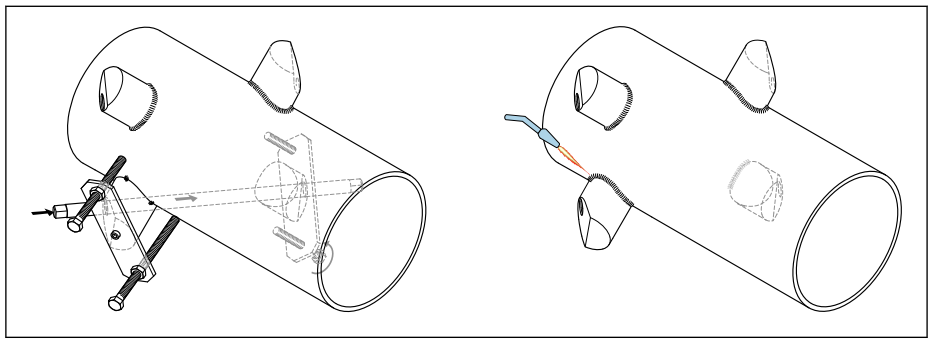

A0044961

12. Weld in both sensor holders.
13. Check the path length, sensor distances and arc lengths again. Deviations can be entered as calibration factors later on when commissioning the measuring point.

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

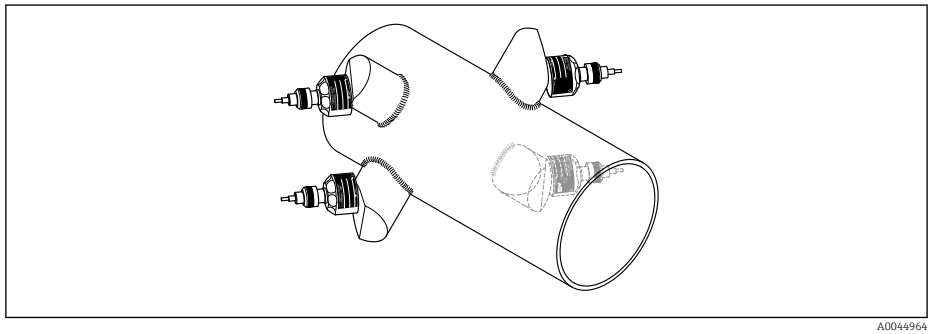


A0044962



A0044963

15. Manually screw the sensors into the sensor holders. If using a tool, tighten with max. 30 Nm.
16. Insert the sensor cable plugs into the openings provided and manually tighten the plugs as far as they will go.



A0044964

6.2.4 Mounting the transmitter

⚠ CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature. → 23
- ▶ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

⚠ CAUTION

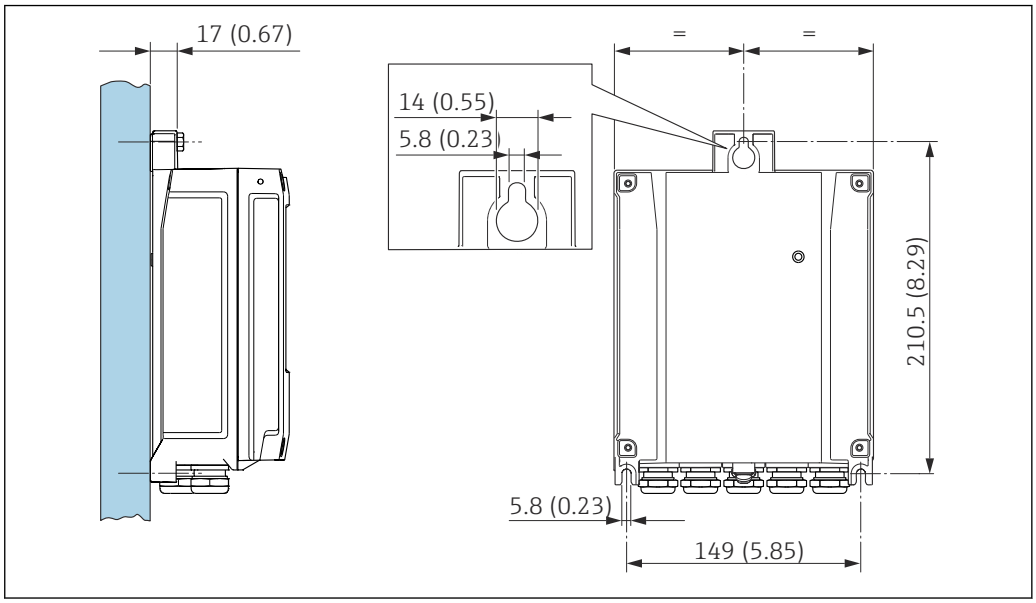
Excessive force can damage the housing!

- ▶ Avoid excessive mechanical stress.

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

- Wall mounting
- Pipe mounting

Wall mounting



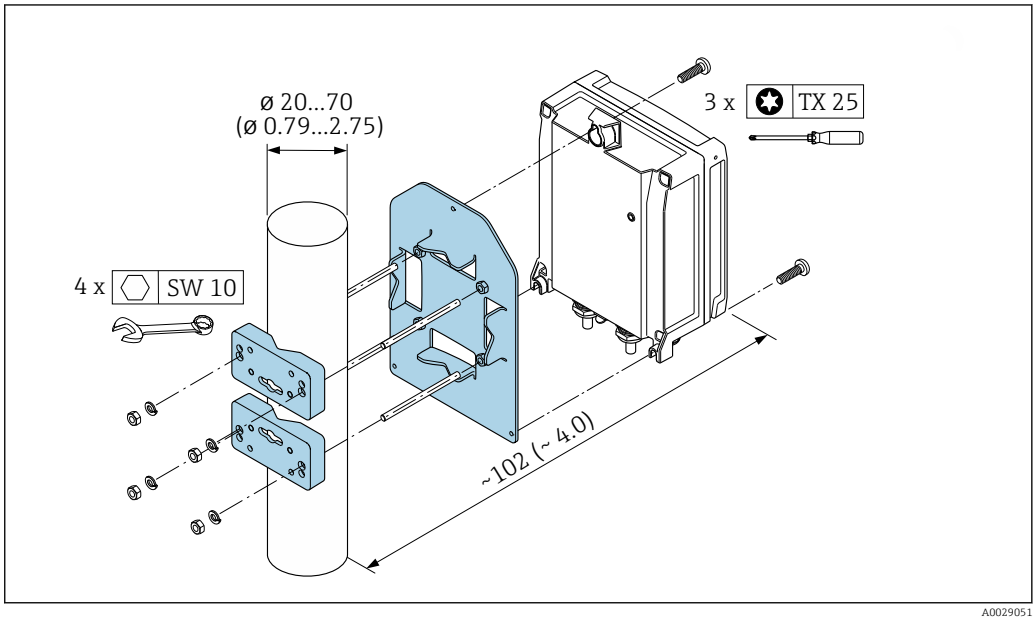
10 *Unit mm (in)*

1. Drill the holes.
2. Insert wall plugs into the drilled holes.
3. Lightly screw in the securing screws.
4. Fit the transmitter housing over the securing screws and hook into place.
5. Tighten the securing screws.

Post mounting

NOTICE

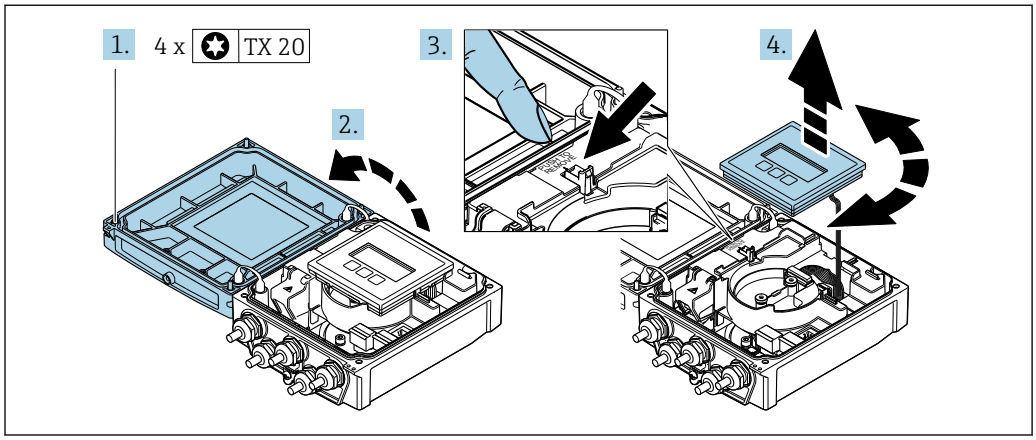
Excessive tightening torque applied to the fixing screws!
Risk of damaging the plastic transmitter.
- ▶ Tighten the fixing screws as per the tightening torque: 2.5 Nm (1.8 lbf ft)



11 *Unit mm (in)*

6.2.5 Turning the display module

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



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

Mounting the transmitter housing

WARNING

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

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

6.3 Post-mounting check

Is the measuring device undamaged (visual inspection)?	❑
Does the measuring device correspond to the measuring point specifications? For example: ▪ Process temperature → 🖹 161 ▪ Inlet run conditions ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected → 🖹 20? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Are the sensors correctly connected to the transmitter (upstream/downstream) → 🖹 5, 🖹 20?	❑
Are the sensors correctly mounted (distance, path length, arc length) → 🖹 22?	❑
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?	❑
Is the sensor holder properly grounded (in the event of different potential between the sensor holder and transmitter)?	❑

7 Electrical connection

⚠ WARNING

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

- ▶ Set up a disconnecting device (switch or power-circuit breaker) to easily disconnect the device from the supply voltage.
- ▶ In addition to the device fuse, include an overcurrent protection unit with max. 16 A in the plant installation.

7.1 Electrical safety

In accordance with applicable national regulations.

7.2 Connecting requirements

7.2.1 Required tools

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

7.2.2 Requirements for connecting cable

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

Permitted temperature range

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

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

Standard installation cable is sufficient.

Signal cable

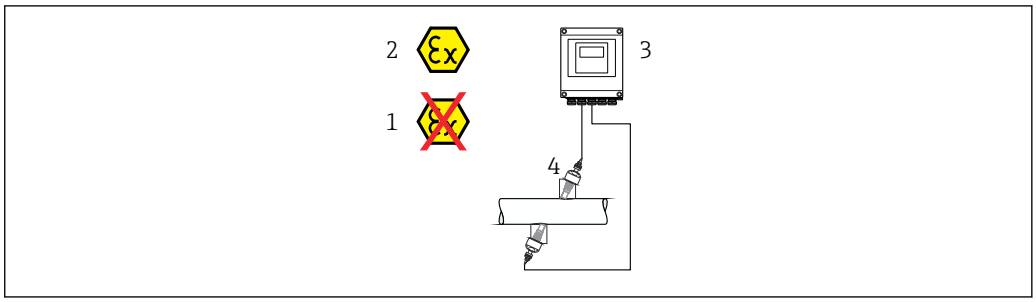
Modbus RS485

The EIA/TIA-485 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm^2 (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Connecting cable between the transmitter and sensor

Sensor cable for sensor - transmitter



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Standard cable	TPE halogen-free: -40 to +80 °C (-40 to +176 °F)
Cable length (max.)	30 m (90 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (30 ft), 15 m (45 ft), 30 m (90 ft)
Operating temperature	Depends on the device version and how the cable is installed: Standard version: ▪ Cable - fixed installation [1]: minimum −40 °C (−40 °F) ▪ Cable - movable installation: minimum −25 °C (−13 °F)

1) Compare details under the row "Standard cable"

Cable diameter

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

7.2.3 Terminal assignment

Transmitter

The sensor can be ordered with terminals.

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

Supply voltage

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

Signal transmission Modbus RS485 and additional outputs

Order code for "Output" and "Input"	Terminal numbers							
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option **M**	Modbus B	Modbus A	-		-		-	
Option **O**	Current output 4 to 20 mA (active)		Pulse/frequency/ switch output (passive)		Pulse/frequency/ switch output (passive)		Modbus B	Modbus A

7.2.4 Shielding and grounding

Shielding and grounding concept

1. Maintain electromagnetic compatibility (EMC).
2. Take explosion protection into consideration.
3. Pay attention to the protection of persons.
4. Comply with national installation regulations and guidelines.
5. Observe cable specifications .
6. Keep the stripped and twisted lengths of cable shield to the ground terminal as short as possible.
7. Shield cables fully.

Grounding of the cable shield

NOTICE

In systems without potential matching, the multiple grounding of the cable shield causes mains frequency equalizing currents!

Damage to the bus cable shield.

- ▶ Only ground the bus cable shield to either the local ground or the protective ground at one end.
- ▶ Insulate the shield that is not connected.

To comply with EMC requirements:

1. Ensure the cable shield is grounded to the potential matching line at multiple points.
2. Connect every local ground terminal to the potential matching line.

7.2.5 Preparing the measuring device

Carry out the steps in the following order:

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

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

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

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.

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

7.3 Connecting the measuring device

WARNING

Risk of electric shock! Components carry dangerous voltages!

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

7.3.1 Connecting the sensor with transmitter

WARNING

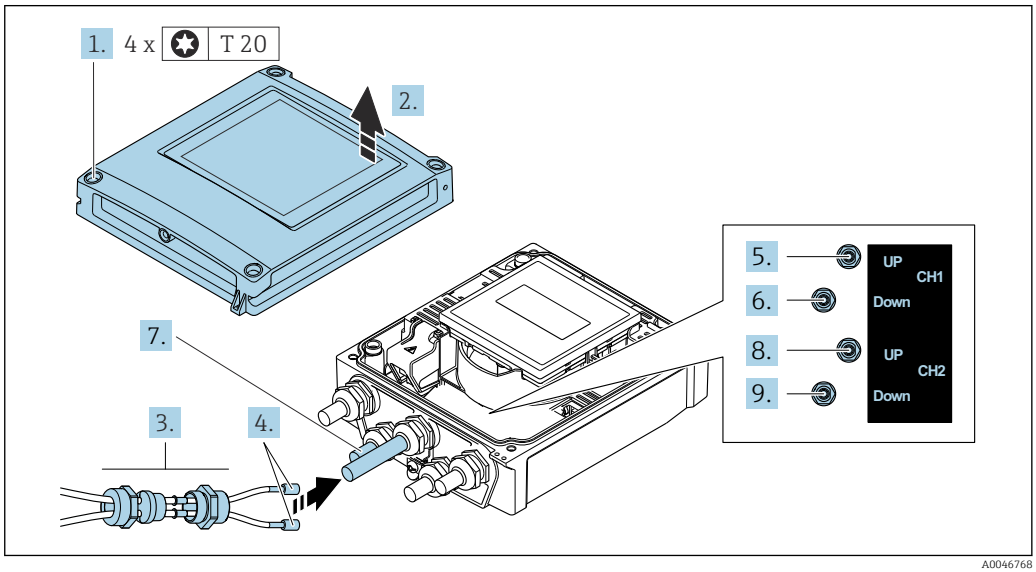
Risk of damaging electronic components!

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

The following sequence of steps is recommended when connecting:

1. Mount the sensor and transmitter.
2. Connect the sensor cable.
3. Connect the transmitter.

Connecting the sensor cable to the transmitter



12 *Transmitter: main electronics module with terminals*

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Route the two sensor cables of channel 1 through the slackened top union nut of the cable entry. To ensure tight sealing, mount a sealing insert on the sensor cables (push the cables through the slotted sealing insert).

4. Mount the screw part in the center cable entry at the top and then guide both sensor cables through the entry. Then fit the coupling nut with the sealing insert on the screw part and tighten. Ensure that the sensor cables are positioned in the cut-outs provided in the screw part.
5. Connect sensor cable to channel 1 upstream.
6. Connect sensor cable to channel 1 downstream.
7. For a two-path measurement: proceed as per steps 3+4
8. Connect sensor cable to channel 2 upstream.
9. Connect sensor cable to channel 2 downstream.
10. Tighten the cable gland(s).
    ↳ This concludes the process for connecting the sensor cable(s).
11. **⚠ WARNING**

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

    Reverse the removal procedure to reassemble the transmitter.

7.3.2 Connecting the transmitter

⚠ WARNING

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

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

Tightening torques for plastic housing

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

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the cable according to the terminal assignment → 🖹 35. For supply voltage: open the shock protection cover.
6. Firmly tighten the cable glands.

Reassembling the transmitter

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

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

   - ▶ Screw in the screw without using any lubricant.

   Tighten the 4 fixing screws on the housing cover.

7.3.3 Potential equalization

Requirements

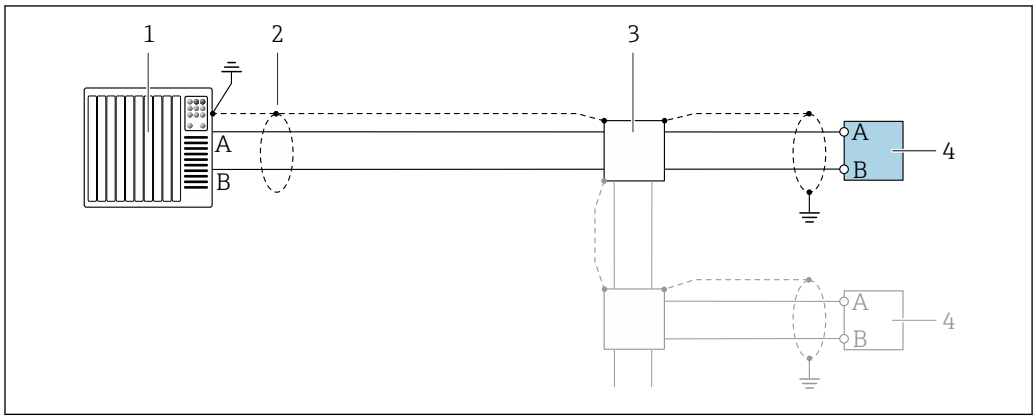
For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Connect the sensor and transmitter to the same electric potential [2)]
- Use a ground cable with a minimum cross-section of 6 mm^2 (10 AWG) and a cable lug for potential equalization connections

2)

7.4 Special connection instructions

7.4.1 Connection examples

Modbus RS485



13 *Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2*

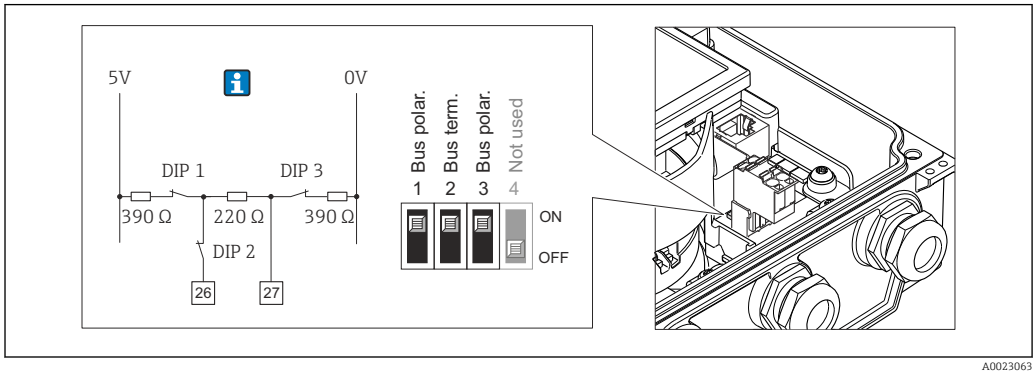
1 *Control system (e.g. PLC)*
2 *Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Distribution box*
4 *Transmitter*

7.5 Hardware settings

7.5.1 Activating the terminating resistor

Modbus RS485

To avoid incorrect communication transmission caused by impedance mismatch, terminate the Modbus RS485 cable correctly at the start and end of the bus segment.



14 *Terminating resistor can be enabled via DIP switch on the electronics module*

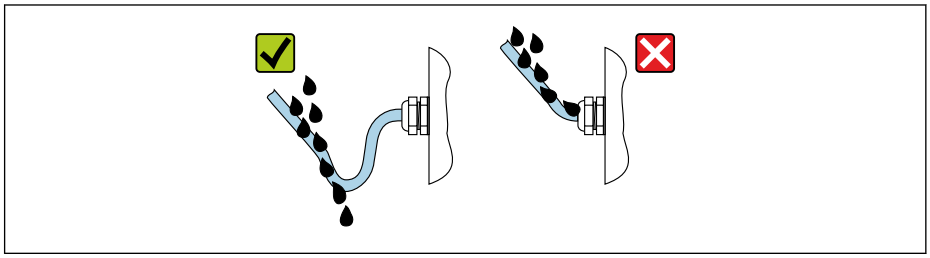
7.6 Ensuring the degree of protection

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

The measuring device fulfills all the requirements for the 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 electrical connection:

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



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

NOTICE

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

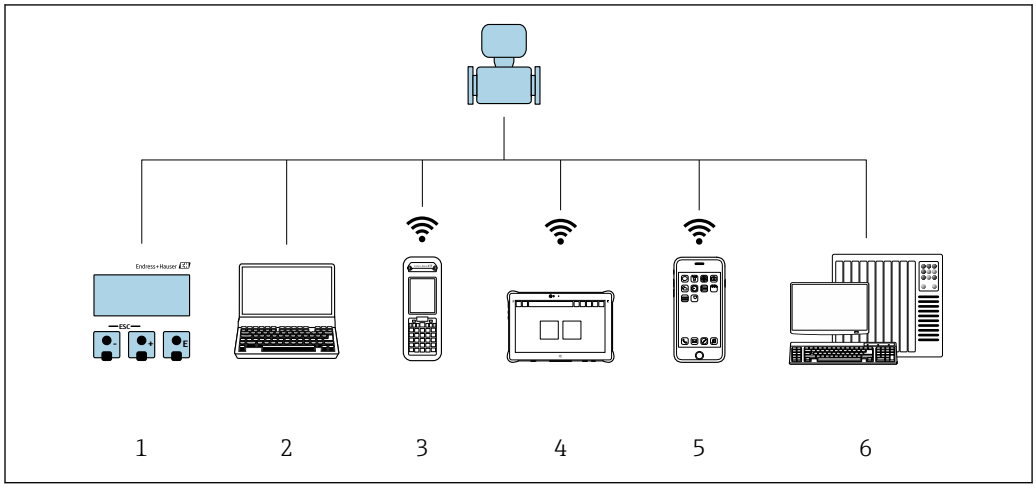
▶ Use suitable dummy plugs corresponding to the degree of protection.

7.7 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used comply with the requirements → 🖹 34?	❑
Are the mounted cables relieved of tension?	❑
Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" → 🖹 40?	❑
Does the supply voltage match the specifications on the transmitter nameplate → 🖹 156?	❑
Is the terminal assignment correct → 🖹 35?	❑
If supply voltage is present, do values appear on the display module?	❑
Are all housing covers installed and the screws tightened with the correct tightening torque?	❑

8 Operation options

8.1 Overview of operation methods

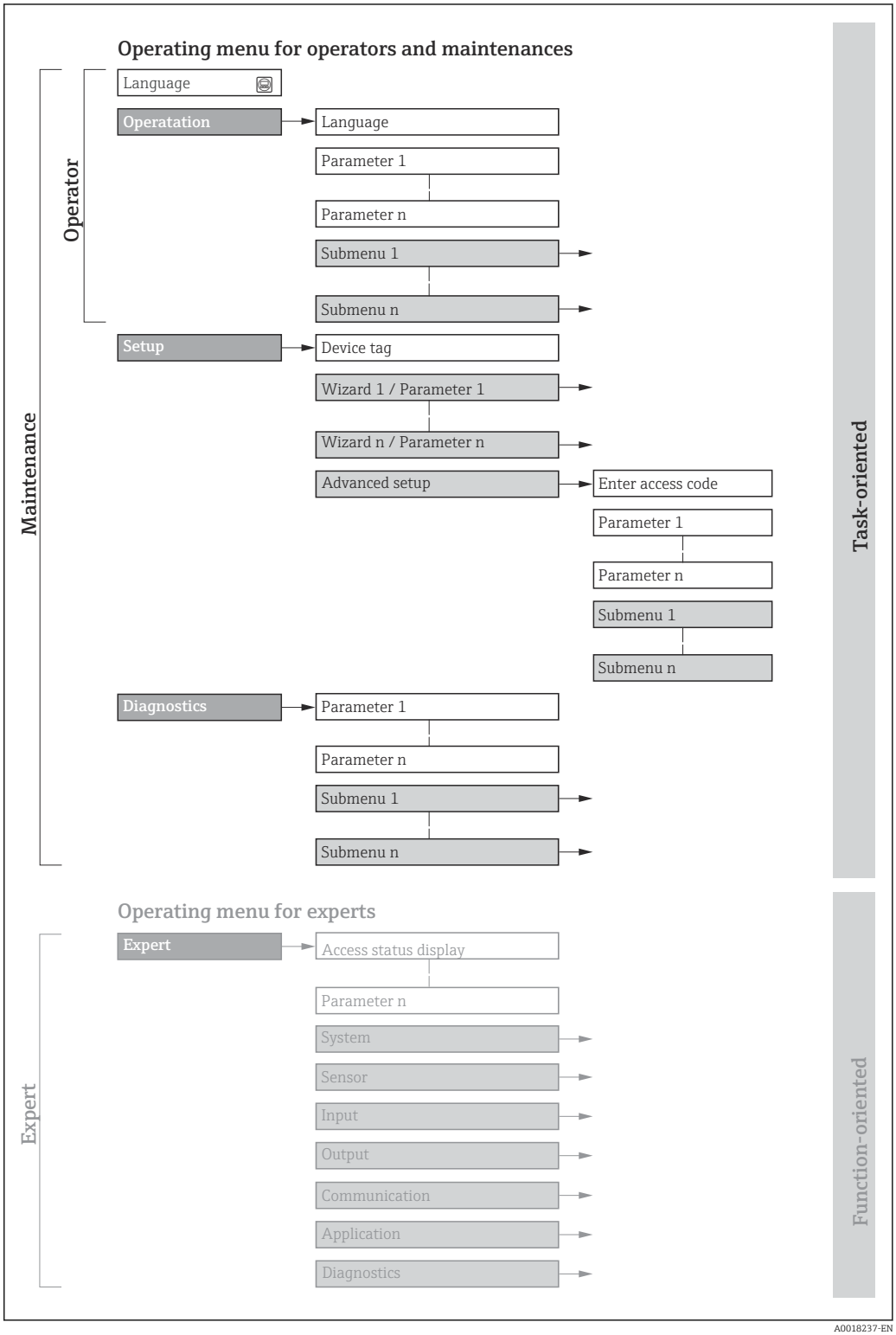


1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Field Xpert SFX350 or SFX370*
4 *Field Xpert SMT70*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

For an overview of the operating menu for experts: see the "Description of Device Parameters" document supplied with the device → 169



15 *Schematic structure of the operating menu*

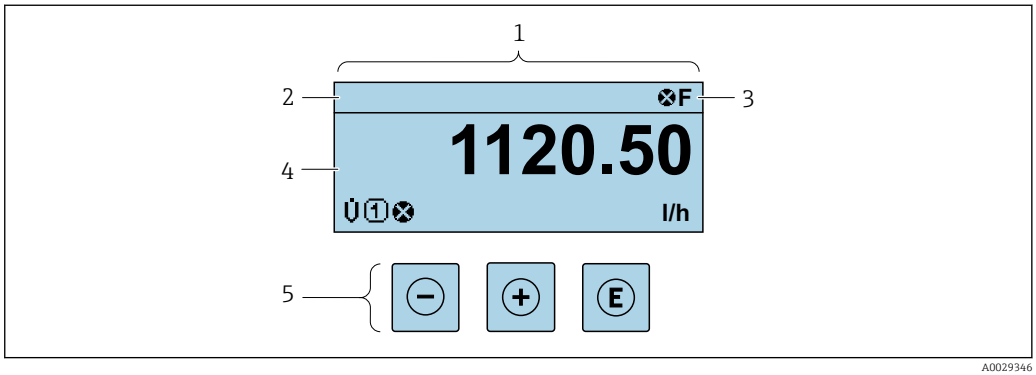
8.2.2 Operating philosophy

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/parameter		User role and tasks	Content/meaning
Language	Task-oriented	**Role "Operator", "Maintenance"** Tasks during operation: ▪ Configuration of the operational display ▪ Reading measured values	▪ Defining the operating language ▪ Defining the Web server operating language ▪ Resetting and controlling totalizers
Operation			▪ Configuration of the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: Configuration of the measurement	Wizards for fast commissioning: ▪ Configuring the measuring point ▪ Configuring the system units ▪ Configuring the 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 ▪ Configuration of WLAN settings ▪ 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 status input ▪ Output Configuration of the analog current outputs as well as the pulse/frequency and switch output ▪ Communication Configuration of the digital communication interface and the Web server ▪ 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



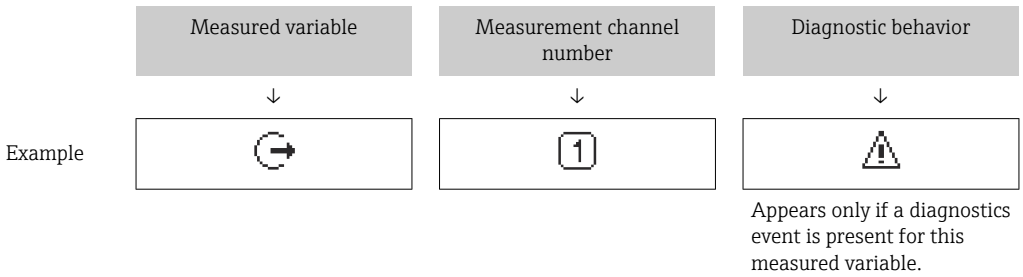
1 *Operational display*
2 *Device tag*
3 *Status area*
4 *Display range for measured values (up to 4 lines)*
5 *Operating elements → 50*

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 129
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 130
  - : Alarm
  - : Warning
- : Locking (the device is locked via the hardware)
- : Communication (communication via remote operation is active)

Display area

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



Measured variables

Symbol	Meaning
ṁ	Mass flow
c	Sound velocity

	Flow velocity
SNR	Signal to noise ratio
	Signal strength

The number and display format of the measured variables can be configured via the **Format display** parameter (→ 100).

Totalizer

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

Output

Symbol	Meaning
	Output The measurement channel number indicates which of the outputs is displayed.

Input

Symbol	Meaning
	Status input

Measurement channel numbers

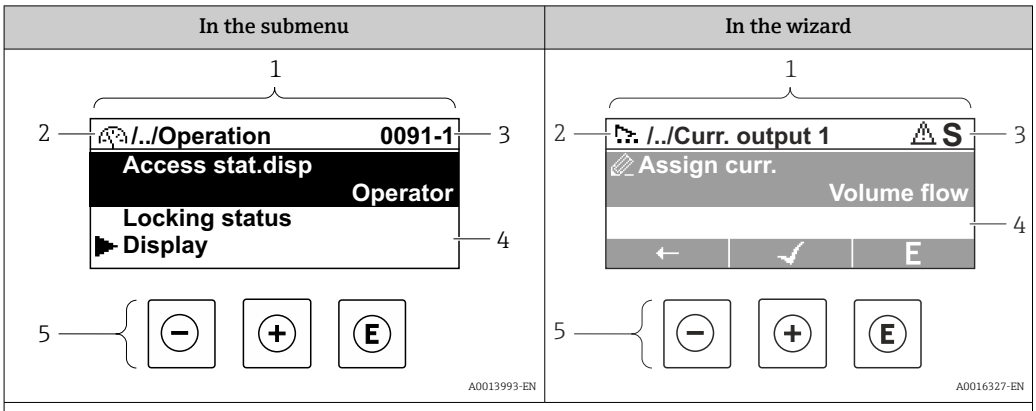
Symbol	Meaning
1 ... 4	Measurement channel 1 to 4 The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. totalizer 1 to 3).

Diagnostic behavior

Symbol	Meaning
	Alarm ▪ Measurement is interrupted. ▪ Signal outputs and totalizers assume the defined alarm condition. ▪ A diagnostic message is generated. ▪ The background lighting changes to red.
	Warning ▪ Measurement 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



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

Navigation path

The navigation path 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
Example	▶	/ ../	Indication

For more information about the icons in the menu, refer to the "Display area" section → 🖹 47

Status area

The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code 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

- For information on the diagnostic behavior and status signal → 🖹 129
- For information on the function and entry of the direct access code → 🖹 52

Display area

Menus

Symbol	Meaning
	Operation Is displayed: ▪ In the menu next to the "Operation" selection ▪ At the left in the navigation path in the **Operation** menu

	Setup Is displayed: ▪ In the menu next to the "Setup" selection ▪ At the left in the navigation path in the **Setup** menu
	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
	Parameters within a wizard No display symbol exists for parameters in submenus.

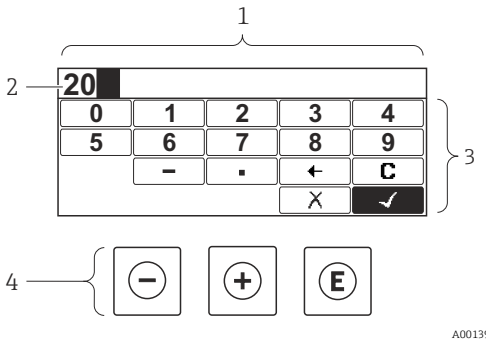
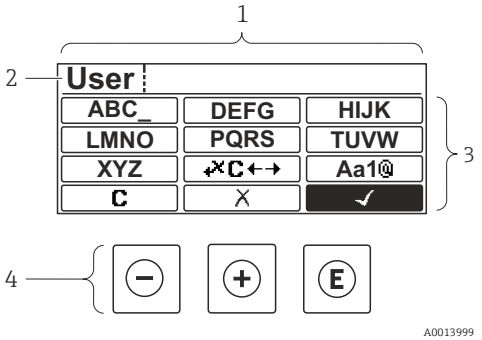
Locking procedure

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

Wizards

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

8.3.3 Editing view

Numeric editor	Text editor
	

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

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.
✓	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.
abc _ … xyz	Selection of letters from a to z.
'"^ _ … ~& _	Selection of special characters.
✓	Confirms the selection.
✗C↔	Switches to the selection of the correction tools.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Text correction under ✗C↔

Symbol	Meaning
C	Clears all entered characters.

	Moves the input position one position to the right.
	Moves the input position one position to the left.
	Deletes one character immediately to the left of the input position.

8.3.4 Operating elements

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
	In the operational display
	Pressing the key for 2 s opens the context menu including the option for activating the keypad lock.
	In menu, submenu
	▪ Pressing the key briefly:
	  ▪ Opens the selected menu, submenu or parameter.
	  ▪ Starts the wizard.
	  ▪ 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.
	In wizards
	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").
	In wizards
	Exits the wizard and takes you to the next higher level
	In the text and numeric editor
	Closes the text or numeric editor without applying changes.

	Minus/Plus/Enter key combination (press the keys simultaneously) *In the operational display* Enables or disables the keypad lock (only SD02 display module).

8.3.5 Opening the context menu

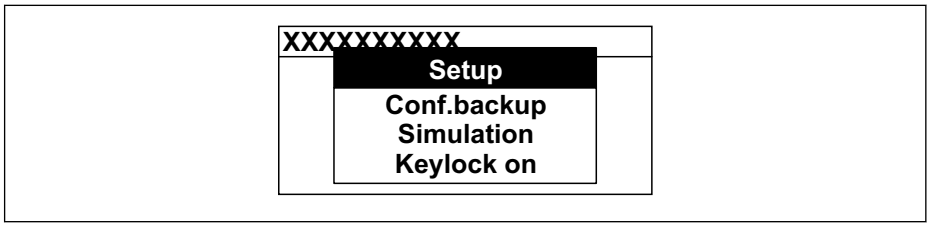
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

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



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

Calling up the menu via the context menu

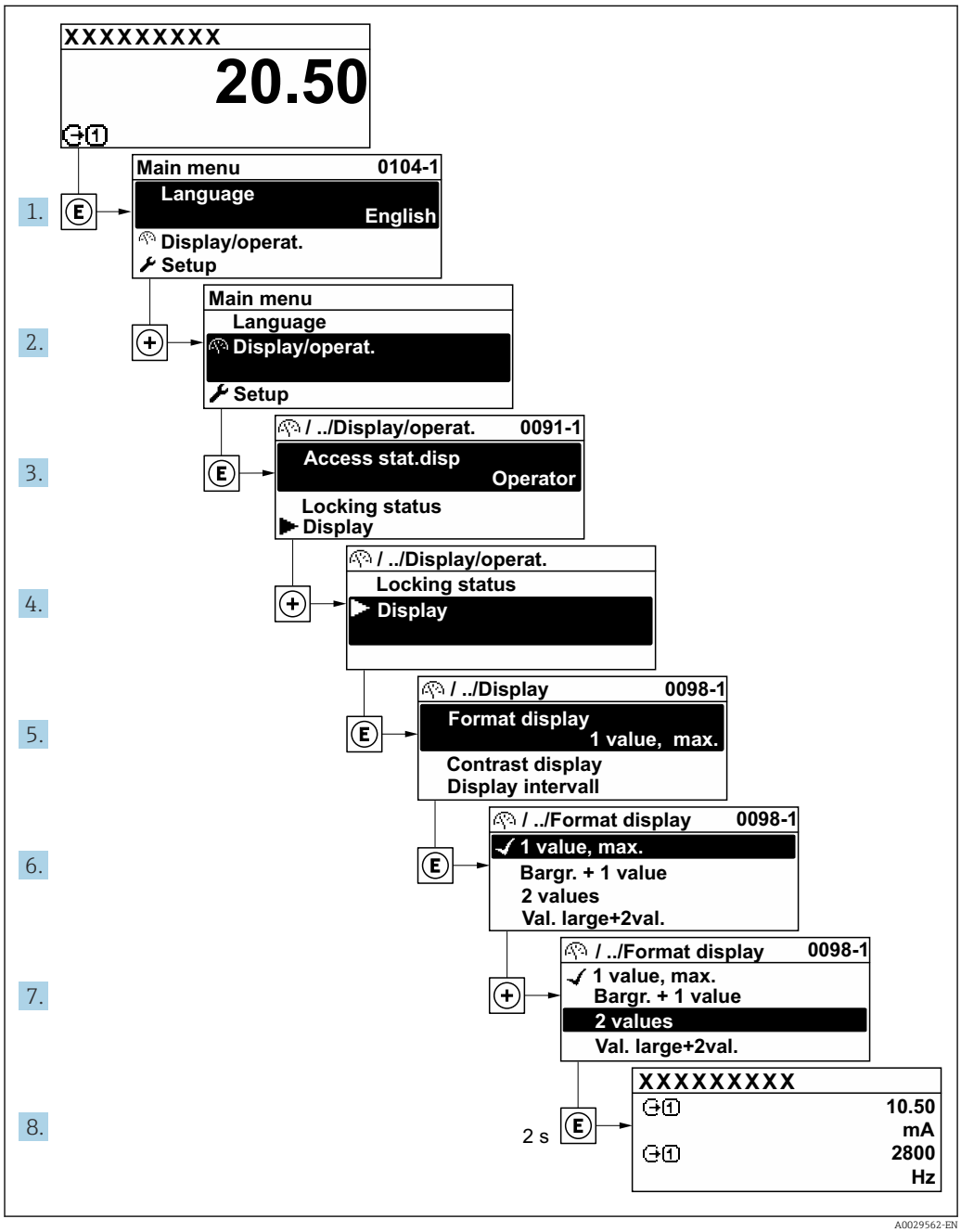
1. Open the context menu.
2. Press ⊞ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

8.3.6 Navigating and selecting from list

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

For an explanation of the navigation view with symbols and operating elements
→ 47

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

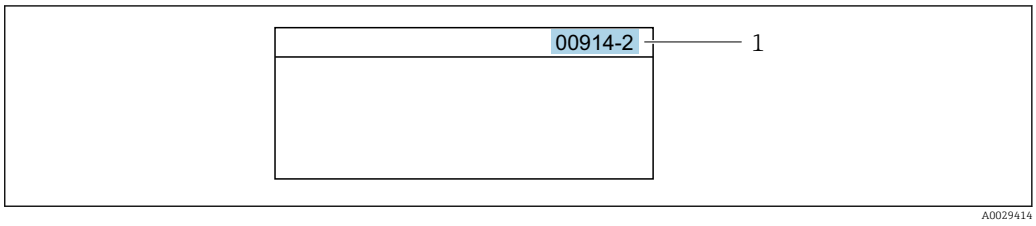


8.3.7 Calling the parameter directly

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

Navigation path
Expert → Direct access

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



1 Direct access code

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

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

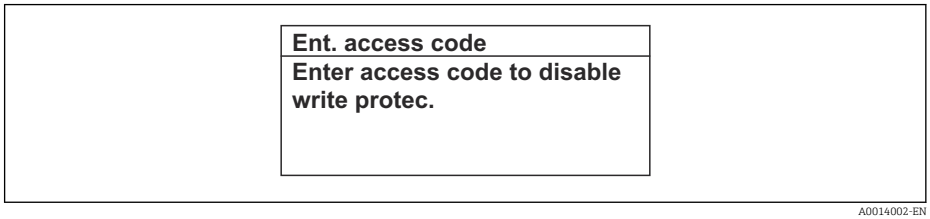
8.3.8 Calling up help text

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

Calling up and closing the help text

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

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



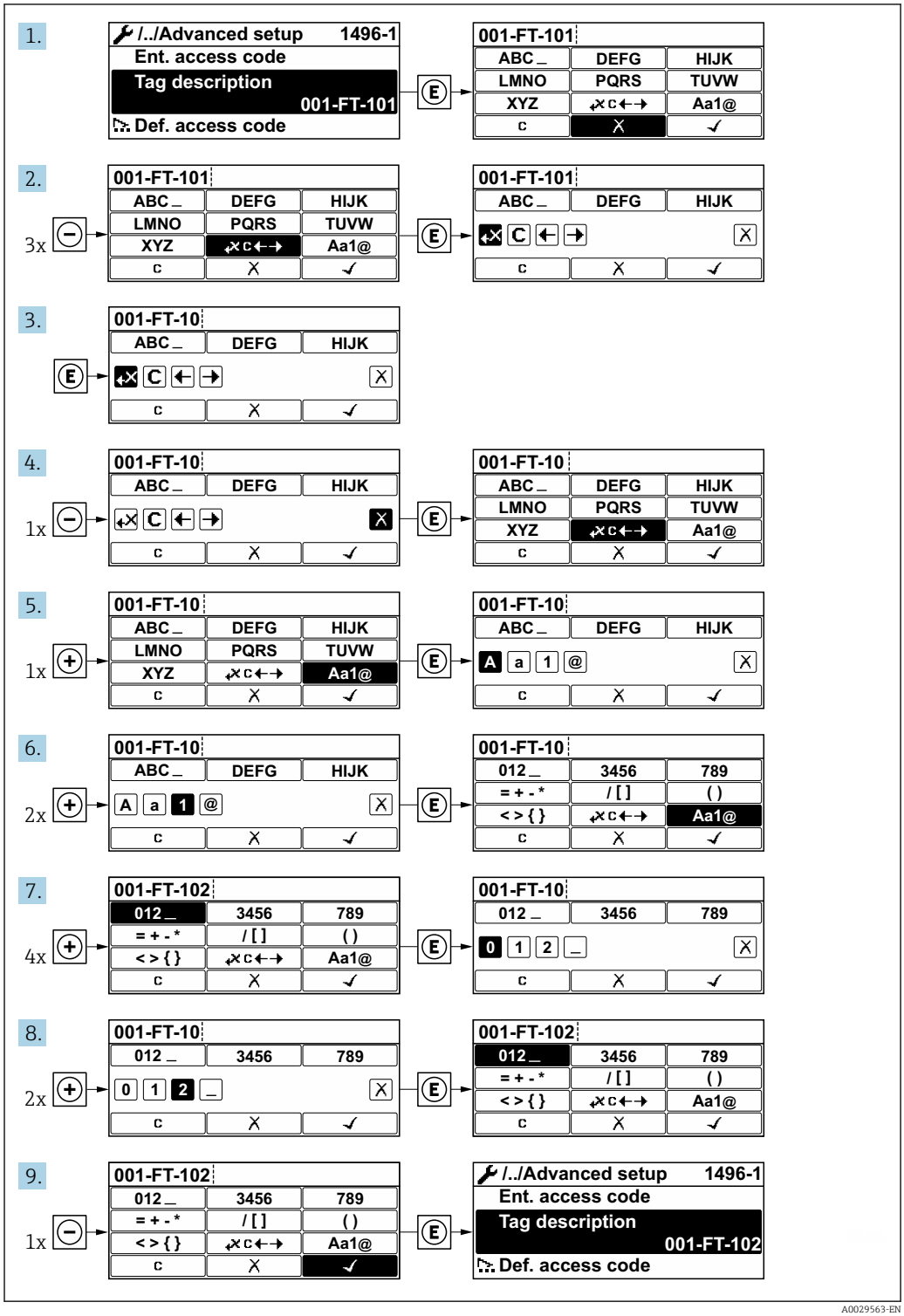
16 Example: Help text for parameter "Enter access code"

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

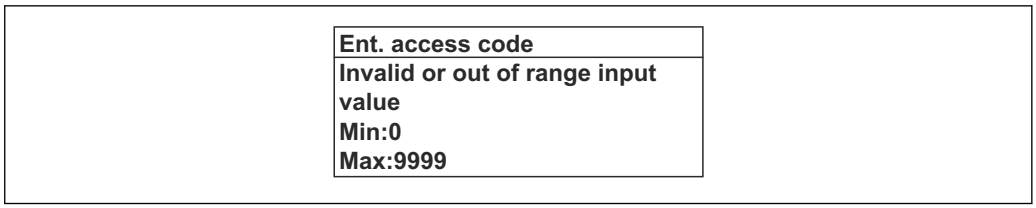
8.3.9 Changing the parameters

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

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



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



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8.3.10 User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access → 🖹 114.

Defining access authorization for user roles

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

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

Access authorization to parameters: "Maintenance" user role

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

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

Access authorization to parameters: "Operator" user role

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

1) Despite the defined access code, certain parameters can always be modified and thus are excluded from the write protection as they do not affect the measurement: write protection via access code → 🖹 114

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

8.3.11 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 🖹 114.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 🖹 104) via the respective access option.

1. After you press ⓔ, the input prompt for the access code appears.
2. Enter the access code.
   - ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

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

To activate the keylock manually:

1. The device is in the measured value display.
   Press the ⊟ and Ⓔ keys for 3 seconds.
   ↳ A context menu appears.
2. In the context menu select the **Keylock on** option.
   ↳ The keypad lock is switched on.

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

Switching off the keypad lock

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

8.4 Access to operating menu via web browser

8.4.1 Function range

With the integrated web server, the device can be operated and configured via a web browser service interface (CDI-RJ45) or WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is displayed and can be used to monitor device health. Furthermore the device data can be managed and the network parameters can be configured.

For additional information on the web server, see the Special Documentation for the device. → 169

8.4.2 Requirements

Computer hardware

Hardware	Interface	
	CDI-RJ45	WLAN
Interface	The computer must have a RJ45 interface. [1]	The operating unit must have a WLAN interface.
Connection	Standard Ethernet cable	Connection via Wireless LAN.
Screen	Recommended size: ≥12" (depends on the screen resolution)	

1) Recommended cable: CAT5e, CAT6 or CAT7, with shielded plug (e.g. YAMAICHI product; part no. Y-ConProfixPlug63/Prod. ID: 82-006660)

Computer software

Software	Interface	
	CDI-RJ45	WLAN

Recommended operating systems	▪ Microsoft Windows 8 or higher.
	▪ Mobile operating systems:
	  ▪ iOS
	  ▪ Android
	Microsoft Windows XP and Windows 7 is supported.	

Web browsers supported	▪ Microsoft Internet Explorer 8 or higher ▪ Microsoft Edge ▪ Mozilla Firefox ▪ Google Chrome ▪ Safari	

Computer settings

Settings	Interface	
	CDI-RJ45	WLAN
User rights	Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (e.g. for adjusting the IP address, subnet mask etc.).	
Proxy server settings of the web browser	The web browser setting *Use a proxy server for your LAN* must be **disabled** .	
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: Enter http://192.168.1.212/servlet/basic.html in the address bar of the web browser. A fully functional but simplified version of the operating menu structure starts in the web browser. When installing a new firmware version: To enable correct data display, clear the temporary memory (cache) under **Internet options** in the web browser.	JavaScript must be enabled. The WLAN display requires JavaScript support.
Network connections	Only use the active network connections to the measuring device.	
	Switch off all other network connections such as WLAN for example.	Switch off all other network connections.

In the event of connection problems: → 126

Measuring device: Via CDI-RJ45 service interface

Device	CDI-RJ45 service interface
Measuring device	The measuring device has an RJ45 interface.
Web server	Web server must be enabled; factory setting: ON For information on enabling the Web server → 62

Measuring device: via WLAN interface

Device	WLAN interface
Measuring device	The measuring device has a WLAN antenna: Transmitter with integrated WLAN antenna
Web server	Web server and WLAN must be enabled; factory setting: ON For information on enabling the Web server → 62

8.4.3 Connecting the device

Via service interface (CDI-RJ45)

Preparing the measuring device

Configuring the Internet protocol of the computer

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

IP address of the device: 192.168.1.212 (factory setting)

1. Switch on the measuring device.
2. Connect the computer to the RJ45 plug via the standard Ethernet cable .
3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

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

Via WLAN interface

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

Note the following to avoid a network conflict:

- Avoid accessing the measuring device simultaneously from the same mobile terminal via the service interface (CDI-RJ45) and the WLAN interface.
- Only activate one service interface (CDI-RJ45 or WLAN interface).
- If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparing the mobile terminal

- Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Prosonic Flow_400_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password:
   Serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ The LED on the display module flashes. It is now possible to operate the measuring device with the web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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

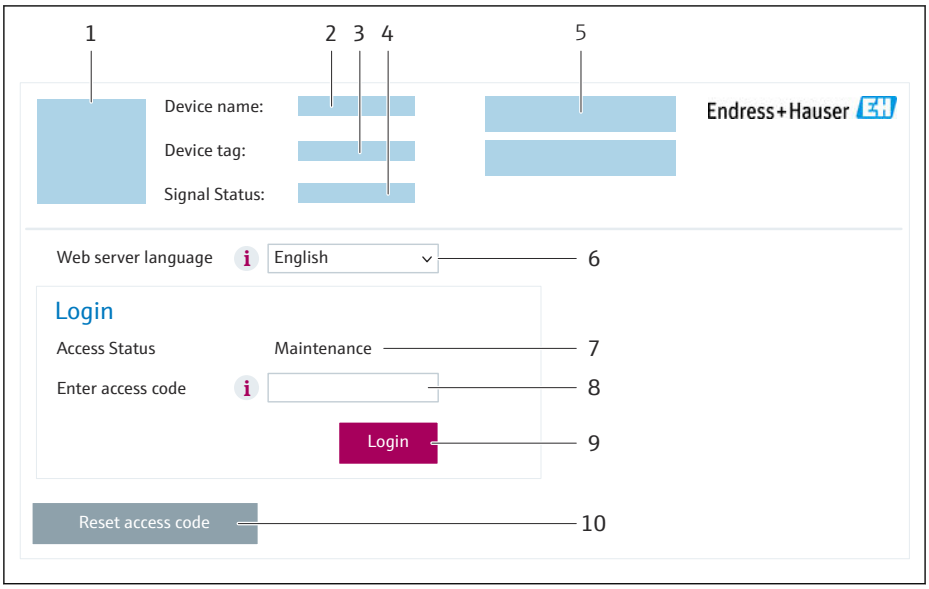
Terminating the WLAN connection

- After configuring the device:
  Terminate the WLAN connection between the mobile terminal and measuring device.

Starting the web browser

1. Start the web browser on the computer.

2. Enter the IP address of the web server in the address line of the web browser: 192.168.1.212
   ↳ The login page appears.



1 *Picture of device*
2 *Device name*
3 *Device tag*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 112)*

If a login page does not appear, or if the page is incomplete → 126

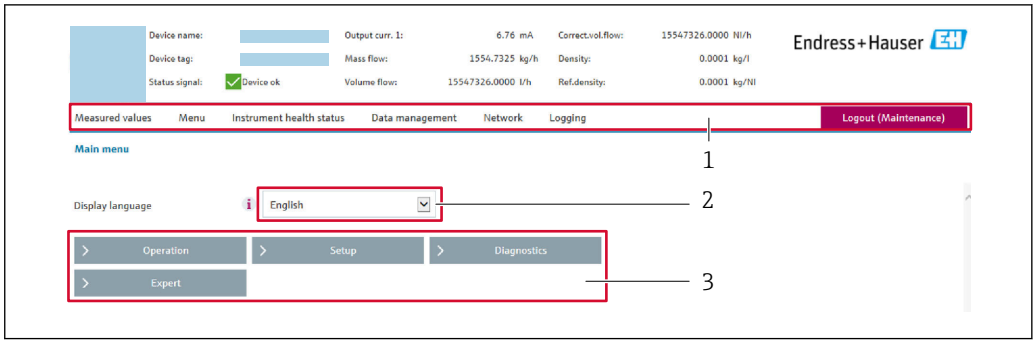
8.4.4 Logging on

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

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

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

8.4.5 User interface



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

Header

The following information appears in the header:
- Device name
- Device tag
- Device status with status signal → 132
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the device
Menu	▪ Access to the operating menu from the measuring device ▪ The structure of the operating menu is the same as for the local display Detailed information on the operating menu structure: Description of Device Parameters
Device status	Displays the diagnostic messages currently pending, listed in order of priority

Data management	Data exchange between computer and measuring device:
	▪ Device configuration:
	  ▪ Load settings from the device (XML format, save configuration)
	  ▪ Save settings to the device (XML format, restore configuration)
	▪ Logbook - Export Event logbook (.csv file)
	▪ Documents - Export documents:
	  ▪ Export backup data record (.csv file, create documentation of the measuring point configuration)
	  ▪ Verification report (PDF file, only available with the "Heartbeat Verification" application package)

Network	Configuration and checking of all the parameters required for establishing the connection to the measuring device: ▪ Network settings (e.g. IP address, MAC address) ▪ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

The menus, the associated submenus and parameters can be selected in the navigation area.

Working area

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

8.4.6 Disabling the Web server

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

Navigation
"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection
Web server functionality	Switch the Web server on and off.	▪ Off ▪ On

Function scope of the "Web server functionality" parameter

Option	Description
Off	▪ The Web server is completely disabled. ▪ Port 80 is locked.
On	▪ The complete Web server functionality is available. ▪ JavaScript is used. ▪ The password is transferred in an encrypted state. ▪ Any change to the password is also transferred in an encrypted state.

Enabling the Web server

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

8.4.7 Logging out

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

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. If no longer needed:
   Reset the modified properties of the Internet protocol (TCP/IP) → 58.

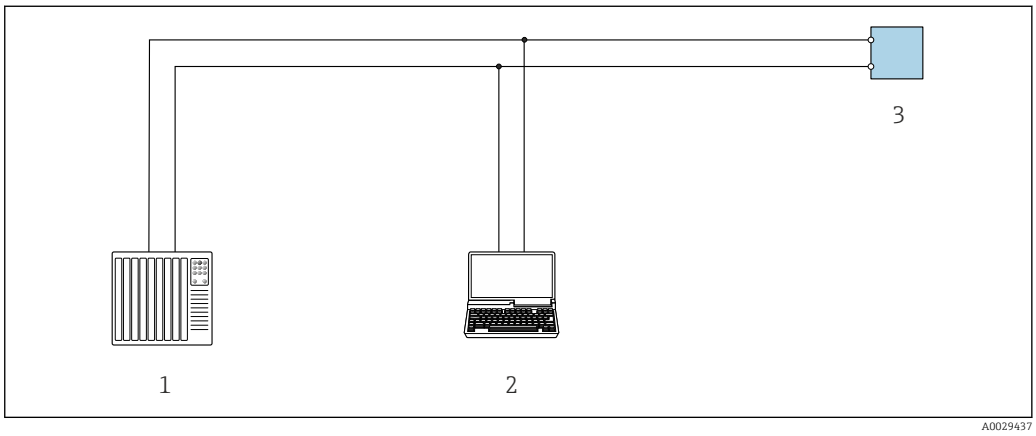
8.5 Access to the operating menu via the operating tool

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

8.5.1 Connecting the operating tool

Via Modbus RS485 protocol

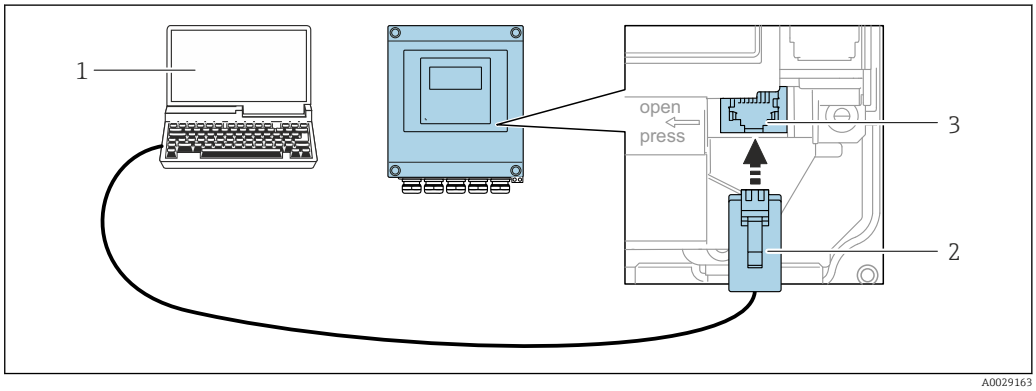
This communication interface is available in device versions with a Modbus RS485 output.



17 *Options for remote operation via Modbus RS485 protocol (active)*

1 *Control system (e.g. PLC)*
2 *Computer with web browser (e.g. Microsoft Edge) to access the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM*
3 *Transmitter*

Via service interface (CDI-RJ45)

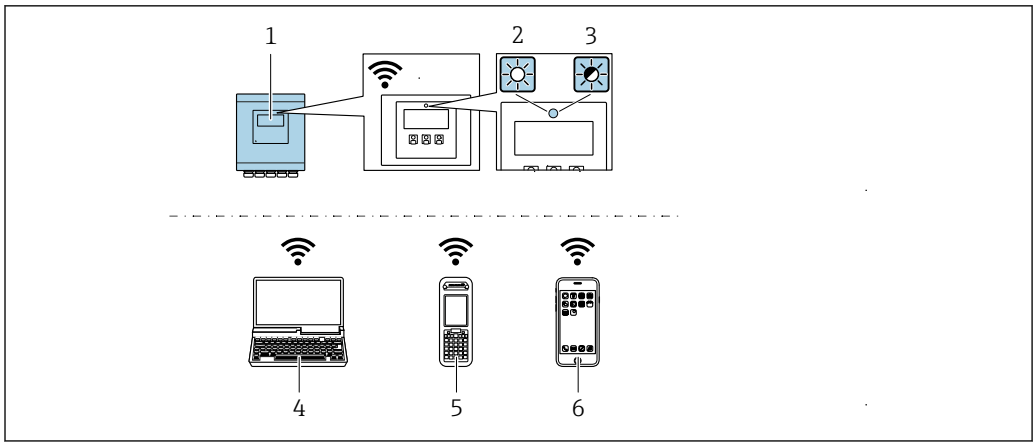


18 *Connection via service interface (CDI-RJ45)*

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

Via WLAN interface

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



A0043149

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

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

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

Note the following to avoid a network conflict:

- ▶ Avoid accessing the measuring device simultaneously from the same mobile terminal via the service interface (CDI-RJ45) and the WLAN interface.
- ▶ Only activate one service interface (CDI-RJ45 or WLAN interface).
- ▶ If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparing the mobile terminal

- ▶ Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Prosonic Flow_400_A802000).
2. If necessary, select the WPA2 encryption method.

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

The serial number can be found on the nameplate.

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

Terminating the WLAN connection

- After configuring the device:
  Terminate the WLAN connection between the mobile terminal and measuring device.

8.5.2 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:

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

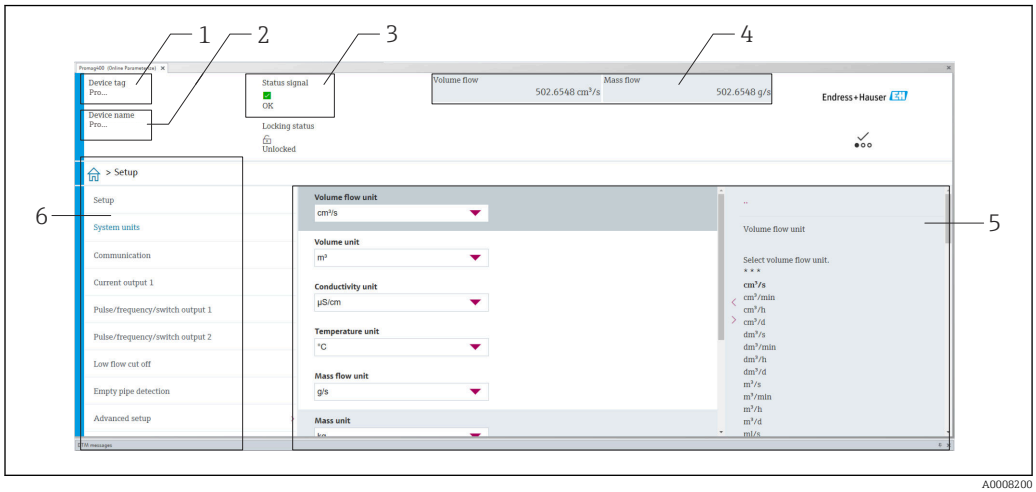
- Operating Instructions BA00027S
- Operating Instructions BA00059S

Source for device description files → 68

Establishing a connection

- Operating Instructions BA00027S
- Operating Instructions BA00059S

User interface



A0008200

1 *Device name*
2 *Device tag*
3 *Status area with status signal → 132*
4 *Display area for current measured values*
5 *Editing toolbar with other functions*
6 *Navigation area with operating menu structure*

8.5.3 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 → 68

8.5.4 Field Xpert SMT70, SMT77

Field Xpert SMT70

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

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

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

Source for device description files → 68

Field Xpert SMT77

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

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

Source for device description files → 68

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version		▪ On the title page of the manual ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version		---

For an overview of the various firmware versions for the device → 144

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.

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)

9.2 Compatibility with previous model

If the device is replaced, the measuring device Prosonic Flow supports the compatibility of the Modbus registers for the process variables and the diagnostic information with the previous model Prosonic Flow 93. It is not necessary to change the engineering parameters in the automation system.

Compatible Modbus registers: process variables

Process variable	Compatible Modbus registers
Mass flow	2007
Volume flow	2009
Totalizer 1	2610
Totalizer 2	2810
Totalizer 3	3010

Compatible Modbus registers: diagnostic information

Diagnostic information	Compatible Modbus registers
Diagnostic code (data type: String), e.g. F270	6821
Diagnostic number (data type: Integer), e.g. 270	6859

The Modbus registers are compatible but the diagnostic numbers are not. Overview of the new diagnostic numbers → 135

9.3 Modbus RS485 information

9.3.1 Function codes

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

Code	Name	Description	Application
03	Read holding register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read and write access Example: Read volume flow
04	Read input register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read access Example: Read totalizer value
06	Write single registers	Master writes a new value to **one** Modbus register of the measuring device. Use function code 16 to write multiple registers with just 1 telegram.	Write only 1 device parameter Example: reset totalizer
08	Diagnostics	Master checks the communication connection to the measuring device. The following "Diagnostics codes" are supported: ▪ Sub-function 00 = Return query data (loopback test) ▪ Sub-function 02 = Return diagnostics register	

Code	Name	Description	Application
16	Write multiple registers	Master writes a new value to multiple Modbus registers of the device. A maximum of 120 consecutive registers can be written with 1 telegram. If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map → 71	Write multiple device parameters
23	Read/Write multiple registers	Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed **before** read access.	Write and read multiple device parameters Example: ▪ Read mass flow ▪ Reset totalizer

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

9.3.2 Register information

For an overview of device parameters with their respective Modbus register information, please refer to the "Modbus RS485 register information" section in the "Description of device parameters" documentation → 169.

9.3.3 Response time

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

9.3.4 Data types

The measuring device supports the following data types:

FLOAT (floating point number IEEE 754) Data length = 4 bytes (2 registers)			
Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
S = sign, E = exponent, M = mantissa			

INTEGER Data length = 2 bytes (1 register)	
Byte 1	Byte 0
Most significant byte (MSB)	Least significant byte (LSB)

STRING Data length = depends on the device parameter, e.g. presentation of a device parameter with a data length = 18 bytes (9 registers)				
Byte 17	Byte 16	...	Byte 1	Byte 0
Most significant byte (MSB)		...		Least significant byte (LSB)

9.3.5 Byte transmission sequence

Byte addressing, i.e. the transmission sequence of the bytes, is not specified in the Modbus specification. For this reason, it is important to coordinate or match the addressing method between the master and slave during commissioning. This can be configured in the measuring device using the **Byte order** parameter.

The bytes are transmitted depending on the selection in the **Byte order** parameter:

FLOAT				
	Sequence			
Options	1.	2.	3.	4.
1 – 0 – 3 – 2 *	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)
0 – 1 – 2 – 3	Byte 0 (MMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 2 (EMMMMMMM)	Byte 3 (SEEEEEEE)
2 – 3 – 0 – 1	Byte 2 (EMMMMMMM)	Byte 3 (SEEEEEEE)	Byte 0 (MMMMMMM)	Byte 1 (MMMMMMM)
3 – 2 – 1 – 0	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)
* = factory setting, S = sign, E = exponent, M = mantissa				

INTEGER		
	Sequence	
Options	1.	2.
1 – **0** – 3 – 2 * 3 – 2 – **1** – **0**	Byte 1 (MSB)	Byte 0 (LSB)
0 – **1** – 2 – 3 2 – 3 – **0** – **1**	Byte 0 (LSB)	Byte 1 (MSB)
* = factory setting, MSB = most significant byte, LSB = least significant byte		

STRING Presentation taking the example of a device parameter with a data length of 18 bytes.					
	Sequence				
Options	1.	2.	...	17.	18.
1 – **0** – 3 – 2 * 3 – 2 – **1** – **0**	Byte 17 (MSB)	Byte 16	...	Byte 1	Byte 0 (LSB)
0 – **1** – 2 – 3 2 – 3 – **0** – **1**	Byte 16	Byte 17 (MSB)	...	Byte 0 (LSB)	Byte 1
* = factory setting, MSB = most significant byte, LSB = least significant byte					

9.3.6 Modbus data map

Function of the Modbus data map

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

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

Structure of the Modbus data map

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

For an overview of device parameters with their respective Modbus register information, please refer to the "Modbus RS485 register information" section in the "Description of device parameters" documentation → 169.

Scan list configuration

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

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

Configuration of the scan list via FieldCare or DeviceCare

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

Scan list	
No.	**Configuration register**
0	Scan list register 0
...	...
15	Scan list register 15

Configuration of the scan list via Modbus RS485

Carried out using register addresses 5001 - 5016

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

Reading out data via Modbus RS485

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

Master access to data area	Via register addresses 5051-5081

Data area				
Device parameter value	**Modbus RS485 register**		**Data type***	**Access****
	Start register	**End register (Float only)**		
Value of scan list register 0	5051	5052	Integer/float	read/write
Value of scan list register 1	5053	5054	Integer/float	read/write
Value of scan list register ...	...	...	...	...
Value of scan list register 15	5081	5082	Integer/float	read/write

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

10 Commissioning

10.1 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-mounting" check→ 32
- Checklist for "Post-connection check" → 41

10.2 Switching on the measuring device

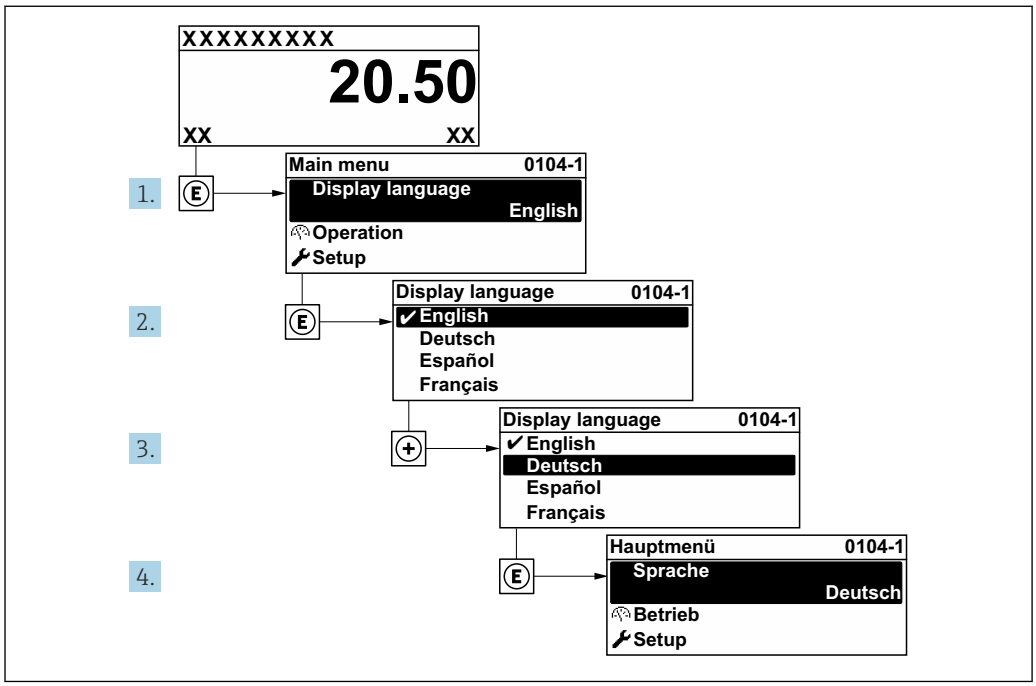
▶ Switch on the device upon successful completion of the post-mounting and post-connection check.

↳ 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" → 126.
- If diagnostic information 104, 105 or 106 appears on the local display, then the measuring point is not yet correctly mounted/configured → 135.

10.3 Setting the operating language

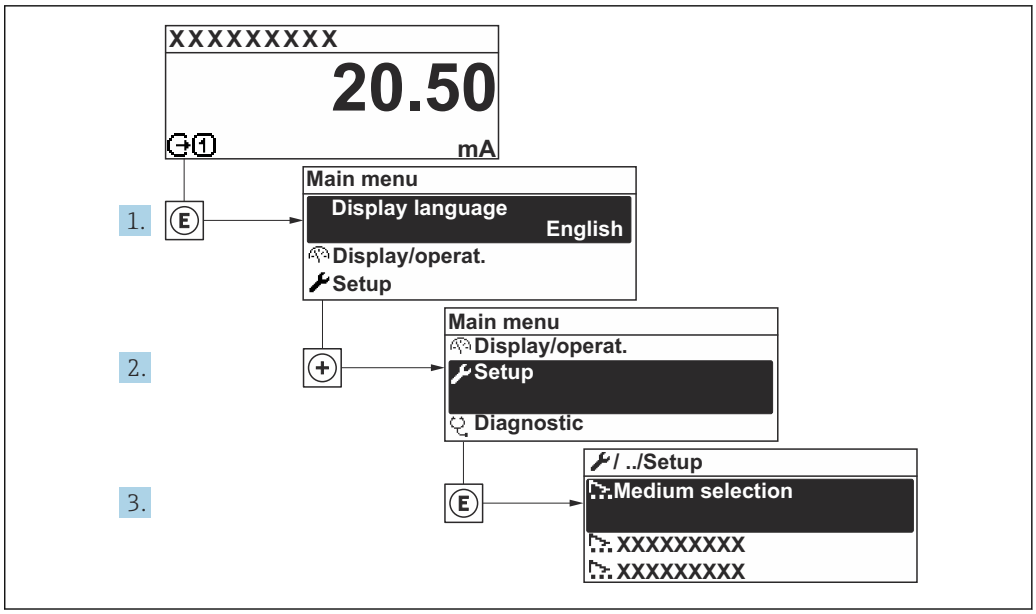
Factory setting: English or ordered local language



19 *Taking the example of the local display*

10.4 Configuring the measuring device

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



20 *Navigation to "Setup" menu using the example of the local display*

The number of submenus and parameters can vary depending on the device version. Certain submenus and parameters in these submenus are not described in the Operating Instructions. Instead a description is provided in the Special Documentation for the device ("Supplementary documentation"→ 168).

Navigation

"Setup" menu

Setup	
Device tag (7157)	→ 81
▶ System units	→ 81
Volume flow unit (0553)	→ 81
Volume unit (0563)	→ 81
Mass flow unit (0554)	→ 82
Mass unit (0574)	→ 82
Velocity unit (0566)	→ 82
Temperature unit (0557)	→ 82
Density unit (0555)	→ 82
Length unit (0551)	→ 82

Cable length (2939)	→ 86
FlowDC inlet configuration (3049)	→ 87
Intermediate pipe length (2945)	→ 87
Inlet diameter (3054)	→ 87
Transition length (3065)	→ 87
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Relative sensor position (2985)	→ 87
Result sensor type / mounting type (2946)	→ 87
Result sensor distance / measuring aid (2947)	→ 87
Result sensor type / sensor distance (3066)	→ 87
Result path length / arc length (3067)	→ 87
▶ Installation status	→ 88
Installation status (2958)	→ 88
Signal strength (2914)	→ 88
Signal to noise ratio (2917)	→ 88
Sound velocity (2915)	→ 88
Sound velocity deviation (2986)	→ 88
▶ Current output 1	→ 89
Process variable current output (0359–1)	→ 89
Current range output (0353–1)	→ 89
Lower range value output (0367–1)	→ 90
Upper range value output (0372–1)	→ 90
Fixed current (0365–1)	→ 90

Damping current output (0363–1) → 90

Failure behavior current output (0364–1) → 90

Failure current (0352–1) → 90

▶ **Pulse/frequency/switch output** → 90

▶ **Display** → 99

Format display (0098) → 100

Value 1 display (0107) → 100

0% bargraph value 1 (0123) → 100

100% bargraph value 1 (0125) → 100

Value 2 display (0108) → 100

Value 3 display (0110) → 101

0% bargraph value 3 (0124) → 101

100% bargraph value 3 (0126) → 101

Value 4 display (0109) → 101

▶ **Low flow cut off** → 101

Assign process variable (1837) → 102

On value low flow cutoff (1805) → 102

Off value low flow cutoff (1804) → 102

▶ **Advanced setup** → 103

▶ **Sensor adjustment** → 104

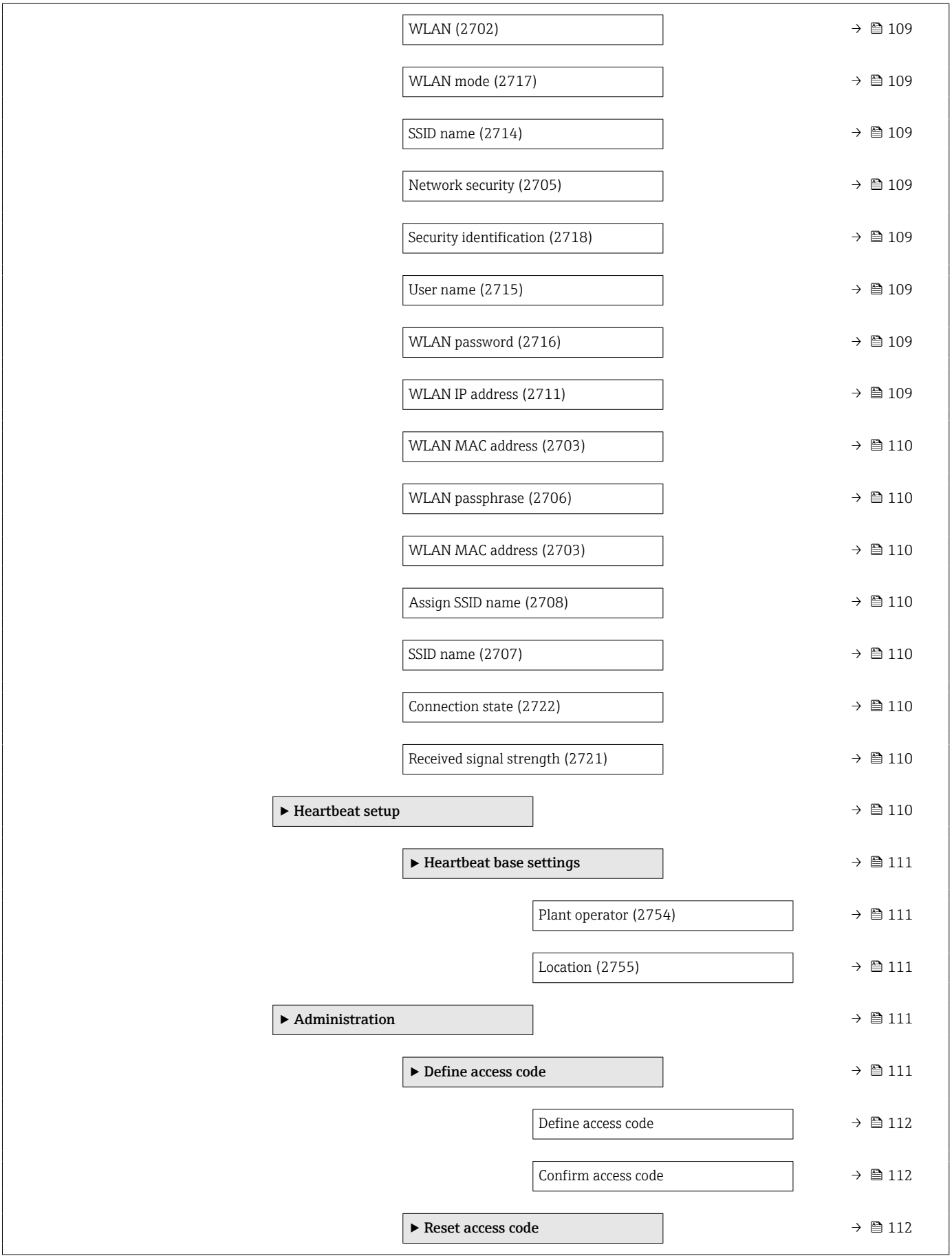
Installation direction (1809) → 104

▶ **Totalizer 1 to n** → 104

Assign process variable 1 to n (0914–1 to n) → 105

Process variable unit 1 to n (0915–1 to n) → 105

Totalizer 1 to n operation mode (0908–1 to n)	→ 105
Totalizer 1 to n failure behavior (0901–1 to n)	→ 105
▶ **Display**	→ 106
Format display (0098)	→ 107
Value 1 display (0107)	→ 107
0% bargraph value 1 (0123)	→ 107
100% bargraph value 1 (0125)	→ 107
Decimal places 1 (0095)	→ 107
Value 2 display (0108)	→ 107
Decimal places 2 (0117)	→ 107
Value 3 display (0110)	→ 107
0% bargraph value 3 (0124)	→ 107
100% bargraph value 3 (0126)	→ 107
Decimal places 3 (0118)	→ 107
Value 4 display (0109)	→ 108
Decimal places 4 (0119)	→ 108
Display language (0104)	→ 108
Display interval (0096)	→ 108
Display damping (0094)	→ 108
Header (0097)	→ 108
Header text (0112)	→ 108
Separator (0101)	→ 108
Backlight (0111)	→ 108
▶ **WLAN settings**	→ 108


WLAN (2702) → 109
WLAN mode (2717) → 109
SSID name (2714) → 109
Network security (2705) → 109
Security identification (2718) → 109
User name (2715) → 109
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WLAN IP address (2711) → 109
WLAN MAC address (2703) → 110
WLAN passphrase (2706) → 110
WLAN MAC address (2703) → 110
Assign SSID name (2708) → 110
SSID name (2707) → 110
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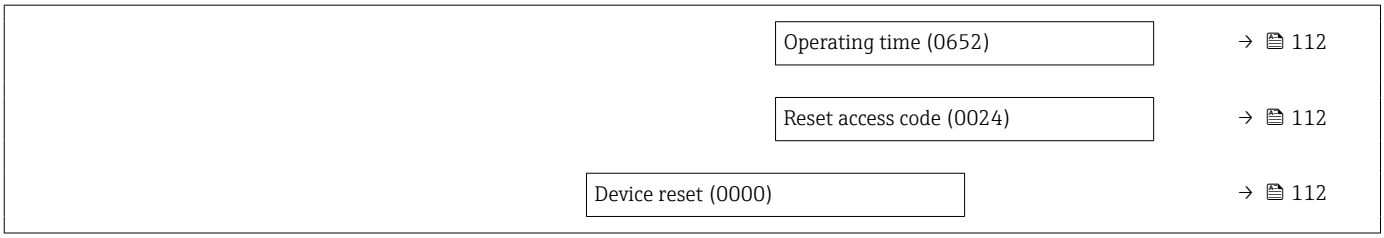
Received signal strength (2721) → 110
▶ Heartbeat setup → 110
▶ Heartbeat base settings → 111
Plant operator (2754) → 111
Location (2755) → 111
▶ Administration → 111
▶ Define access code → 111
Define access code → 112
Confirm access code → 112
▶ Reset access code → 112



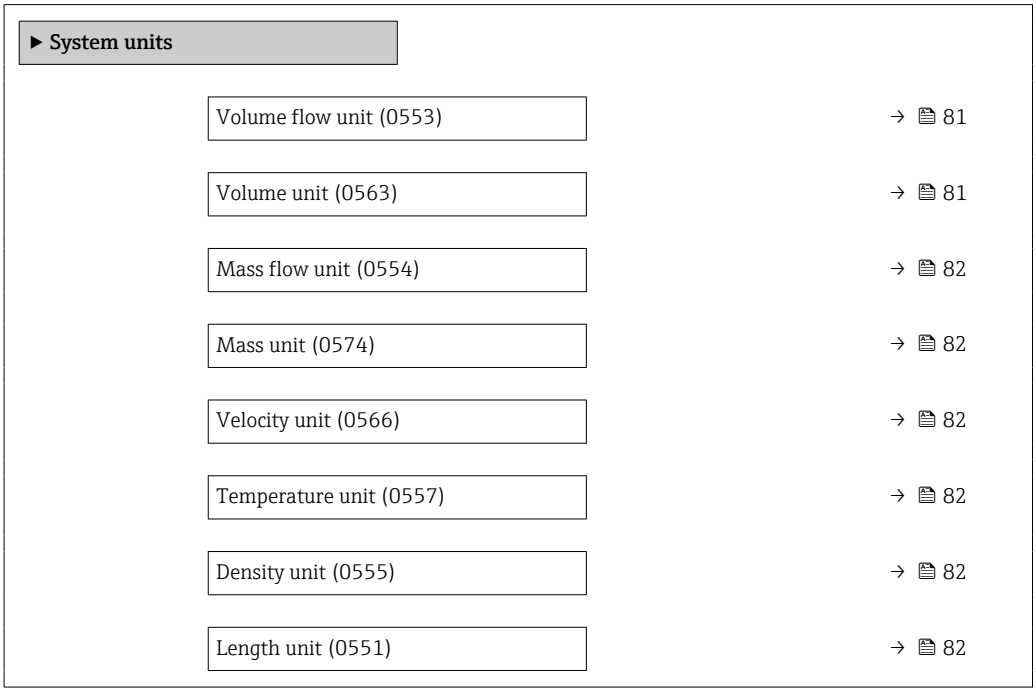
Parameter overview with brief description

Parameter	Description	User entry
Device tag	Enter the name for the measuring point.	Character string comprising numbers, letters and special characters (32)

10.4.1 Setting the system units

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

Navigation
"Setup" menu → System units



Parameter overview with brief description

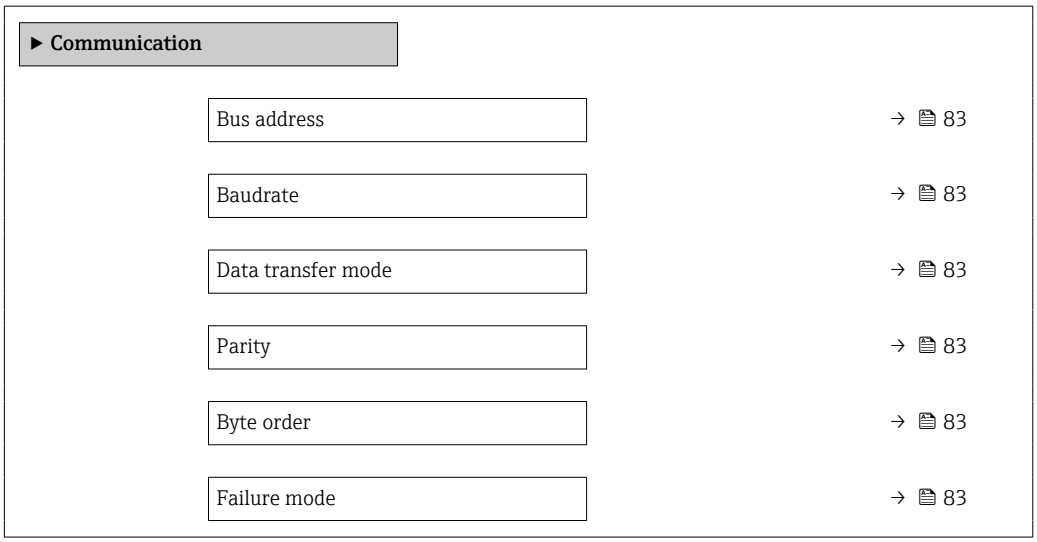
Parameter	Description	Selection	Factory setting
Volume flow unit	Select volume flow unit. *Result* The selected unit applies to: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ m^3/h ▪ ft^3/min
Volume unit	Select volume unit.	Unit choose list	Country-specific: ▪ m^3 ▪ ft^3

Parameter	Description	Selection	Factory setting
Mass flow unit	Select mass flow unit. *Result* 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
Velocity unit	Select velocity unit. *Effect* The selected unit applies to: ▪ Flow velocity ▪ Sound velocity	Unit choose list	Depends on country: ▪ m/s ▪ ft/s
Temperature unit	Select temperature unit. *Result* The selected unit applies to: ▪ Temperature ▪ **Electronic temperature** parameter (6053) ▪ **External temperature** parameter (6080) ▪ **Reference temperature** parameter (1816)	Unit choose list	Country-specific: ▪ °C ▪ °F
Density unit	Select density unit. *Result* The selected unit applies to: ▪ Output ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/dm³ ▪ lb/ft³
Length unit	Select the unit of length.	Unit choose list	Country-specific: ▪ mm ▪ in

10.4.2 Configuring the communication interface

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

Navigation
"Setup" menu → Communication



Parameter overview with brief description

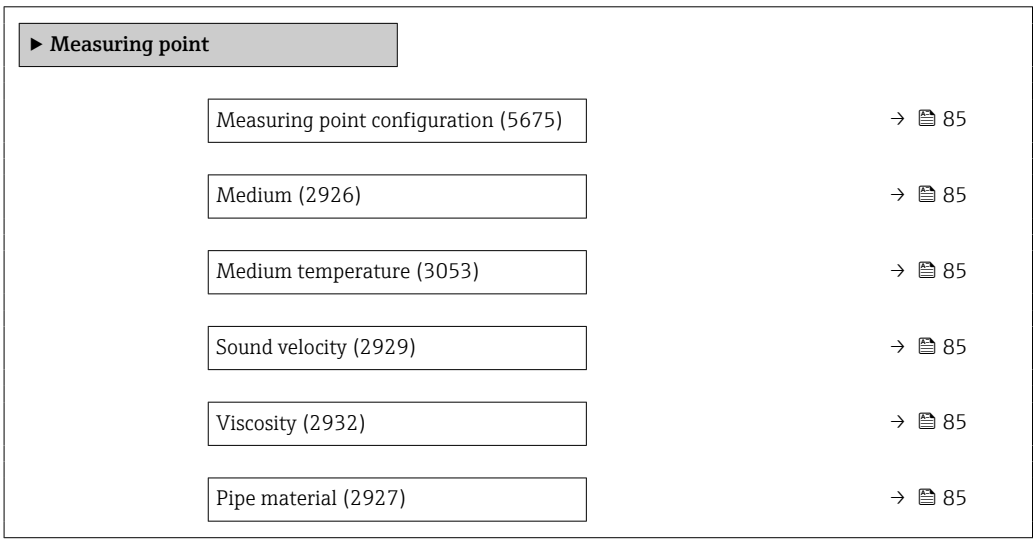
Parameter	Description	User entry / Selection
Bus address	Enter device address.	1 to 247
Baudrate	Define data transfer speed.	▪ 1200 BAUD ▪ 2400 BAUD ▪ 4800 BAUD ▪ 9600 BAUD ▪ 19200 BAUD ▪ 38400 BAUD ▪ 57600 BAUD ▪ 115200 BAUD ▪ 230400 BAUD
Data transfer mode	Select data transfer mode.	▪ ASCII ▪ RTU
Parity	Select parity bits.	Picklist **ASCII** option: ▪ 0 = **Even** option ▪ 1 = **Odd** option Picklist **RTU** option: ▪ 0 = **Even** option ▪ 1 = **Odd** option ▪ 2 = **None / 1 stop bit** option ▪ 3 = **None / 2 stop bits** option
Byte order	Select byte transmission sequence.	▪ 0-1-2-3 ▪ 3-2-1-0 ▪ 1-0-3-2 ▪ 2-3-0-1
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. NaN [1]	▪ NaN value ▪ Last valid value

1) Not a Number

10.4.3 Configuring the measuring point

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

Navigation
"Setup" menu → Measuring point



Pipe sound velocity (2933)	
Pipe dimensions (2943)	→ 85
Pipe circumference (2934)	→ 85
Pipe outer diameter (2910)	→ 86
Pipe wall thickness (2916)	→ 86
Liner material (2928)	→ 86
Liner sound velocity (2936)	→ 86
Liner thickness (2935)	→ 86
Sensor type (2924)	→ 86
Sensor coupling (2957)	→ 86
Mounting type (2938)	→ 86
Cable length (2939)	→ 86
FlowDC inlet configuration (3049)	→ 87
Intermediate pipe length (2945)	→ 87
Inlet diameter (3054)	→ 87
Transition length (3065)	→ 87
Inlet run (3050)	→ 87
Relative sensor position (2985)	→ 87
Result sensor type / mounting type (2946)	→ 87
Result sensor distance / measuring aid (2947)	→ 87
Result sensor type / sensor distance (3066)	→ 87
Result path length / arc length (3067)	→ 87

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Measuring point configuration	–	Select configuration for the measuring point.	▪ 1 measuring point - signal path 1 ▪ 1 measuring point - signal path 2 * ▪ 1 measuring point - 2 signal paths *	Depending on the sensor version
Medium	–	Select the medium.	▪ Water ▪ Sea water ▪ Distilled water ▪ Ammonia NH3 ▪ Benzene ▪ Ethanol ▪ Glycol ▪ Milk ▪ Methanol ▪ User-specific liquid	–
Medium temperature	–	Enter the medium temperature for the installation.	–200 to 550 °C	–
Sound velocity	The **User-specific liquid** option is selected in **Medium** parameter.	Enter the medium's sound velocity for the installation.	200 to 3 000 m/s	–
Viscosity	The **User-specific liquid** option is selected in **Medium** parameter.	Enter medium viscosity at installation temperature.	0.01 to 10 000 mm²/s	–
Pipe material	–	Select pipe material.	▪ Carbon steel ▪ Ductile cast iron ▪ Stainless steel ▪ 1.4301 (UNS S30400) ▪ 1.4401 (UNS S31600) ▪ 1.4550 (UNS S34700) ▪ Hastelloy C ▪ PVC ▪ PE ▪ LDPE ▪ HDPE ▪ GRP ▪ PVDF ▪ PA ▪ PP ▪ PTFE ▪ Pyrex glass ▪ Asbestos cement ▪ Copper ▪ Unknown pipe material	–
Pipe sound velocity	The **Unknown pipe material** option is selected in the **Pipe material** parameter.	Enter sound velocity of pipe material.	800.0 to 3 800.0 m/s	–
Pipe dimensions	–	Select if pipe dimensions are defined by diameter or circumference.	▪ Diameter ▪ Pipe circumference	–
Pipe circumference	The **Pipe circumference** option is selected in the **Pipe dimensions** parameter.	Define the pipe circumference.	30 to 62 800 mm	–

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Pipe outer diameter	The **Diameter** option is selected in **Pipe dimensions** parameter.	Define the outer diameter of the pipe.	0 to 20 000 mm	–
Pipe wall thickness	–	Enter the pipe wall thickness.	Positive floating point number	3 mm
Liner material	–	Select liner material.	▪ None ▪ Cement ▪ Rubber ▪ Epoxy resin ▪ Unknown liner material	–
Liner sound velocity	The **Unknown liner material** option is selected in the **Liner material** parameter.	Define the sound velocity of liner material.	800.0 to 3 800.0 m/s	–
Liner thickness	–	Define the thickness of liner.	0 to 100 mm	–
Sensor type	–	Select sensor type.	▪ C-030-A ▪ C-050-A ▪ C-100-A ▪ C-100-B ▪ C-100-C ▪ C-200-A ▪ C-200-B ▪ C-200-C ▪ C-500-A ▪ I-100-A*	–
Pipe sound velocity	The **Unknown pipe material** option is selected in the **Pipe material** parameter.	Enter sound velocity of pipe material.	800.0 to 3 800.0 m/s	–
Sensor coupling	The following option is selected in **Sensor type** parameter: ▪ C-030-A ▪ C-050-A ▪ C-100-A ▪ C-100-B ▪ C-100-C ▪ C-200-A ▪ C-200-B ▪ C-200-C ▪ C-500-A	Select coupling medium.	▪ Coupling pad ▪ Coupling paste	–
Mounting type	–	Select the number of traverses (number of times the signal passes through the medium). ▪ **(1) direct** option: Sensor arrangement with 1 traverse ▪ **(2) V-mounting** option: Sensor arrangement with 2 traverses ▪ **(3) Z-Mounting** option: Sensor arrangement with 3 traverses ▪ **(4) W-mounting** option: Sensor arrangement with 4 traverses	▪ 1 traverse ▪ 2 traverses ▪ 3 traverses ▪ 4 traverses ▪ Automatic	Automatic
Cable length	–	Enter length of sensor cables.	0 to 200 000 mm	As per order

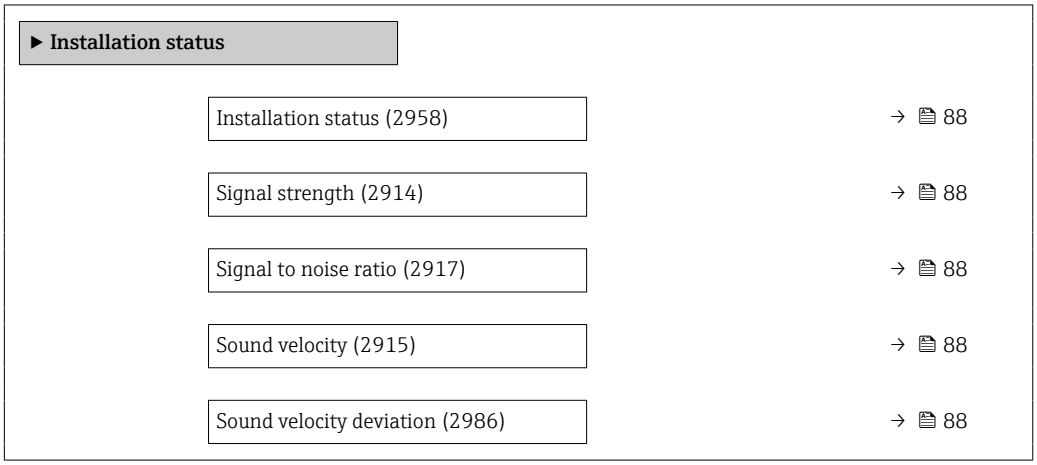
Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
FlowDC inlet configuration	The **1 measuring point - 2 signal paths** option is selected in **Measuring point configuration** parameter.	Select FlowDC inlet configuration.	▪ Off ▪ Single elbow ▪ Double elbow ▪ Double elbow 3D ▪ 45° bend ▪ 2 x 45° bend ▪ Concentric diameter change ▪ Other *	–
Intermediate pipe length	The **1 measuring point - 2 signal paths** option is selected in **Measuring point configuration** parameter.	Enter the length of the intermediate pipe between the two bends.	Positive floating-point number	–
Inlet diameter	▪ The **1 measuring point - 2 signal paths** option is selected in the **Measuring point configuration** parameter. ▪ The **Concentric diameter change** option is selected in the **Inlet configuration** parameter.	Enter the outer diameter of the pipe before the cross-section change. For convenience, the same measuring pipe wall thickness as for the clamp-on system is applied.	1 to 10 000 mm	–
Transition length	▪ In the **Measuring point configuration** parameter, the **1 measuring point - 2 signal paths** option is selected. ▪ In the **Inlet configuration** parameter, the **Concentric diameter change** option is selected.	Enter length of the concentric diameter change.	0 to 20 000 mm	–
Inlet run	The **1 measuring point - 2 signal paths** option is selected in **Measuring point configuration** parameter.	Enter length of the available straight inlet run.	0 to 300 000 mm	–
Relative sensor position	The **1 measuring point - 2 signal paths** option is selected in the **Measuring point configuration** parameter and the **Off** option is not selected in **FlowDC inlet configuration** parameter.	Shows the correct position for the sensor.	▪ 90° ▪ 180°	–
Result sensor type / mounting type	–	Shows the selected sensor type and (if applicable automatically) selected mounting type.	e.g. **C-100-A** option / **(2) V-mounting** option	–
Result sensor distance / measuring aid	–	Shows the calculated sensor distance and vernier or wire length (if applicable) required for installation.	e.g. 201.3 mm / B 21	–
Result sensor type / sensor distance	–	Shows the sensor type and sensor distance calculated for installation.	e.g. I-100-A / 500 mm	–
Result path length / arc length	–	Shows the path length calculated and (if applicable) the calculated arc length.	e.g. 1 085 mm / 257.56 mm	–

* Visibility depends on order options or device settings

10.4.4 Checking the installation status

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

Navigation
"Setup" menu → Installation status



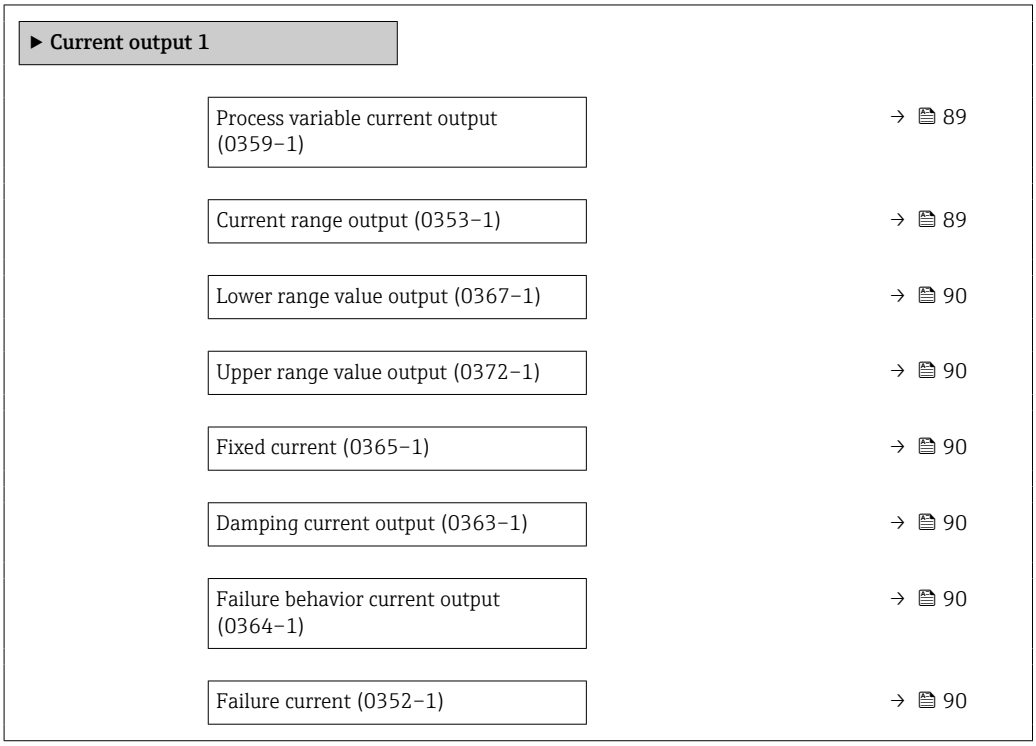
Parameter overview with brief description

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

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 → Current output 1



Parameter overview with brief description

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

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Lower range value output	In **Current span** parameter (→ 🖹 89), one of the following options is selected: ▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA) ▪ 4...20 mA (4...20.5 mA) ▪ 0...20 mA (0...20.5 mA)	Enter lower range value for the measured value range.	Signed floating-point number	Depends on country: ▪ m^3/h ▪ ft^3/h
Upper range value output	In **Current span** parameter (→ 🖹 89), one of the following options is selected: ▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA) ▪ 4...20 mA (4...20.5 mA) ▪ 0...20 mA (0...20.5 mA)	Enter upper range value for the measured value range.	Signed floating-point number	Depends on country and nominal diameter
Fixed current	The **Fixed current** option is selected in the **Current span** parameter (→ 🖹 89).	Defines the fixed output current.	0 to 22.5 mA	22.5 mA
Damping current output	A process variable is selected in the **Assign current output** parameter (→ 🖹 89) and one of the following options is selected in the **Current span** parameter (→ 🖹 89): ▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA) ▪ 4...20 mA (4...20.5 mA) ▪ 0...20 mA (0...20.5 mA)	Enter time constant for output damping (PT1 element). Damping reduces the effect of fluctuations in the measured value on the output signal.	0.0 to 999.9 s	–
Failure behavior current output	A process variable is selected in the **Assign current output** parameter (→ 🖹 89) and one of the following options is selected in the **Current span** parameter (→ 🖹 89): ▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA) ▪ 4...20 mA (4...20.5 mA) ▪ 0...20 mA (0...20.5 mA)	Select output behavior in the event of a device alarm.	▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Fixed value	–
Failure current	The **Defined value** option is selected in the **Failure mode** parameter.	Enter current output value in alarm condition.	0 to 22.5 mA	–

* Visibility depends on order options or device settings

10.4.6 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 → Pulse/frequency/switch output

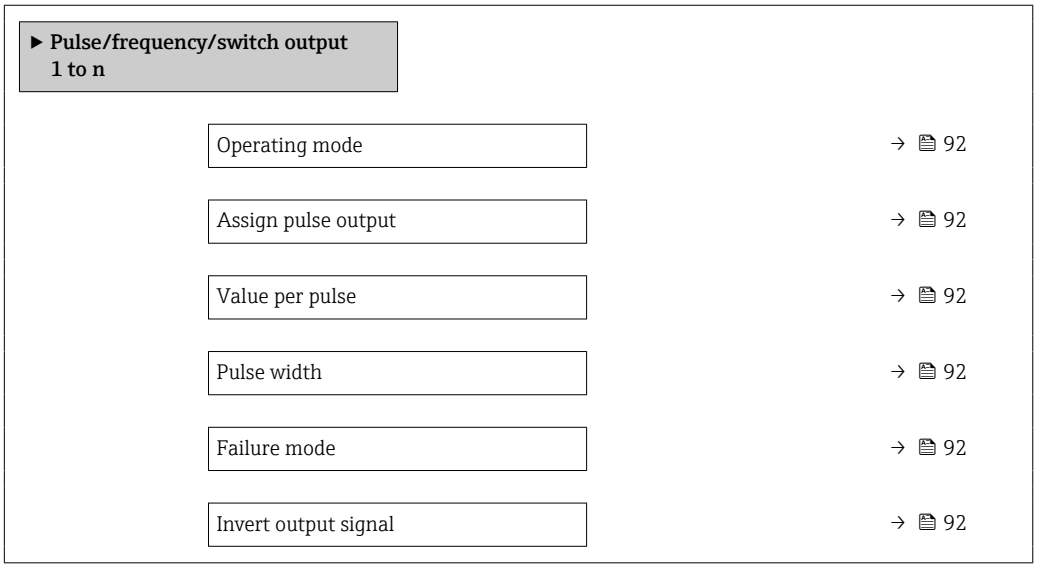
▶ **Pulse/frequency/switch output**

Operating mode (0469)	→ 92
Assign pulse output (0460)	→ 92
Assign frequency output (0478)	→ 93
Switch output function (0481)	→ 95
Assign diagnostic behavior (0482)	→ 95
Assign limit (0483)	→ 95
Assign flow direction check (0484)	→ 96
Assign status (0485)	→ 96
Pulse scaling (0455)	→ 92
Pulse width (0452)	→ 92
Failure mode (0480)	→ 92
Minimum frequency value (0453)	→ 93
Maximum frequency value (0454)	→ 94
Measuring value at minimum frequency (0476)	→ 94
Measuring value at maximum frequency (0475)	→ 94
Failure mode (0451)	→ 94
Failure frequency (0474)	→ 94
Switch-on value (0466)	→ 96
Switch-off value (0464)	→ 96
Switch-on delay (0467)	→ 96
Switch-off delay (0465)	→ 96
Failure mode (0486)	→ 96
Invert output signal (0470)	→ 92

Configuring the pulse output

Navigation

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



Parameter overview with brief description

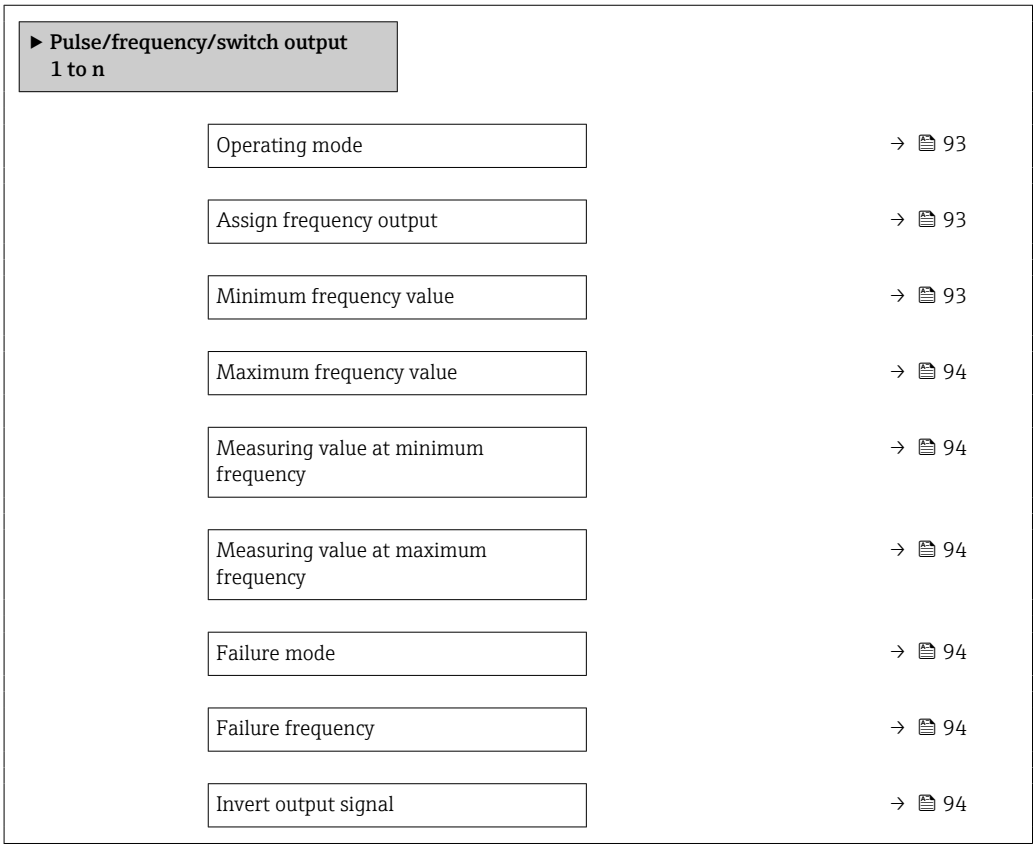
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse * ▪ Frequency * ▪ Switch *	–
Assign pulse output	The **Pulse** option is selected in **Operating mode** parameter.	Select process variable for pulse output.	▪ Off ▪ Volume flow ▪ Mass flow	–
Pulse scaling	The **Pulse** option is selected in the **Operating mode** parameter (→ 92) and a process variable is selected in the **Assign pulse output** parameter (→ 92).	Enter quantity for measured value at which a pulse is output.	Positive floating point number	Depends on country and nominal diameter
Pulse width	The **Pulse** option is selected in the **Operating mode** parameter (→ 92) and a process variable is selected in the **Assign pulse output** parameter (→ 92).	Define time width of the output pulse.	0.05 to 2 000 ms	–
Failure mode	The **Pulse** option is selected in the **Operating mode** parameter (→ 92) and a process variable is selected in the **Assign pulse output** parameter (→ 92).	Select output behavior in the event of a device alarm.	▪ Actual value ▪ No pulses	–
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	–

* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

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



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse * ▪ Frequency * ▪ Switch *	–
Assign frequency output	The **Frequency** option is selected in **Operating mode** parameter (→ 92).	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature ▪ Density ▪ Electronics temperature ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Turbulence *	–
Minimum frequency value	The **Frequency** option is selected in the **Operating mode** parameter (→ 92) and a process variable is selected in the **Assign frequency output** parameter (→ 93).	Enter minimum frequency.	0.0 to 10 000.0 Hz	–

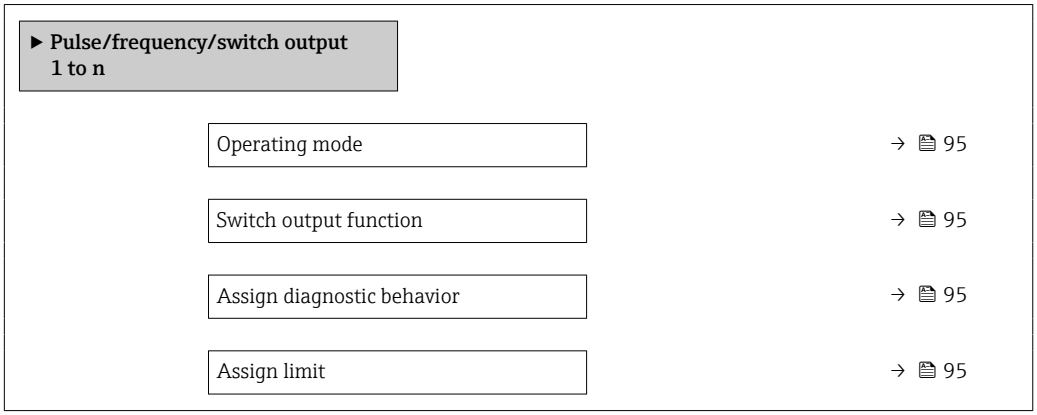
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Maximum frequency value	The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 92) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 93).	Enter maximum frequency.	0.0 to 10 000.0 Hz	–
Measuring value at minimum frequency	The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 92) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 93).	Enter measured value for minimum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum frequency	The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 92) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 93).	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 (→ 🖹 92) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 93).	Select output behavior in the event of a device alarm.	▪ Actual value ▪ Defined value ▪ 0 Hz	–
Failure frequency	In the **Operating mode** parameter (→ 🖹 92), the **Frequency** option is selected, in the **Assign frequency output** parameter (→ 🖹 93) a process variable is selected, and in the **Failure mode** parameter, the **Defined value** option is selected.	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	–
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	–

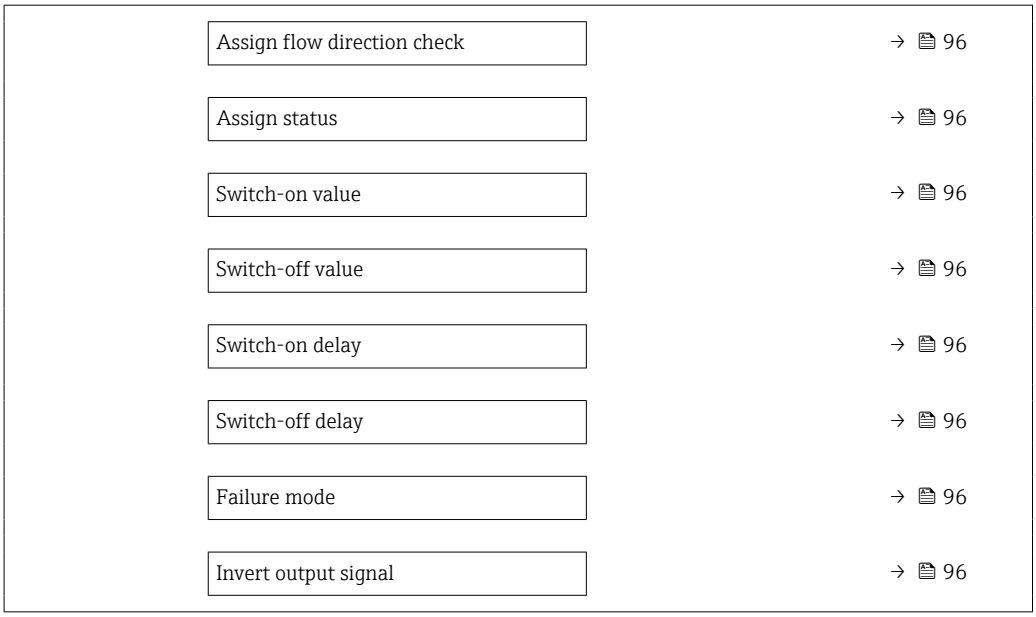
* Visibility depends on order options or device settings

Configuring the switch output

Navigation

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





Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse * ▪ Frequency * ▪ Switch *	–
Switch output function	The **Switch** option is selected in the **Operating mode** parameter.	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	–
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.	The output is switched on (closed, conductive), if there is a pending diagnostic event of the assigned behavioral category.	▪ Alarm ▪ Alarm or warning ▪ Warning	–
Assign limit	▪ The **Switch** option is selected in **Operating mode** parameter. ▪ The **Limit** option is selected in **Switch output function** parameter.	Select the variable to monitor in case the specified limit value is exceeded. If a limit value is exceeded, the output is switched on (conductive).	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature ▪ Density ▪ Electronics temperature ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Turbulence * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3	–

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign flow direction check	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Flow direction check** option is selected in the **Switch output function** parameter.	Select process variable for flow direction monitoring.		–
Assign status	▪ The **Switch** option is selected in **Operating mode** parameter. ▪ The **Status** option is selected in **Switch output function** parameter.	Select the device function for which to report the status. If the function is triggered, the output is closed and conductive (standard configuration).	▪ 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 limit value for switch-on point (process variable > switch-on value = closed, conductive).	Signed floating-point number	Depends on country
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 limit value for switch-off point (process variable < switch-off value = open, nonconductive).	Signed floating-point number	Depends on country
Switch-on delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Enter a delay before the output is switched on.	0.0 to 100.0 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.	Enter a delay before the output is switched off.	0.0 to 100.0 s	–
Failure mode	–	Select output behavior in the event of a device alarm.	▪ Actual status ▪ Open ▪ Closed	–
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	–

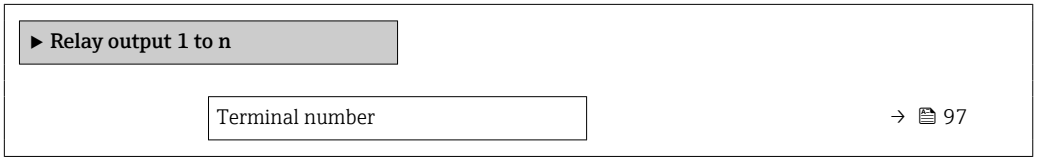
* Visibility depends on order options or device settings

10.4.7 Configuring the relay output

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

Navigation

"Setup" menu → Relay output 1 to n



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection / User entry
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4)
Switch output function	–		▪ Close ▪ Open ▪ Batching
Assign flow direction check	The **Flow direction check** option is selected in the **Relay output function** parameter.	Select process variable for flow direction monitoring.	

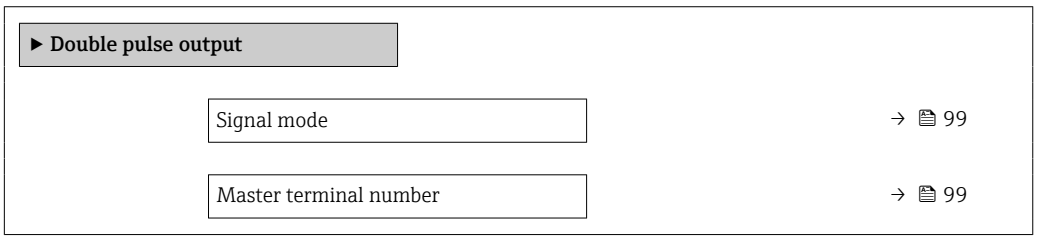
Parameter	Prerequisite	Description	User interface / Selection / User entry
Assign limit	The **Limit** option is selected in **Relay output function** parameter.	Select process variable for limit function.	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow ▪ Carrier mass flow ▪ Density ▪ Reference density ▪ Dynamic viscosity ▪ Concentration ▪ Kinematic viscosity ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Oscillation damping
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select device status for switch output.	▪ Partially filled pipe detection ▪ Low flow cut off
Switch-off value	The **Limit** option is selected in the **Relay output function** parameter.	Enter measured value for the switch-off point.	Signed floating-point number
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-off of status output.	0.0 to 100.0 s
Switch-on value	The **Limit** option is selected in the **Relay output function** parameter.	Enter measured value for the switch-on point.	Signed floating-point number
Switch-on delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-on of status output.	0.0 to 100.0 s
Failure mode	–	Select output behavior in the event of a device alarm.	▪ Actual status ▪ Open ▪ Closed
Switch state	–	Select status of switch output.	▪ Closed ▪ Open
Powerless relay status	–		▪ Open ▪ Closed

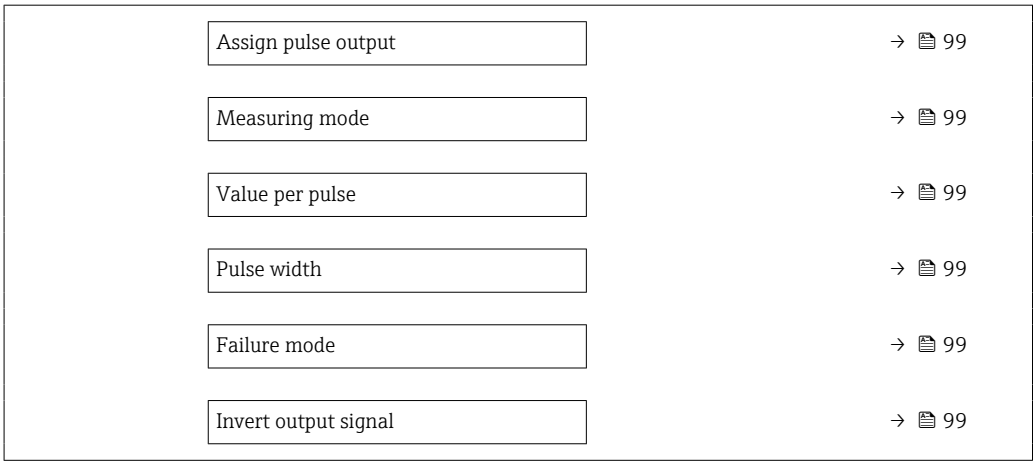
10.4.8 Configuring the double pulse output

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

Navigation

"Setup" menu → Double pulse output





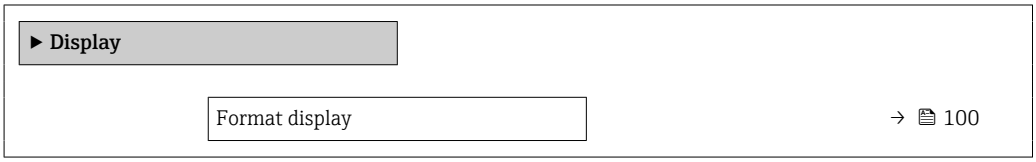
Parameter overview with brief description

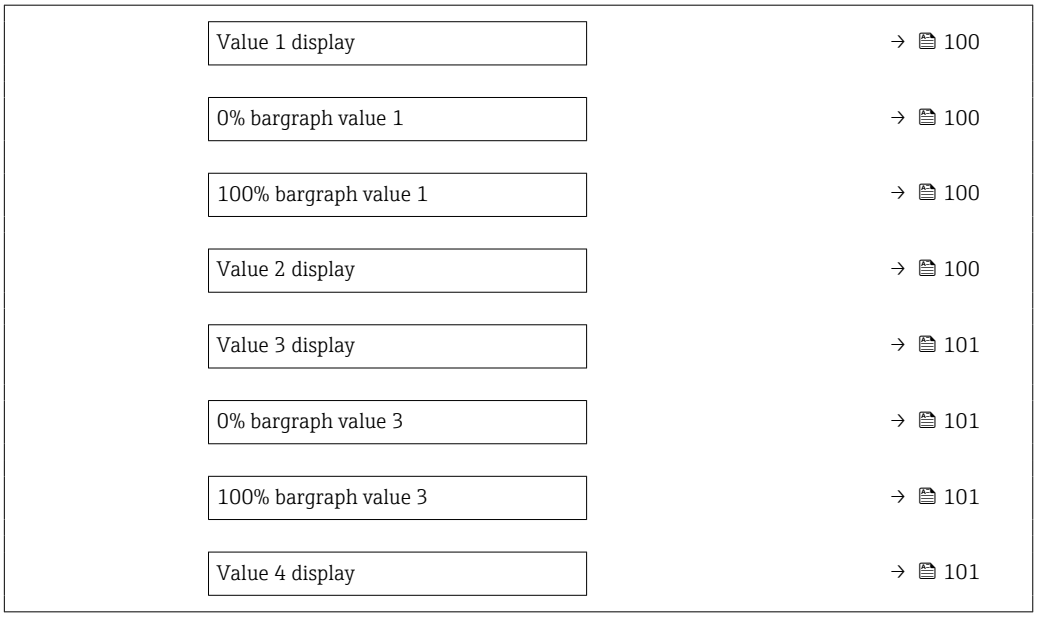
Parameter	Description	Selection / User interface / User entry	Factory setting
Signal mode	Select the signal mode for the double pulse output.	▪ Passive ▪ Active ▪ Passive NAMUR	–
Master terminal number	Shows the terminal numbers used by the master of the double pulse output module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4)	–
Assign pulse output 1	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow ▪ Carrier mass flow	–
Measuring mode	Select measuring mode for pulse output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow ▪ Reverse flow compensation	–
Value per pulse	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	Define time width of the output pulse.	0.5 to 2 000 ms	–
Failure mode	Select output behavior in the event of a device alarm.	▪ Actual value ▪ No pulses	–
Invert output signal	Invert the output signal.	▪ No ▪ Yes	–

10.4.9 Configuring the local display

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

Navigation
"Setup" menu → Display





Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 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 ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature ▪ Density ▪ Electronics temperature ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Turbulence * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0 % value for bar graph display.	Signed floating-point number	Country-specific
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 (→ 100) For the picklist, see **Value 1 display** parameter (→ 100)	–

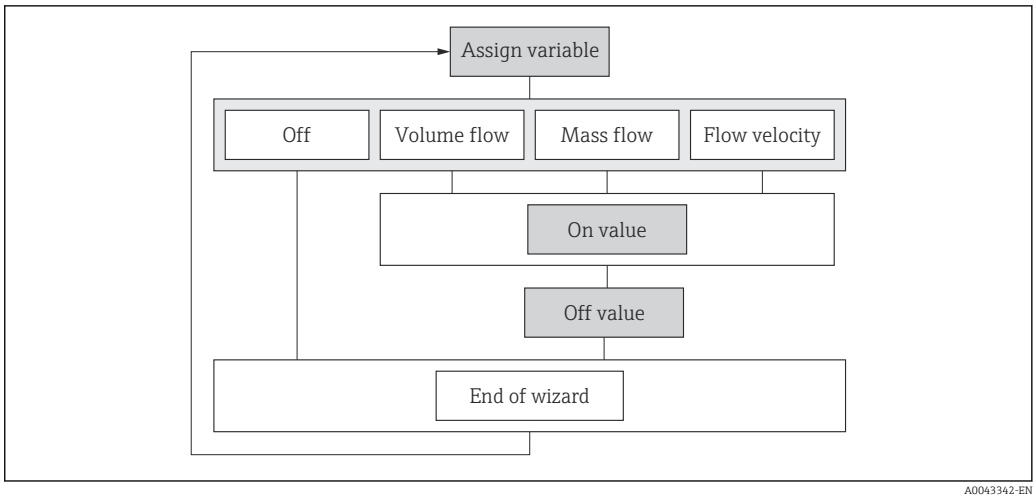
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see **Value 1 display** parameter (→ 100)	–
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0 % value for bar graph display.	Signed floating-point number	Country-specific
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100 % value for bar graph display.	Signed floating-point number	–
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 (→ 100)	–
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 (→ 100)	–
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 (→ 100)	–
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 (→ 100)	–
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 (→ 100)	–

* Visibility depends on order options or device settings

10.4.10 Configuring the low flow cut off

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

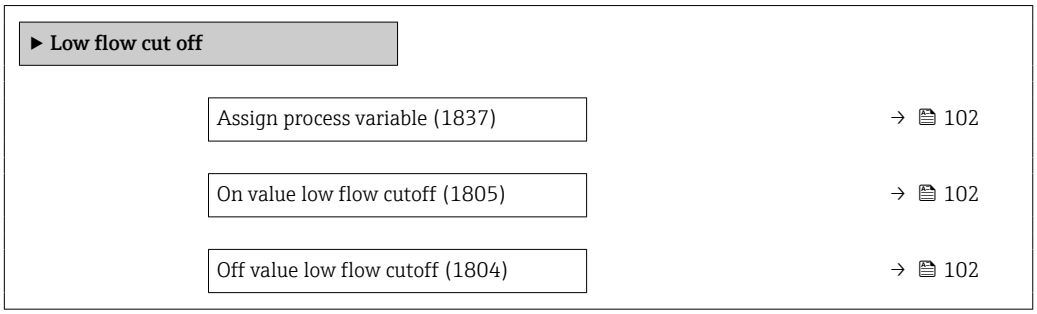
Structure of the wizard



21 "Low flow cutoff" wizard in the "Setup" menu

Navigation

"Setup" menu → Low flow cut off



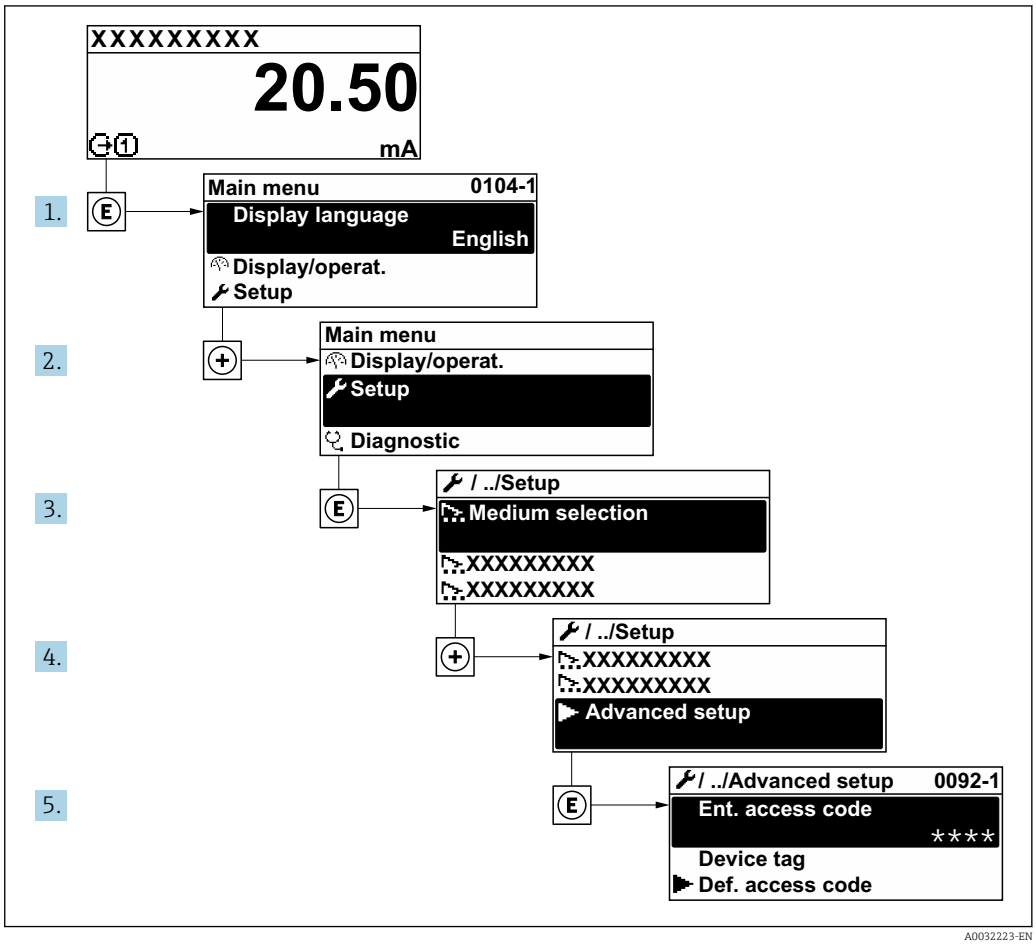
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity	Flow velocity
On value low flow cutoff	A process variable is selected in the **Assign process variable** parameter (→ 102).	Enter on value for low flow cut off.	Positive floating-point number	0.3 m/s
Off value low flow cutoff	A process variable is selected in the **Assign process variable** parameter (→ 102).	Enter off value for low flow cut off.	0 to 100.0 %	–

10.5 Advanced settings

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

Navigation to the "Advanced setup" submenu

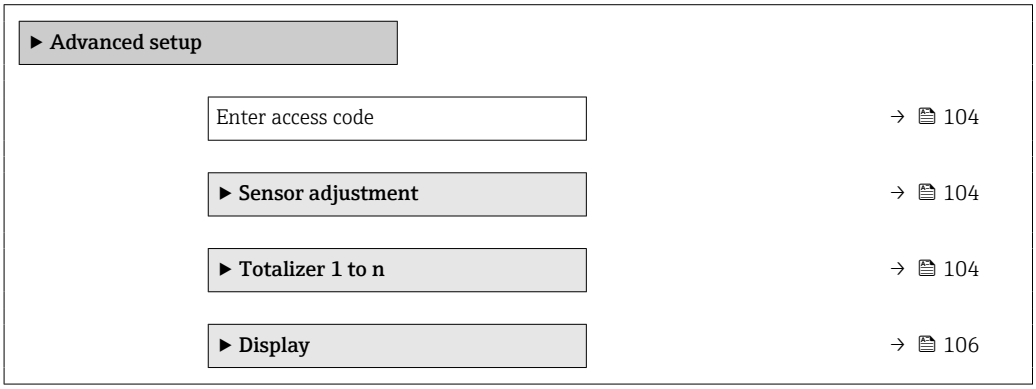


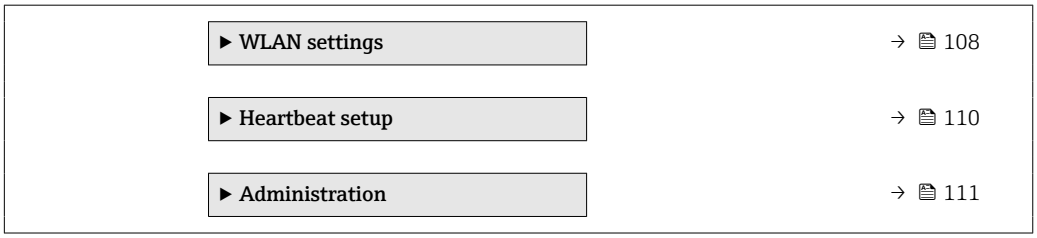
A0032223-EN

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"→ 168).

Navigation

"Setup" menu → Advanced setup





10.5.1 Using the parameter to enter the access code

Navigation
"Setup" menu → Advanced setup

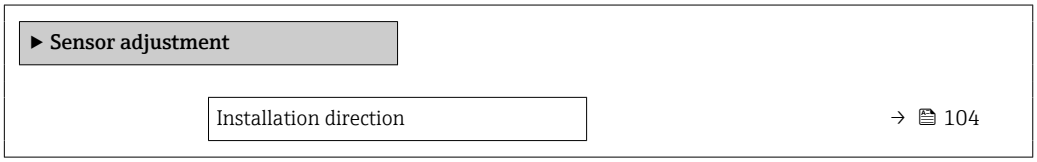
Parameter overview with brief description

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

10.5.2 Carrying out a sensor adjustment

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

Navigation
"Setup" menu → Advanced setup → Sensor adjustment



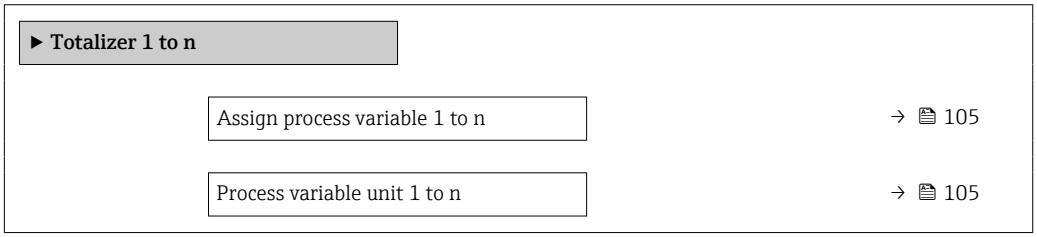
Parameter overview with brief description

Parameter	Description	Selection
Installation direction	Select sign of flow direction.	▪ Forward flow ▪ Reverse flow

10.5.3 Configuring the totalizer

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

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



Totalizer 1 to n operation mode	→ 🖹 105
Totalizer 1 to n failure behavior	→ 🖹 105

Parameter overview with brief description

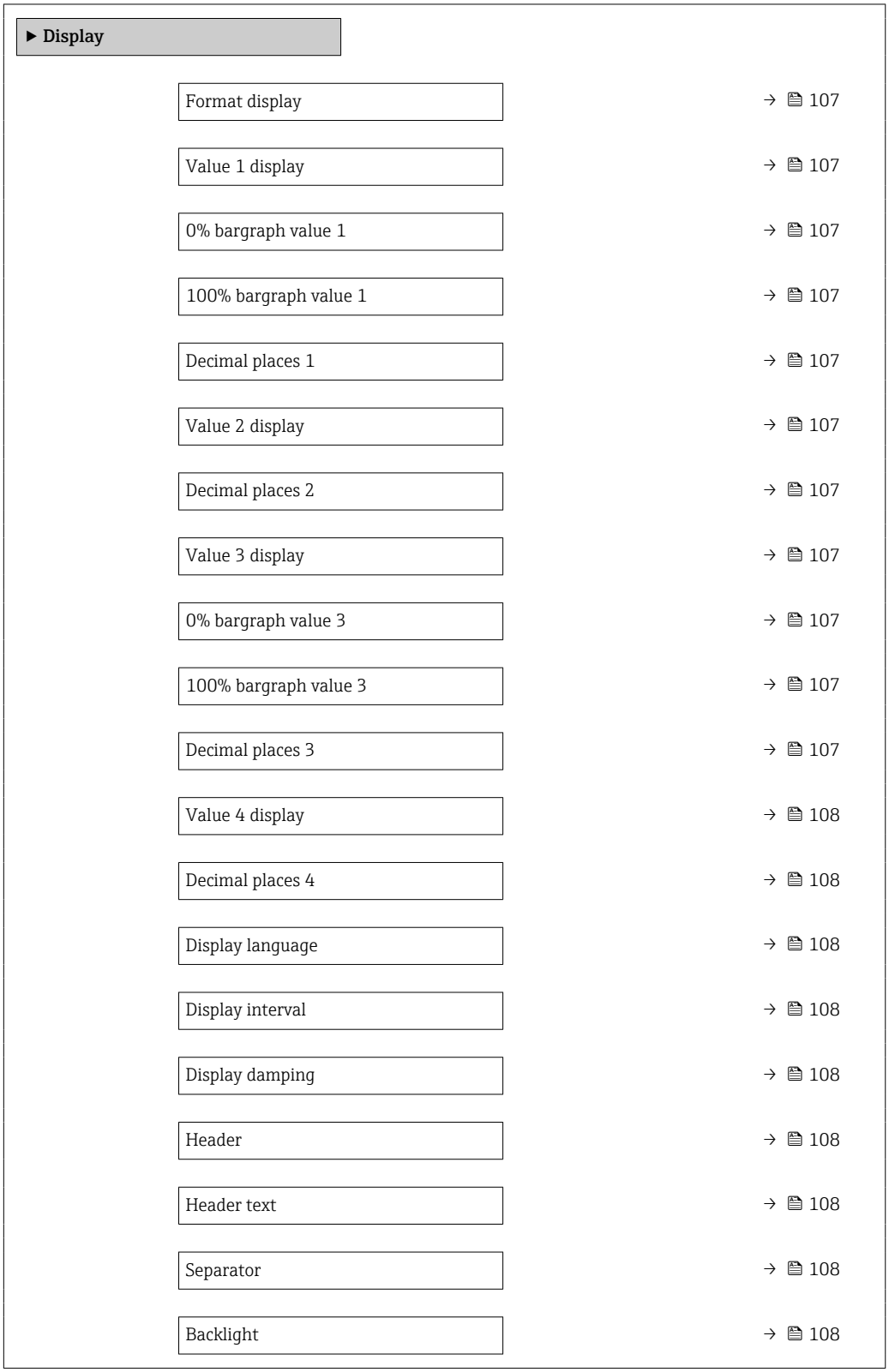
Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable 1 to n	–	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow	Volume flow
Process variable unit 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 🖹 105) of the **Totalizer 1 to n** submenu.	Select the unit for the process variable of the totalizer.	▪ g * ▪ kg * ▪ t * ▪ oz * ▪ lb * ▪ STon * ▪ cm³ * ▪ dm³ * ▪ m³ * ▪ ml * ▪ l * ▪ hl * ▪ Ml Mega * ▪ af * ▪ ft³ * ▪ Mft³ * ▪ Mft³ * ▪ fl oz (us) * ▪ gal (us) * ▪ kgal (us) * ▪ Mgal (us) * ▪ bbl (us;liq.) * ▪ bbl (us;beer) * ▪ bbl (us;oil) * ▪ bbl (us;tank) * ▪ gal (imp) * ▪ Mgal (imp) * ▪ bbl (imp;beer) * ▪ bbl (imp;oil) * ▪ None *	Depends on country: ▪ m³ ▪ ft³
Totalizer 1 to n operation mode	A process variable is selected in the **Assign process variable** parameter (→ 🖹 105) of the **Totalizer 1 to n** submenu.	Select totalizer operation mode, e.g. only totalize forward flow or only totalize reverse flow.	▪ Net ▪ Forward ▪ Reverse	Net flow total
Totalizer 1 to n failure behavior	A process variable is selected in the **Assign process variable** parameter (→ 🖹 105) of the **Totalizer 1 to n** submenu.	Select totalizer behavior in the event of a device alarm.	▪ Hold ▪ Continue ▪ Last valid value + continue	Stop

* Visibility depends on order options or device settings

10.5.4 Carrying out additional display configurations

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

Navigation
"Setup" menu → Advanced setup → Display



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 ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature ▪ Density ▪ Electronics temperature ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Turbulence * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0 % value for bar graph display.	Signed floating-point number	Country-specific
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.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 (→ 🖹 100) For the picklist, see **Value 1 display** parameter (→ 🖹 100)	–
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.xxxx	–
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 (→ 🖹 100)	–
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0 % value for bar graph display.	Signed floating-point number	Country-specific
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100 % value for bar graph display.	Signed floating-point number	–
Decimal places 3	A measured value is specified in the **Value 3 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	–

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
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 (→ 🖹 100)	–
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.xxxx	–
Display language	A local display is provided.	Set display language.	▪ English ▪ Deutsch ▪ Français ▪ Español ▪ Italiano ▪ Nederlands ▪ Portuguesa ▪ Polski ▪ русский язык (Russian) ▪ Svenska ▪ Türkçe ▪ 中文 (Chinese) ▪ 日本語 (Japanese) ▪ 한국어 (Korean) ▪ 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	–
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	–
Header	A local display is provided.	Select header contents on local display.	▪ Device tag ▪ Free text	–
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	A local display is provided.	Switch the local display backlight on and off.	▪ Disable ▪ Enable	–

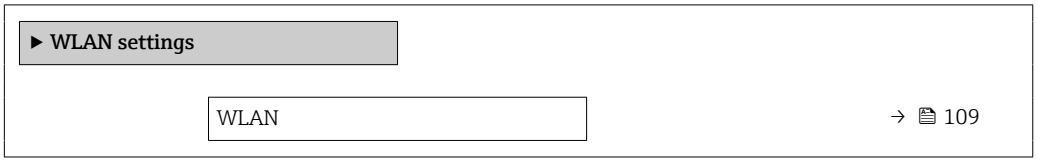
* Visibility depends on order options or device settings

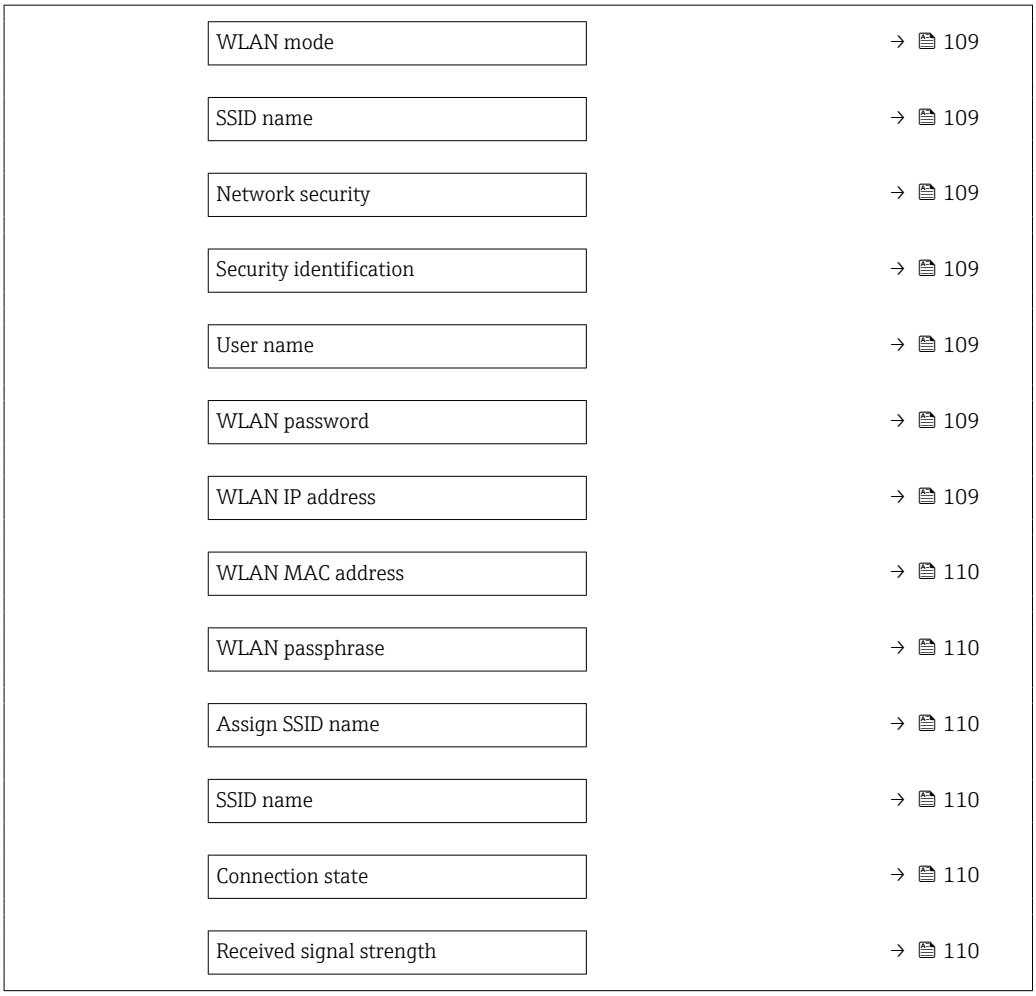
10.5.5 WLAN configuration

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

Navigation

"Setup" menu → Advanced setup → WLAN settings





Parameter overview with brief description

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

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

* Visibility depends on order options or device settings

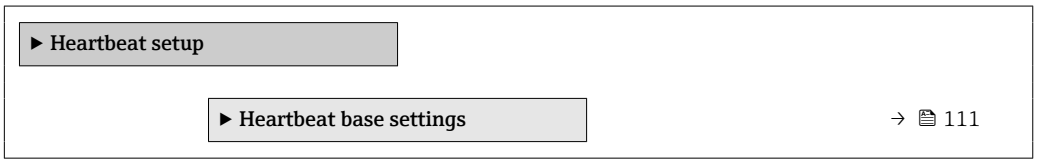
10.5.6 Performing Heartbeat basic setup

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

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

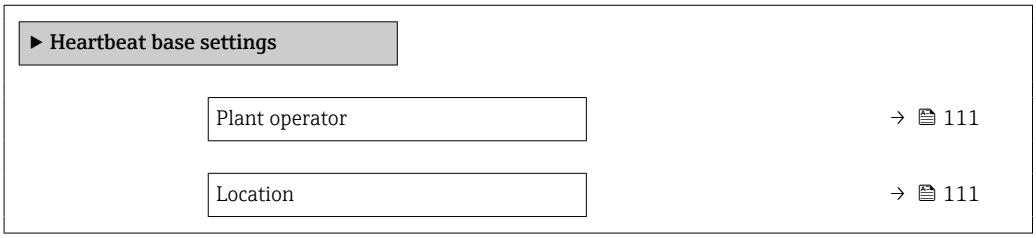
Navigation

"Setup" menu → Advanced setup → Heartbeat setup



"Heartbeat base settings" submenu

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



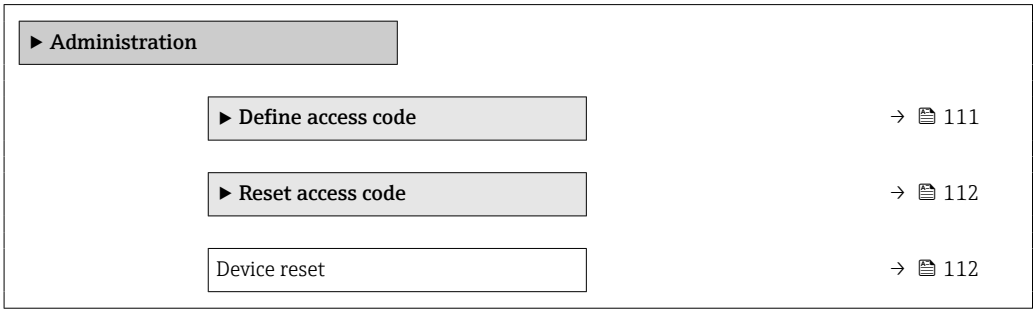
Parameter overview with brief description

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

10.5.7 Using parameters for device administration

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

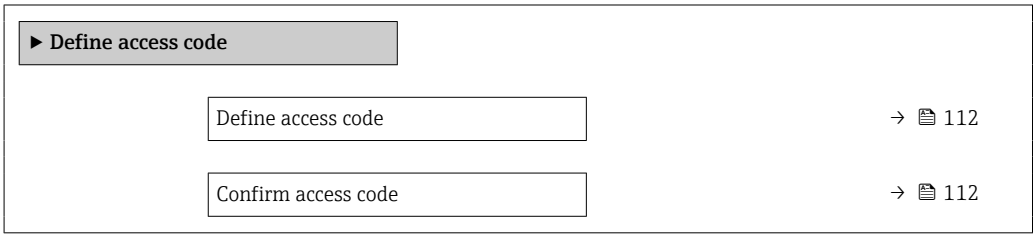
Navigation
"Setup" menu → Advanced setup → Administration



Using the parameter to define the access code

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

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

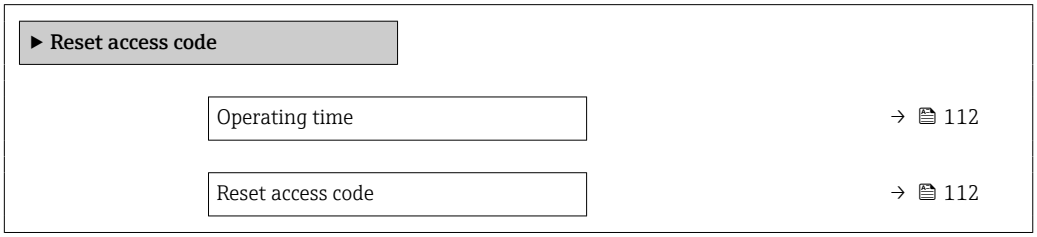


Parameter overview with brief description

Parameter	Description	User entry
Define access code	Specify an access code that is required to obtain the access rights for the Maintenance role.	Max. 16-digit character string comprising numbers, letters and special characters
Confirm access code	Confirm the access code entered for the Maintenance role.	Max. 16-digit character string comprising numbers, letters and special characters

Using the parameter to reset the access code

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



Parameter overview with brief description

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

Using the parameter to reset the device

Navigation
"Setup" menu → Advanced setup → Administration

Parameter overview with brief description

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

* Visibility depends on order options or device settings

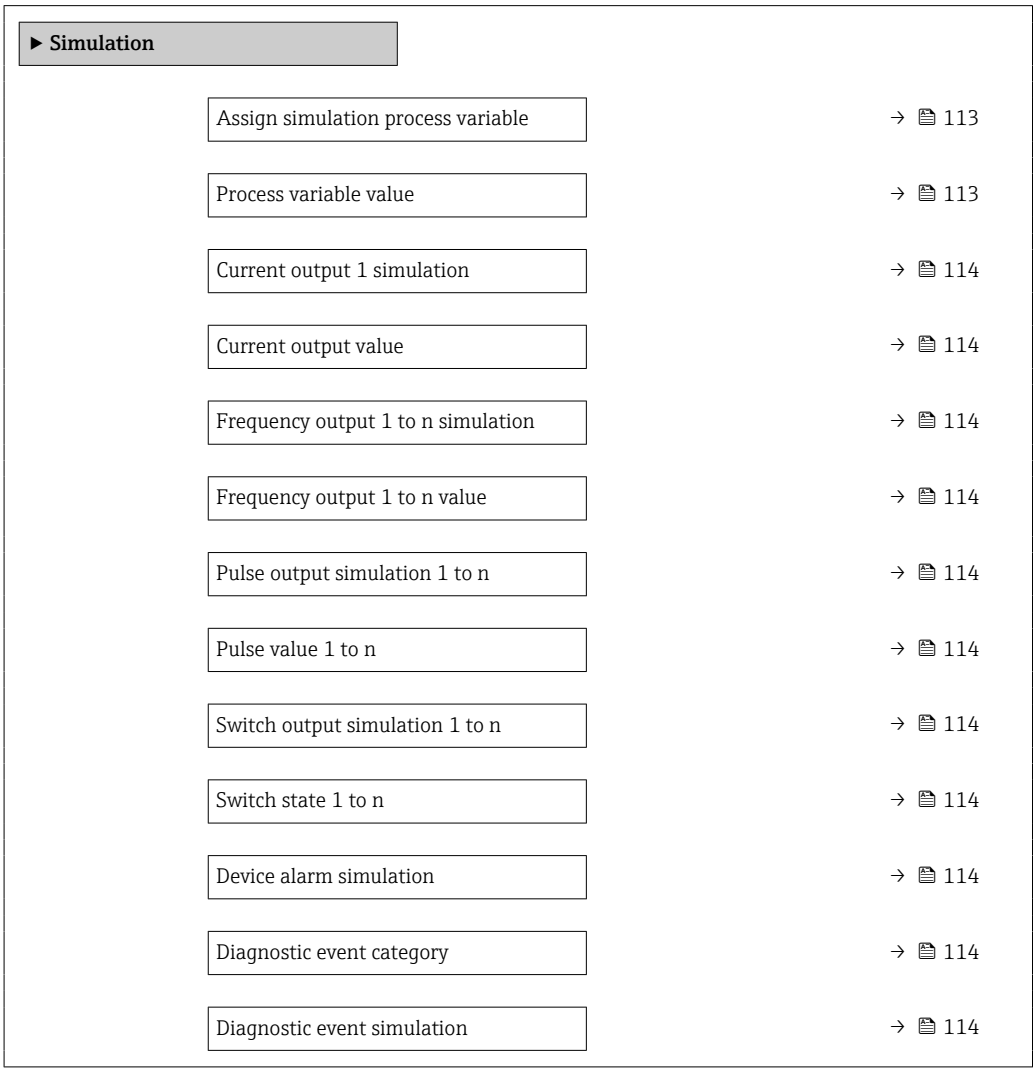
10.6 Simulation

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).

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

Navigation
"Diagnostics" menu → Simulation



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature ▪ Density
Process variable value	A process variable is selected in the **Assign simulation process variable** parameter (→ 113).	Enter the simulation value for the selected process variable.	Depends on the process variable selected

Parameter	Prerequisite	Description	Selection / User entry
Simulation status input	For the following order code: "Output; input", option I "4-20mA HART, 2x pul./freq./switch output; status input"		▪ Off ▪ On
Value status input	In the **Simulation status input** parameter, the **On** option is selected.		▪ High ▪ Low
Current output 1 simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On
Current output value	In the **Current output simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA
Frequency output 1 to n simulation	In the **Operating mode** parameter, the **Frequency** option is selected.	Switch the simulation of the frequency output on and off.	▪ Off ▪ On
Frequency output 1 to n value	In the **Frequency simulation 1 to n** parameter, the **On** option is selected.	Enter the frequency value for the simulation.	0.0 to 12 500.0 Hz
Pulse output simulation 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter (→ 92) defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value
Pulse value 1 to n	In the **Pulse output simulation 1 to n** parameter, the **Down-counting value** option is selected.	Enter the number of pulses for simulation.	0 to 65 535
Switch output simulation 1 to n	In the **Operating mode** parameter, the **Switch** option is selected.	Switch the simulation of the switch output on and off.	▪ Off ▪ On
Switch state 1 to n	–	Select the status of the status output for the simulation.	▪ Open ▪ Closed
Device alarm simulation	–	Switch the device alarm on and off.	▪ Off ▪ On
Diagnostic event category	–	Select a diagnostic event category.	▪ Sensor ▪ Electronics ▪ Configuration ▪ Process
Diagnostic event simulation	–	Select a diagnostic event to simulate this event.	▪ Off ▪ Diagnostic event picklist (depends on the category selected)

10.7 Protecting settings from unauthorized access

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

10.7.1 Write protection via access code

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

Defining the access code via the local display

1. Navigate to the **Define access code** parameter (→ 🖹 112).
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 **Confirm access code** parameter (→ 🖹 112) to confirm.
   ↳ The 🔒 symbol appears in front of all write-protected parameters.

- Disabling parameter write protection via access code → 🖹 55.
- 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 → 🖹 55

- 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
Display language	Format display	Control Totalizer
	Contrast display	Preset value
	Display interval	Reset all totalizers

Defining the access code via the web browser

1. Navigate to the **Define access code** parameter (→ 🖹 112).
2. Define a 16-digit (max.) numeric code as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 🖹 112) to confirm.
   ↳ The web browser switches to the login page.

- Disabling parameter write protection via access code → 🖹 55.
- If the access code is lost: Resetting the access code .
- The **Access status tooling** parameter shows which user role the user is currently logged in with.
  - Navigation path: Operation → Access status tooling
  - User roles and their access rights → 🖹 55

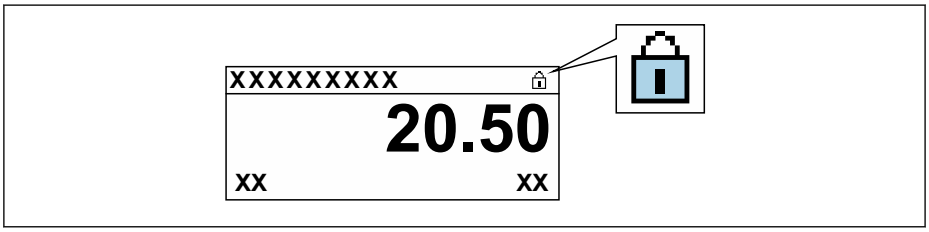
If no action is performed for 10 minutes, the web browser automatically returns to the login page.

10.7.2 Write protection via write protection switch

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

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via MODBUS RS485 protocol

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



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   If hardware write protection is disabled: No option is displayed in the **Locking status** parameter . In the local display, the 🔓 symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.
3. **⚠ WARNING**
   Excessive tightening torque applied to the fixing screws!
   Risk of damaging the plastic transmitter.
   ▶ Tighten the fixing screws as per the tightening torque → 📄 39.

   Reassemble the transmitter in the reverse order.

11 Operation

11.1 Reading off the device locking status

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

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access authorization displayed in the **Access status display** parameter applies → 🖹 55. Only appears on local display.
Hardware locked	The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters (e.g. via local display or operating tool) → 🖹 116.
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset, etc.). Once the internal processing has been completed, the parameters can be changed once again.

11.2 Adjusting the operating language

Detailed information:
- To configure the operating language → 🖹 74
- For information on the operating languages supported by the measuring device → 🖹 163

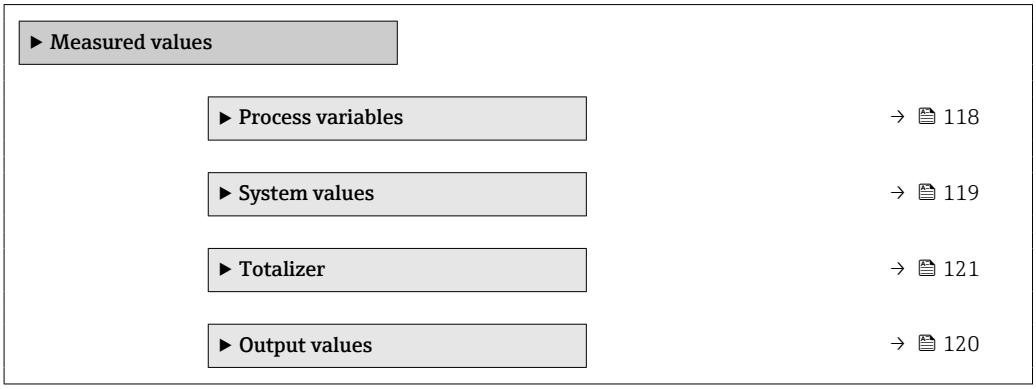
11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 🖹 99
- On the advanced settings for the local display → 🖹 106

11.4 Reading off measured values

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

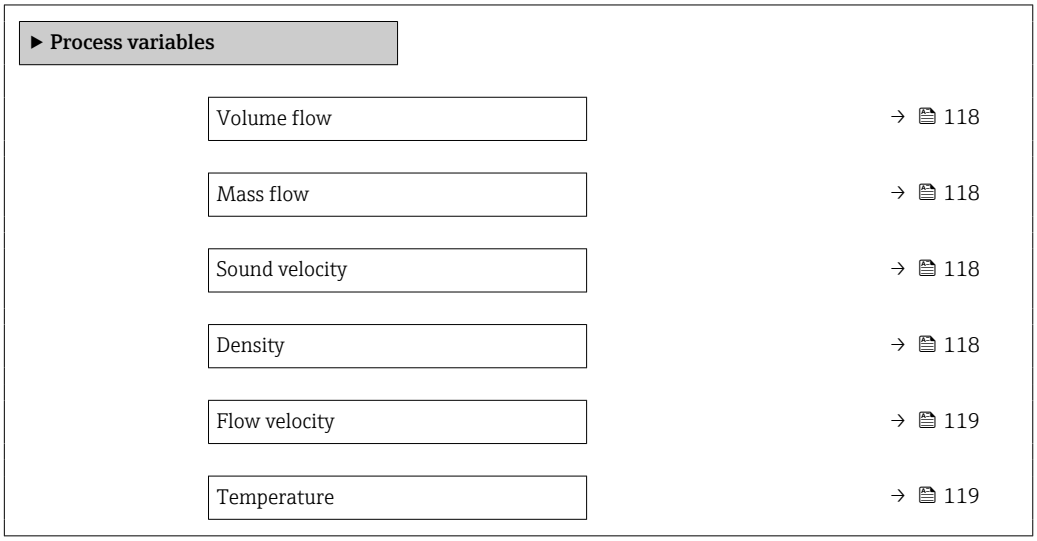
Navigation
"Diagnostics" menu → Measured values



11.4.1 Process variables

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

Navigation
"Diagnostics" menu → Measured values → Process variables



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Volume flow	–	Displays the volume flow that is currently measured. *Dependency* The unit is taken from: **Volume flow unit** parameter (→ 81)	Signed floating-point number
Mass flow	–	Displays the mass flow that is currently calculated. *Dependency* The unit is taken from the **Mass flow unit** parameter (→ 82).	Signed floating-point number
Sound velocity	–	Displays the sound velocity that is currently measured. *Dependency* The unit is taken from the **Velocity unit** parameter.	Signed floating-point number
Density	A fixed density is not entered.	Displays the density that is currently calculated. *Dependency* The unit is taken from: **Density unit** parameter	Signed floating-point number

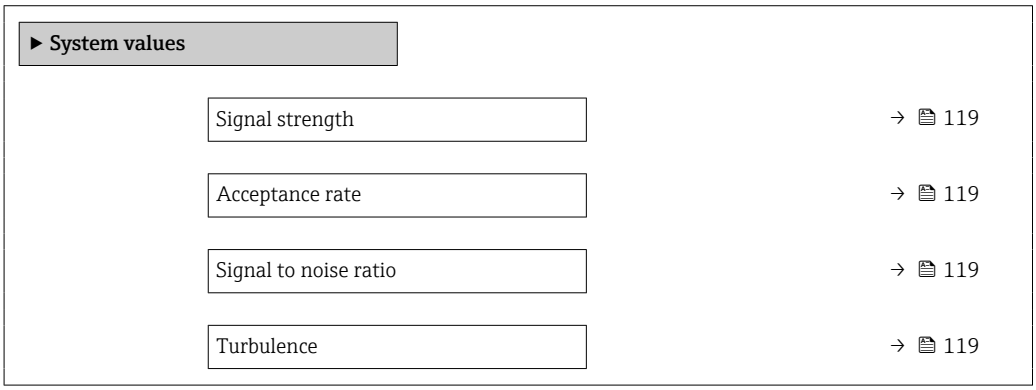
Parameter	Prerequisite	Description	User interface
Flow velocity	–	Displays the average flow velocity that is currently calculated. *Dependency* The unit is taken from: **Velocity unit** parameter	Signed floating-point number
Temperature	Temperature is not entered as a fixed value.	Displays the temperature that is currently measured. *Dependency* The unit is taken from: **Temperature unit** parameter	Signed floating-point number

11.4.2 System values

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

Navigation

"Diagnostics" menu → Measured values → System values



Parameter overview with brief description

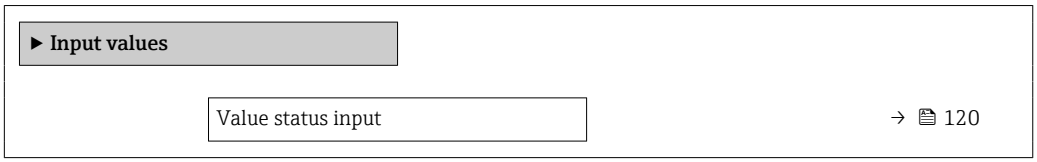
Parameter	Description	User interface
Signal strength	Displays the current signal strength (0 to 100 dB). Assessment of the signal strength: ▪ < 10 dB: bad ▪ > 90 dB: very good	Signed floating-point number
Acceptance rate	Displays the ratio of the number of ultrasonic signals accepted for flow calculation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

11.4.3 Input values

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

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

Navigation
"Diagnostics" menu → Measured values → Input values



Parameter overview with brief description

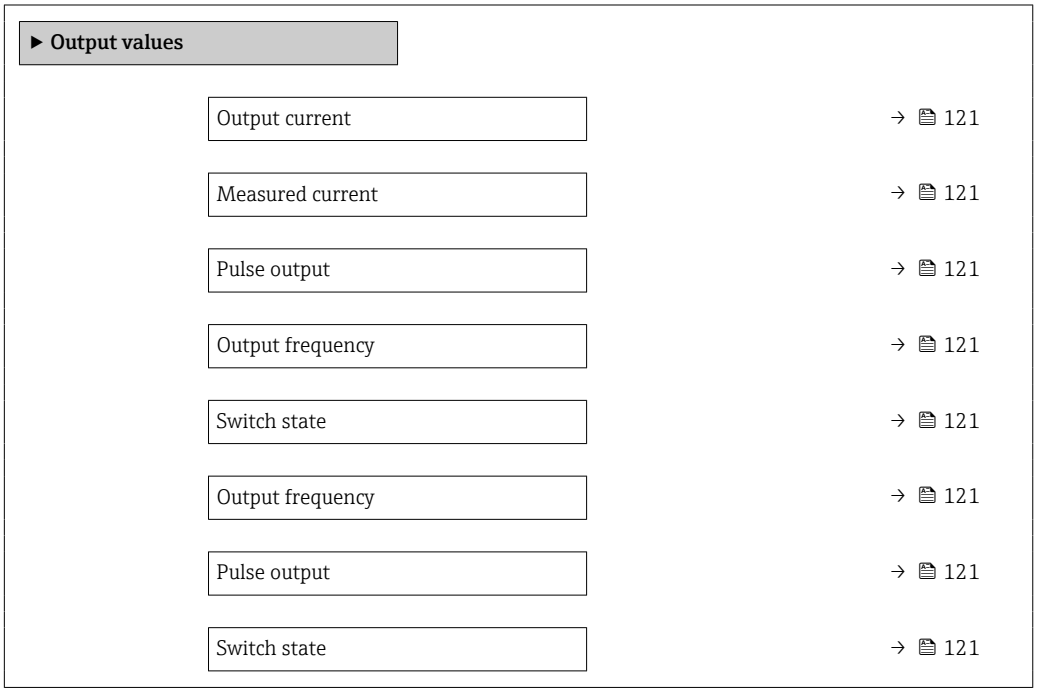
Parameter	Prerequisite	Description	User interface
Value status input	For the following order code: "Output; input", option **I** "4-20mA HART, 2x pul./freq./switch output; status input"		▪ High ▪ Low

11.4.4 Output values

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

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

Navigation
"Diagnostics" menu → Measured values → Output values



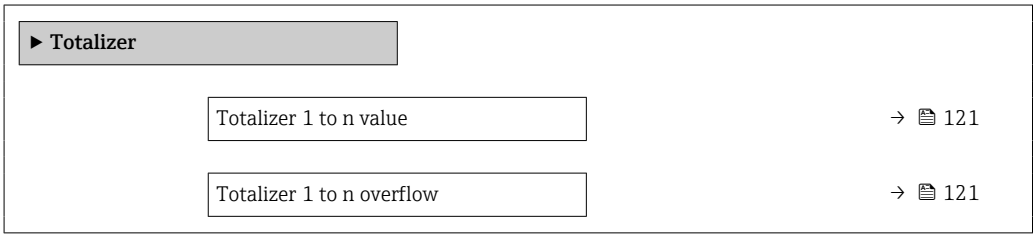
Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Output current	–	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current	–	Displays the current value currently measured for the current output.	0 to 30 mA
Pulse output 1 to n	The **Pulse** option is selected in the **Operating mode** parameter parameter.	Displays the pulse frequency currently output.	Positive floating-point number
Output frequency 1 to n	In the **Operating mode** parameter, the **Frequency** option is selected.	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz
Switch state 1 to n	In the **Operating mode** parameter, the **Switch** option is selected.	Displays the current switch output status.	▪ Open ▪ Closed

11.4.5 "Totalizer" submenu

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

Navigation
"Diagnostics" menu → Measured values → Totalizer



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Totalizer 1 to n value	One of the following options is selected in the **Assign process variable** parameter (→ 105) of the **Totalizer 1 to n** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer counter value.	Signed floating-point number
Totalizer 1 to n overflow	One of the following options is selected in the **Assign process variable** parameter (→ 105) of the **Totalizer 1 to n** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer overflow.	Integer with sign

11.5 Adapting the measuring device to the process conditions

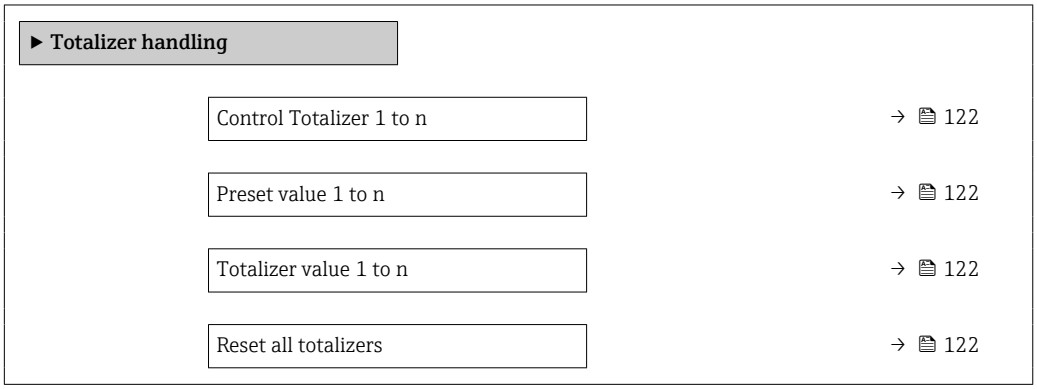
The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 74)
- Advanced settings using the**Advanced setup** submenu (→ 103)

11.6 Performing a totalizer reset

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

Navigation

"Operation" menu → Totalizer handling



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Totalizer 1 to n control	A process variable is selected in the **Assign process variable** parameter (→ 105) of the **Totalizer 1 to n** submenu.	Control totalizer value.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize ▪ Hold	–
Preset value 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 105) 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 (→ 105) for the totalizer.	Signed floating-point number	Depends on country: ▪ 0 m^3 ▪ 0 ft^3
Totalizer value	One of the following options is selected in the **Assign process variable** parameter (→ 105) of the **Totalizer 1 to n** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer counter value.	Signed floating-point number	–
Reset all totalizers	–	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	–

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.

Options	Description
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

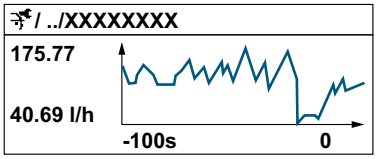
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the previously aggregated flow values.

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 → 65.
- Web browser

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



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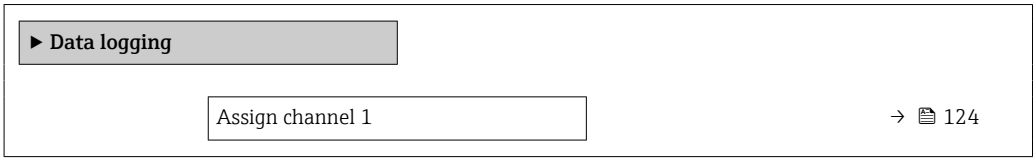
- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

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

Navigation
"Diagnostics" menu → Data logging



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface
Assign channel 1	The **Extended HistoROM** application package is available.	Assign process variable to logging channel.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature ▪ Density ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Turbulence * ▪ Electronics temperature ▪ Current output 1
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 (→ 124)
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 (→ 124)
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 (→ 124)

Parameter	Prerequisite	Description	Selection / User entry / User interface
Logging interval	The **Extended HistoROM** application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	0.1 to 3 600.0 s
Clear logging data	The **Extended HistoROM** application package is available.	Clear the entire logging data.	▪ Cancel ▪ Clear data
Data logging	–	Select the type of data logging.	▪ Overwriting ▪ Not overwriting
Logging delay	In the **Data logging** parameter, the **Not overwriting** option is selected.	Enter the time delay for measured value logging.	0 to 999 h
Data logging control	In the **Data logging** parameter, the **Not overwriting** option is selected.	Start and stop measured value logging.	▪ None ▪ Delete + start ▪ Stop
Data logging status	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the measured value logging status.	▪ Done ▪ Delay active ▪ Active ▪ Stopped
Entire logging duration	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the total logging duration.	Positive floating-point number

* Visibility depends on order options or device settings

12 Diagnosis and troubleshooting

12.1 General troubleshooting

For local display

Error	Possible causes	Remedial action
Local display dark and no output signals	Supply voltage does not match the voltage specified on the nameplate.	Apply the correct supply voltage → 39.
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 main electronics module correctly.	Check terminals.
Local display dark and no output signals	▪ ▪ Main electronics module is defective.	Order spare part → 146.
Local display dark and no output signals	The connector between the main electronics module and display module is not plugged in correctly.	Check the connection and correct if necessary.
Local display 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 ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 146.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures → 135
Text on local display appears in a language that cannot be understood.	The selected operating language cannot be understood.	1. Press ⊟ + ⊞ for 2 s ("home position"). 2. Press Ⓔ. 3. Configure the required language in the **Display language** parameter (→ 108).
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 → 146.

For output signals

Error	Possible causes	Remedial action
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 146.
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.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

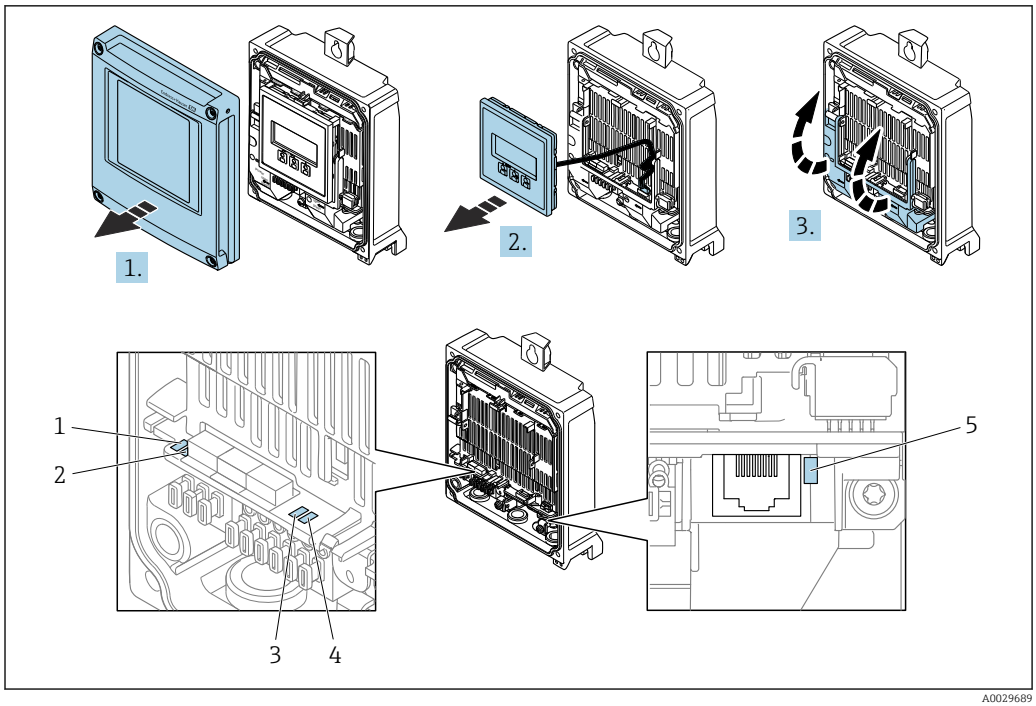
Error	Possible causes	Remedial action
Write access to parameter not possible.	Hardware write protection is enabled.	Set the write protection switch on the main electronics module to the **OFF** position → 116.
Write access to parameter not possible.	Current user role has limited access authorization.	1. Check user role → 55. 2. Enter correct customer-specific access code → 55.

Error	Possible causes	Remedial action
Connection via Modbus RS485 is not possible.	Modbus RS485 bus cable is connected incorrectly.	Check the terminal assignment .
Connection via Modbus RS485 is not possible.	Modbus RS485 cable is incorrectly terminated.	Check the terminating resistor → 🖹 40.
Connection via Modbus RS485 is not possible.	Settings for the communication interface are incorrect.	Check the Modbus RS485 configuration → 🖹 82.
Connection to the web server is not possible.	Web server is disabled.	Use the "FieldCare" or "DeviceCare" operating tool to check if the web server of the device is enabled and enable if necessary → 🖹 62.
	The Ethernet interface is incorrectly configured on the PC.	▶ Check the properties of the Internet protocol (TCP/IP) → 🖹 58. ▶ Check the network settings with the IT manager.
Connection to the web server is not possible.	The IP address is incorrectly configured on the PC.	Check the IP address: 192.168.1.212 → 🖹 58
Web browser is frozen and no further operation possible.	Data transfer is active.	Wait until data transfer or current action is finished.
	Connection lost	▶ Check cable connection and power supply. ▶ Refresh web browser and restart if necessary.
The web browser contents are difficult to read or incomplete.	The web browser version used is not the best option.	▶ Use correct web browser version → 🖹 57. ▶ Empty the web browser cache. ▶ Restart the web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No contents displayed in the web browser or contents incomplete.	▪ JavaScript is not enabled. ▪ JavaScript cannot be enabled.	▶ Enable JavaScript. ▶ Enter http://192.168.1.212/servlet/basic.html as the as IP address.
Operation with FieldCare or DeviceCare not possible via CDI-RJ45 service interface (port 8000).	Firewall of the PC or network prevents communication.	Depending on the settings of the firewall used on the PC or in the network, the firewall must be disabled or adjusted for FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare not possible via CDI-RJ45 service interface (port 8000 or TFTP ports).	Firewall of the PC or network prevents communication.	Depending on the settings of the firewall used on the PC or in the network, the firewall must be disabled or adjusted for FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

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



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

1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.

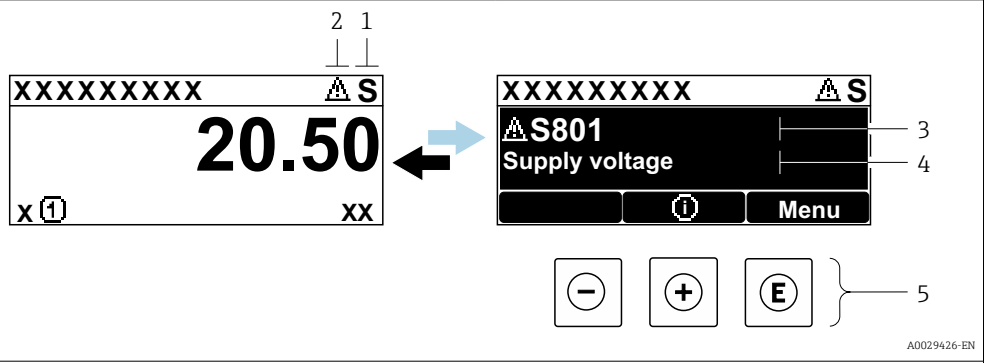
LED	Color	Meaning
Supply voltage	Off	Supply voltage is off or too low
	Green	Supply voltage is ok
Alarm	Off	Device status is ok
	Flashing red	A device error of diagnostic behavior "Warning" has occurred
	Red	▪ A device error of diagnostic behavior "Alarm" has occurred ▪ Boot loader is active
Device status	Green	Device status is ok
	Flashing red	A device error of diagnostic behavior "Warning" has occurred
	Red	A device error of diagnostic behavior "Alarm" has occurred
	Alternately flashing red/green	Boot loader is active
Communication	Flashing white	Modbus RS485 communication is active
Alarm	Green	Measuring device is ok
	Flashing green	Measuring device not configured
	Off	Firmware error
	Red	Main error
	Flashing red	Fault
	Flashing red/green	Start measuring device

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

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

Operational display in alarm condition	Diagnostic message



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

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

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter → 138
- Via submenus → 139

Status signals

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

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

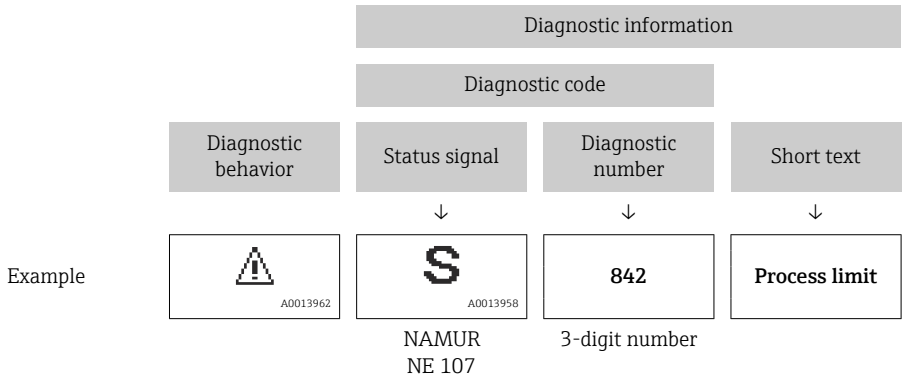
Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device is being operated: Outside its technical specification limits (e.g. outside the process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

Diagnostic behavior

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

Diagnostic information

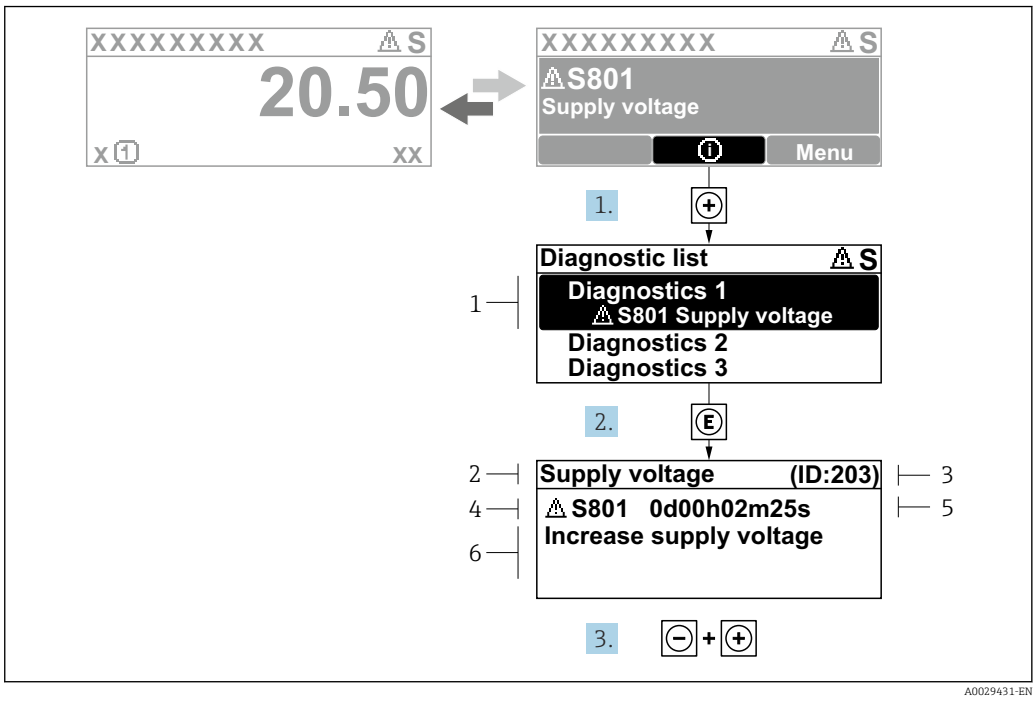
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Operating key	Meaning
	**Plus key** *In menu, submenu* Opens the message about the remedial measures.
	**Enter key** *In menu, submenu* Opens the operating menu.

12.3.2 Calling up remedial measures



22 *Message for remedial measures*

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

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

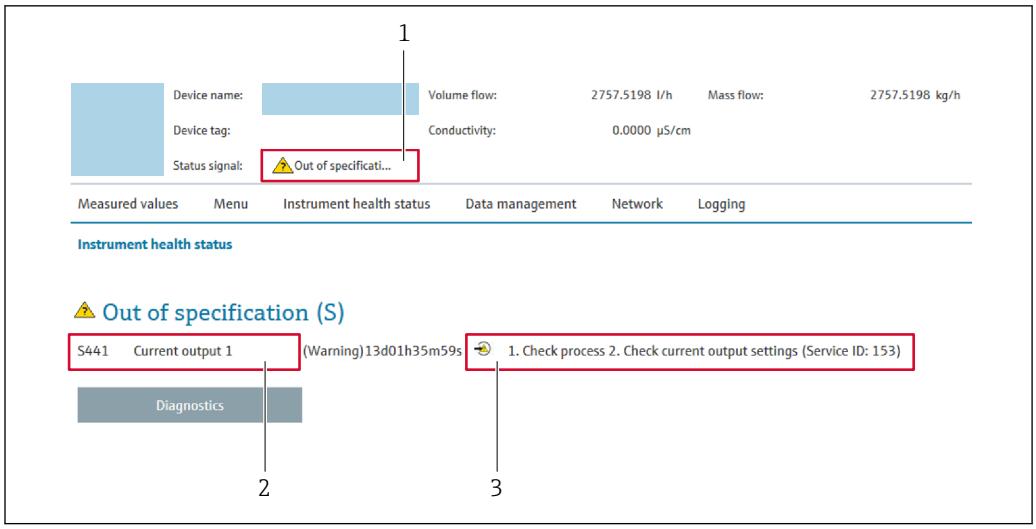
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

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

12.4 Diagnostic information in the web browser

12.4.1 Diagnostic options

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



1 *Status area with status signal*
2 *Diagnostic information → 130*
3 *Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 138
- Via submenu → 139

Status signals

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

Symbol	Meaning
	Failure A device error has occurred. The measured value is no longer valid.
	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)
	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.

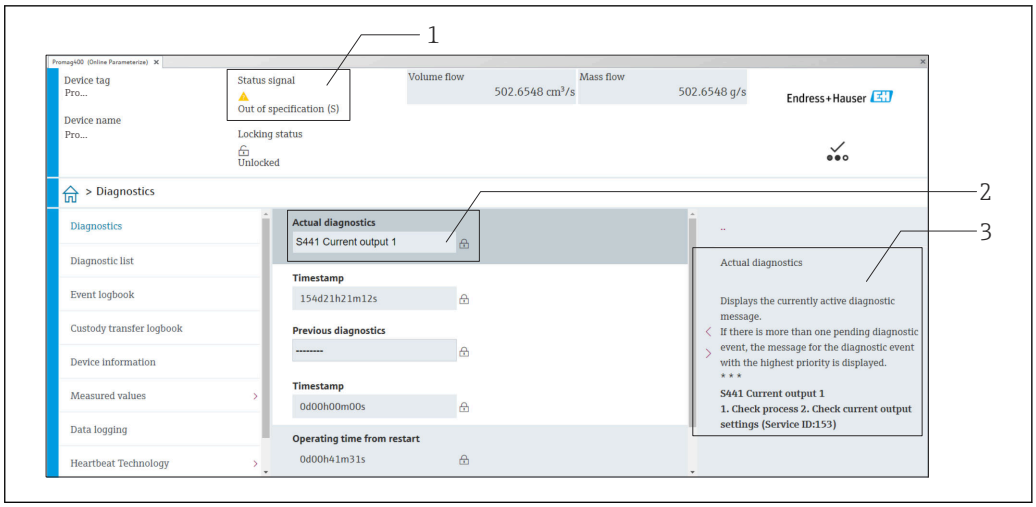
12.4.2 Calling up remedy information

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

12.5 Diagnostic information in FieldCare or DeviceCare

12.5.1 Diagnostic options

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

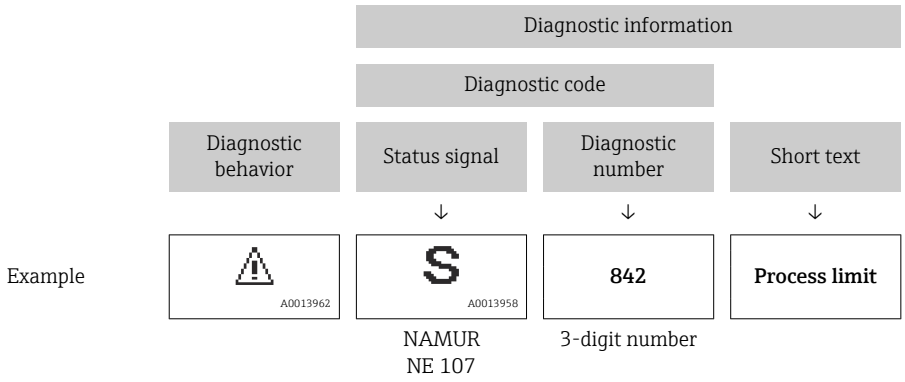


1 *Status area with status signal* → 🖹 *129*
2 *Diagnostic information* → 🖹 *130*
3 *Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 🖹 138
- Via submenu → 🖹 139

Diagnostic information

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



12.5.2 Calling up remedy information

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

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

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

12.6 Diagnostic information via communication interface

12.6.1 Reading out diagnostic information

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

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

For an overview of diagnostic events with diagnosis number and diagnosis code → 135

12.6.2 Configuring error response mode

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

Navigation path
Setup → Communication

Parameter overview with brief description

Parameter	Description	Options	Factory setting
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. The effect of this parameter depends on the option selected in the **Assign diagnostic behavior** parameter.	▪ NaN value ▪ Last valid value NaN = not a number	NaN value

12.7 Adapting the diagnostic information

12.7.1 Adapting the diagnostic behavior

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

Expert → System → Diagnostic handling → Diagnostic behavior

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

Options	Description
Alarm	The device stops measurement. The measured value output via Modbus RS485 and the totalizers assume the defined alarm condition. A diagnostic message is generated. The background lighting changes to red.
Warning	The device continues to measure. The measured value output via Modbus RS485 and the totalizers are not affected. A diagnostic message is generated.
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.

12.8 Overview of diagnostic information

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

In the case of some items of diagnostic information, the diagnostic behavior can be changed. Adapting the diagnostic information → 134

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
019	Device initialization active	Device initialization in progress, please wait	S	Warning [1]
082	Data storage inconsistent	Check module connections	F	Alarm
083	Memory content inconsistent	1. Restart device 2. Restore S-DAT data 3. Replace S-DAT	F	Alarm
104	Sensor signal path 1 to n	1. Check process conditions 2. Clean or replace transducers 3. Replace sensor electronic module (ISEM)	F	Alarm
105	Downstream transducer path 1 to n defective	1. Check connection to the downstream transducer 2. Replace downstream transducer	F	Alarm
106	Upstream transducer path 1 defective	1. Check connection to the upstream transducer 2. Replace upstream transducer	F	Alarm
160	Signal path switched off	Contact service	M	Warning [1]
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
242	Firmware incompatible	1. Check firmware version 2. Flash or replace electronic module	F	Alarm
252	Module incompatible	1. Check electronic modules 2. Check if correct modules are available (e.g. NEx, Ex) 3. Replace electronic modules	F	Alarm
262	Module connection interrupted	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics 2. Check or replace ISEM or main electronics	F	Alarm
270	Main electronics defective	1. Restart device 2. Replace main electronic module	F	Alarm
271	Main electronics faulty	1. Restart device 2. Replace main electronic module	F	Alarm
272	Main electronics faulty	Restart device	F	Alarm
273	Main electronics defective	1. Pay attention to display emergency operation 2. Replace main electronics	F	Alarm
275	I/O module defective	Change I/O module	F	Alarm
276	I/O module faulty	1. Restart device 2. Change I/O module	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
281	Electronic initialization active	Firmware update active, please wait!	F	Alarm
283	Memory content inconsistent	Restart device	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning [1)]
311	Sensor electronics (ISEM) faulty	Maintenance required! Do not reset device	M	Warning
361	I/O module 1 faulty	1. Restart device 2. Check electronic modules 3. Change I/O module or main electronics	F	Alarm
372	Sensor electronics (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
373	Sensor electronics (ISEM) faulty	Transfer data or reset device	F	Alarm
375	I/O- communication failed	1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules	F	Alarm
378	Supply voltage ISEM faulty	1. If available: Check connection cable between sensor and transmitter 2. Replace main electronic module 3. Replace sensor electronic module (ISEM)	F	Alarm
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	Reset device	F	Alarm
384	Transmitter circuit	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
385	Amplifier circuit	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
386	Time of flight	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
387	HistoROM data faulty	Contact service organization	F	Alarm
Diagnostic of configuration				
410	Data transfer failed	1. Retry data transfer 2. Check connection	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 required	Carry out trim	M	Warning
437	Configuration incompatible	1. Update firmware 2. Execute factory reset	F	Alarm
438	Dataset different	1. Check dataset file 2. Check device parameterization 3. Download new device parameterization	M	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
441	Current output 1 saturated	1. Check current output settings 2. Check process	S	Warning [1)]
442	Frequency output 1 to n saturated	1. Check frequency output settings 2. Check process	S	Warning [1)]
443	Pulse output 1 to n saturated	1. Check pulse output settings 2. Check process	S	Warning [1)]
453	Flow override active	Deactivate flow override	C	Warning
484	Failure mode simulation active	Deactivate simulation	C	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
491	Current output 1 simulation active	Deactivate simulation	C	Warning
492	Frequency output 1 to n simulation active	Deactivate simulation frequency output	C	Warning
493	Pulse output simulation active	Deactivate simulation pulse output	C	Warning
494	Switch output 1 to n simulation active	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	C	Warning
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
Diagnostic of process				
803	Loop current 1 faulty	1. Check wiring 2. Change I/O module	F	Alarm
832	Electronics temperature too high	Reduce ambient temperature	S	Warning [1)]
833	Electronics temperature too low	Increase ambient temperature	S	Warning [1)]
841	Flow velocity too high	Reduce flow rate	S	Warning [1)]
842	Process value below limit	Low flow cut off active! Check low flow cut off configuration	S	Warning [1)]
870	Measuring inaccuracy increased	1. Check process 2. Increase flow volume	F	Alarm [1)]
881	Signal to noise ratio too low	1. Check process conditions 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) 3. Replace sensor electronic module (ISEM)	F	Alarm
882	Input signal faulty	1. Check input signal parameterization 2. Check external device 3. Check process conditions	F	Alarm
930	Sound velocity too high	1. Check process conditions 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) 3. Replace sensor electronic module (ISEM)	S	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
931	Sound velocity too low	1. Check process conditions 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) 3. Replace sensor electronic module (ISEM)	S	Warning [1]
953	Asymmetry noise signal too high path 1 to n	1. Check process conditions 2. Clean or replace transducers 3. Replace sensor electronic module (ISEM)	M	Alarm

1) Diagnostic behavior can be changed.

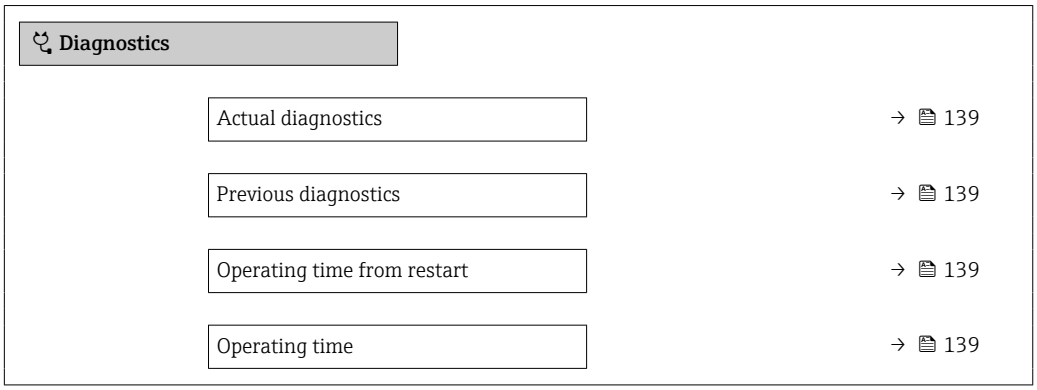
12.9 Pending diagnostic events

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

To call up the measures to rectify a diagnostic event:
- Via local display → 131
- Via web browser → 132
- Via "FieldCare" operating tool → 133
- Via "DeviceCare" operating tool → 133

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 139.

Navigation
"Diagnostics" menu



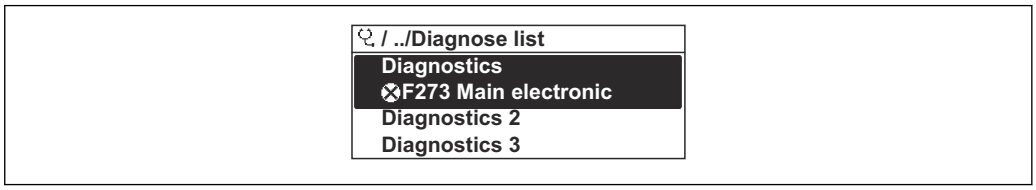
Parameter overview with brief description

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

12.10 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
Diagnostics → Diagnostic list



23 Using the example of the local display

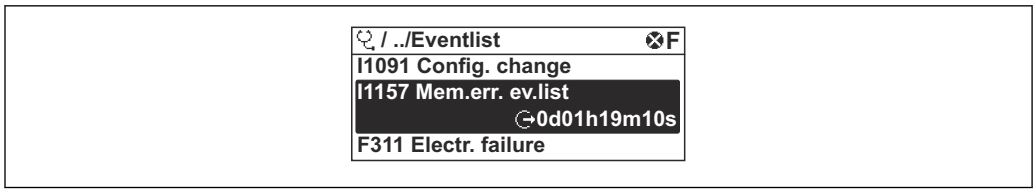
To call up the measures to rectify a diagnostic event:
- Via local display → 131
- Via web browser → 132
- Via "FieldCare" operating tool → 133
- Via "DeviceCare" operating tool → 133

12.11 Event logbook

12.11.1 Reading out the event logbook

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

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



24 *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 → 135
- Information events → 140

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
  - : Occurrence of the event
  - : End of the event
- Information event
  : Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 131
- Via web browser → 132
- Via "FieldCare" operating tool → 133
- Via "DeviceCare" operating tool → 133

For filtering the displayed event messages → 140

12.11.2 Filtering the event logbook

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

Navigation path
Diagnostics → Event logbook → Filter options

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

12.11.3 Overview of information events

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

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed

Info number	Info name
I1092	HistoROM backup deleted
I1137	Electronics changed
I1151	History reset
I1155	Reset electronics temperature
I1156	Memory error trend
I1157	Memory error event list
I1256	Display: access status changed
I1278	I/O module restarted
I1327	Zero point adjust failed signal path
I1335	Firmware changed
I1361	Web server: login failed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1457	Measurement error verification failed
I1459	I/O module verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1622	Calibration changed
I1624	All totalizers reset
I1625	Write protection activated
I1626	Write protection deactivated
I1627	Web server: login successful
I1628	Display: login successful
I1629	CDI: login successful
I1631	Web server access changed
I1632	Display: login failed
I1633	CDI: login failed
I1634	Reset to factory settings
I1635	Reset to delivery settings
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1725	Sensor electronic module (ISEM) changed

12.12 Resetting the measuring device

The entire device configuration or some of the configuration can be reset to a defined state with the **Device reset** parameter (→ 112).

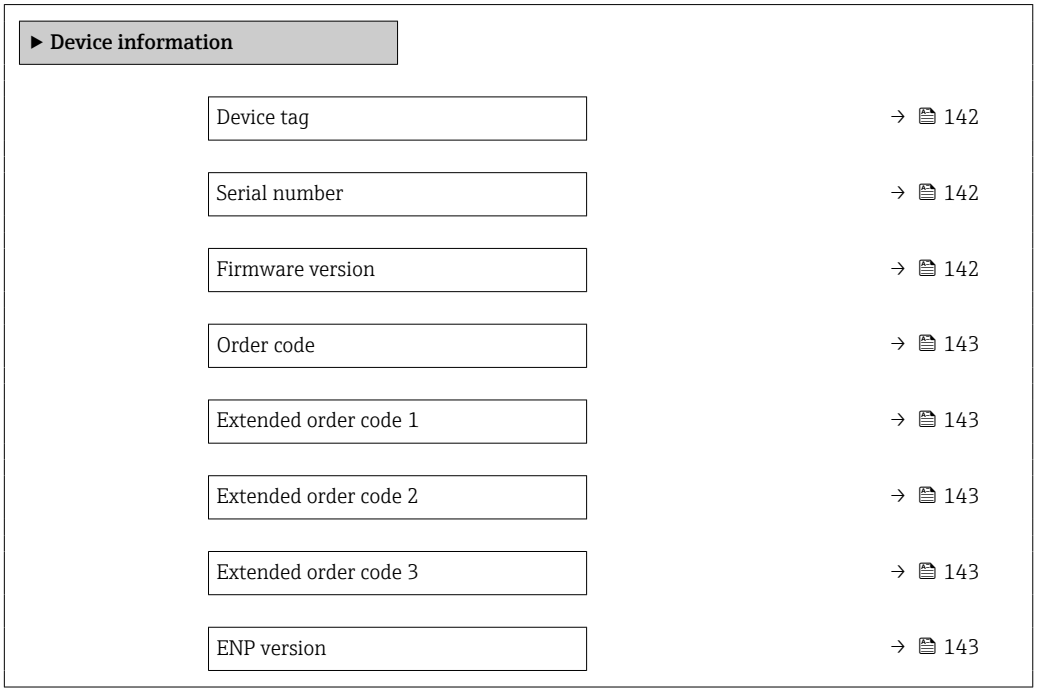
12.12.1 Function range of "Device reset" parameter

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

12.13 Device information

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

Navigation
"Diagnostics" menu → Device information



Parameter overview with brief description

Parameter	Description	User interface / User entry	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	–
Serial number	Shows the serial number of the measuring device.	Max. 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	–
Device name	Shows the name of the transmitter. The name can be found on the nameplate of the transmitter.	Max. 32 characters such as letters or numbers.	–

Parameter	Description	User interface / User entry	Factory setting
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	–
IP address	IP address of the Web server integrated in the measuring device. If the DHCP client is switched off and write access is enabled, the IP address can also be entered.	4 octet: 0 to 255 (in the particular octet)	–
Subnet mask	Displays the subnet mask. If the DHCP client is switched off and write access is enabled, the Subnet mask can also be entered.	4 octet: 0 to 255 (in the particular octet)	–
Default gateway	Displays the default gateway. If the DHCP client is switched off and write access is enabled, the Default gateway can also be entered.	4 octet: 0 to 255 (in the particular octet)	–

12.14 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
05.2024	01.00.zz	Option **77**	Original firmware	Operating Instructions	BA02303D/06/EN/01.24

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

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

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

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

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

13.2 Measuring and test equipment

Endress+Hauser offers a 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: → 150

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

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

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→ 142) in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

14.4 Return

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

1. Refer to the web page for information:
   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!

- Pay attention to high temperatures.

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

14.5.2 Disposing of the measuring device

Observe the following notes during disposal:

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

15 Accessories

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

15.1 Device-specific accessories

15.1.1 For the transmitter

Accessories	Description
Transmitter Prosonic Flow 400	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output / input ▪ Display/operation ▪ Housing ▪ Software For details, see Installation Instructions EA00104D
Post mounting kit	Post mounting kit for transmitter.
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Order number: 71343504 Installation Instructions EA01191D
External WLAN antenna	External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Accessory enclosed", option P8 "Wireless antenna wide area". ▪ The external WLAN antenna is not suitable for use in hygienic applications. ▪ Additional information regarding the WLAN interface → 63. Order number: 71351317 Installation Instructions EA01238D
Sensor cable Proline 400 Sensor – transmitter	The sensor cable can be ordered directly with the measuring device (order code for "Cable") or as an accessory (order number DK9017). The following cable lengths are available: Temperature: –40 to +80 °C (–40 to +176 °F) ▪ Option AA: 5 m (15 ft) ▪ Option AB: 10 m (30 ft) ▪ Option AC: 15 m (45 ft) ▪ Option AD: 30 m (90 ft) Possible cable length for a Proline 400 sensor cable: max. 30 m (90 ft)

15.1.2 For the sensor

Accessories	Description
Sensor set (DK9018)	Sensor set 1 MHz (I-100)
Sensor holder set (DK9014)	Sensor holder set 1 MHz

Accessories	Description
Installation set (DK9016)	▪ Installation set, DN200-DN1800, 8"-72" ▪ Installation set, DN1800-DN4000, 72"-160"
Conduit adapter set (DK9003)	▪ Conduit adapter M20x1.5 + sensor cable gland ▪ Conduit adapter NPT1/2" + sensor cable gland ▪ Conduit adapter G1/2" + sensor cable gland

15.2 Communication-specific accessories

Accessories	Description
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. Technical Information TI405C/07
Fieldgate FXA42	Transmission of the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42
Field Xpert SMT50	The Field Xpert SMT50 table PC for device configuration enables mobile plant asset management. 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. ▪ Technical Information TI01418S ▪ Operating Instructions BA01923S ▪ Product page: www.endress.com/smt77

15.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Choice of measuring devices 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 illustration 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 ▪ As a downloadable DVD for local PC installation.
Netilion	IIoT ecosystem: Unlock knowledge Endress+Hauser 's Netilion IIoT ecosystem enables you to optimize your plant performance, digitize workflows, share knowledge and improve collaboration. Based on decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem that enables you to gain useful insights from data. This knowledge can be used to optimize processes, leading to higher plant availability, efficiency and reliability, and ultimately to a more profitable plant. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress +Hauser Common Data Interface) and the USB port of a computer or laptop. Technical Information TI00405C

15.4 System components

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

16 Technical data

16.1 Application

The measuring device is intended only for the flow measurement of liquids.

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

16.2 Function and system design

Measuring principle

Proline Prosonic Flow uses a measurement method based on the transit time difference.

Measuring system

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

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

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

Information on the structure of the device → 13

16.3 Input

Measured variable

Direct measured variables

- Volume flow
- Flow velocity
- Sound velocity

Calculated measured variables

Mass flow

Measuring range

v = 0 to 15 m/s (0 to 50 ft/s)

Operable flow range

Over 150 : 1

Input signal

External measured values

The measuring device has an optional interface via which an externally measured variable (temperature) can be transmitted to the measuring device: digital input (via HART input or Modbus)

Various pressure transmitters can be ordered from Endress+Hauser: see "Accessories" section → 150

Status input

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

16.4 Output

Output signal

Current output

Current output	Can be set as: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA HART ▪ 0 to 20 mA
Maximum output values	▪ DC 24 V (when idle) ▪ 22.5 mA
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature The range of options increases if the measuring device has one or more application packages.

Pulse/frequency/switch output

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

Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature
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
	  ▪ Mass flow
	  ▪ Sound velocity
	  ▪ Flow velocity
	  ▪ Totalizer 1-3
	  ▪ Electronics temperature
	▪ Flow direction monitoring
	▪ Status
	  Low flow cut off

Modbus RS485

Physical interface	In accordance with EIA/TIA-485-A standard
Terminating resistor	Integrated, can be activated via DIP switch on the transmitter electronics module

Signal on alarm

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

Current output 4 to 20 mA

4 to 20 mA

Failure mode	Choose from: ▪ 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

0 to 20 mA

Failure mode	Choose from: ▪ Max. alarm: 22 mA ▪ Definable value between: 0 to 22.5 mA

Pulse/frequency/switch output

Pulse output	
Fault mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Fault mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Definable value between: 0 to 12 500 Hz
Switch output	
Fault mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Modbus RS485

Failure mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

Local display

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

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
  Modbus RS485
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

Plain text display	With information on cause and remedial measures

Web browser

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred Diagnostic information via light emitting diodes → 127

Low flow cut off

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

Galvanic isolation

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

Protocol-specific data

Protocol-specific data

Protocol	Modbus Applications Protocol Specification V1.1
Response times	▪ Direct data access: typically 25 to 50 ms ▪ Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transmission mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information
System integration	Information regarding system integration → 69. ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

16.5 Power supply

Terminal assignment

→ 35

Supply voltage

Transmitter

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

Power consumption

Order code for "Output"	Maximum power consumption
Option **M**: Modbus RS485	30 VA/8 W
Option **O**: Modbus RS485, 4-20mA, 2 x pulse/ frequency/switch output	30 VA/8 W

Current consumption

Transmitter

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

Device fuse

Fine-wire fuse (slow-blow):
- DC 24 V: T1A
- AC 100 to 240 V: T1A

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.

Overcurrent protection element

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

Electrical connection

→ 37

Potential equalization

→ 39

Terminals

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

Cable entries

Cable entry thread
- M20 x 1.5
- Via adapter:
  - NPT ½"
  - G ½"

Cable gland
M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)

If metal cable entries are used, use a grounding plate.

Cable specification

→ 34

Overvoltage protection

Mains voltage fluctuations	→ 156
Overvoltage category	Overvoltage category II
Short-term, temporary overvoltage	Between cable and ground up to 1200 V, for max. 5 s
Long-term, temporary overvoltage	Between cable and ground up to 500 V

16.6 Performance characteristics

Reference operating conditions

- Maximum permissible error according to ISO/DIN 11631
- Specifications as per measurement report
- Accuracy information is based on accredited calibration rigs that are traced to ISO 17025.

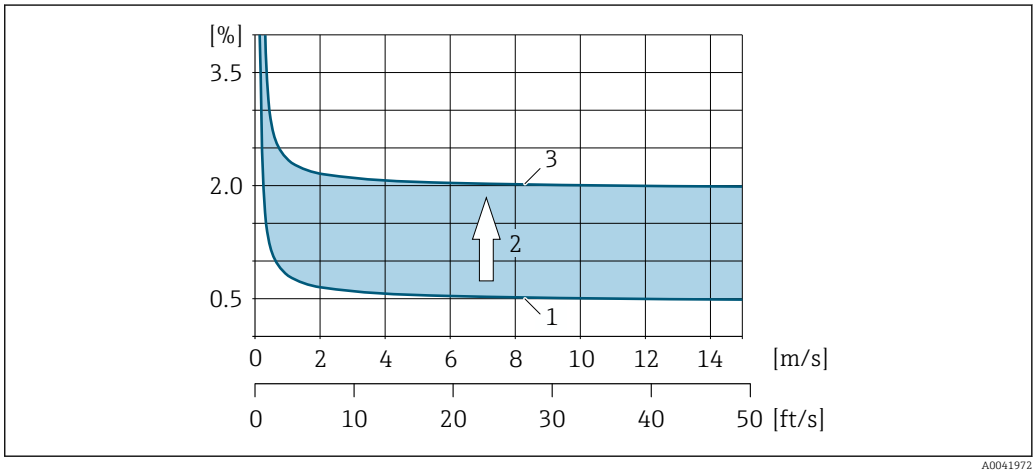
To obtain measured errors, use the *Applicator* sizing tool → 150

Maximum measurement error

o.r. = of reading

The measurement error depends on a number of factors. A distinction is made between the measurement error of the device (0.5% o.r.) and an additional installation-specific measurement error (typically 1.5% o.r.) that is independent of the device.

The installation-specific measurement error depends on the installation conditions on site, such as the nominal diameter, accuracy of sensor mounting (sensor holder welding), real pipe geometry or medium. The sum of the two measurement errors is the measurement error at the measuring point.



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

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

Measurement error at the measuring point

The measurement error at the measuring point is made up of the measurement error of the device (0.5% o.r.) and the measurement error resulting from the installation conditions on site. With a flow velocity > 0.3 m/s (1 ft/s) and a Reynolds number > 10 000, the following are typical error limits:

Nominal diameter	Maximum permissible errors for device	+	Installation-specific maximum permissible errors (typical)	→	Maximum permissible errors at the measuring point (typical)	Field calibration [1]
≥ DN 200 (8")	±0.5% o.r. ± 3 mm/s (0.12 in/s)	+	±1.5% o.r.	→	±2% o.r. ± 3 mm/s (0.12 in/s)	±0.5% o.r. ± 3 mm/s (0.12 in/s)

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

Measurement report

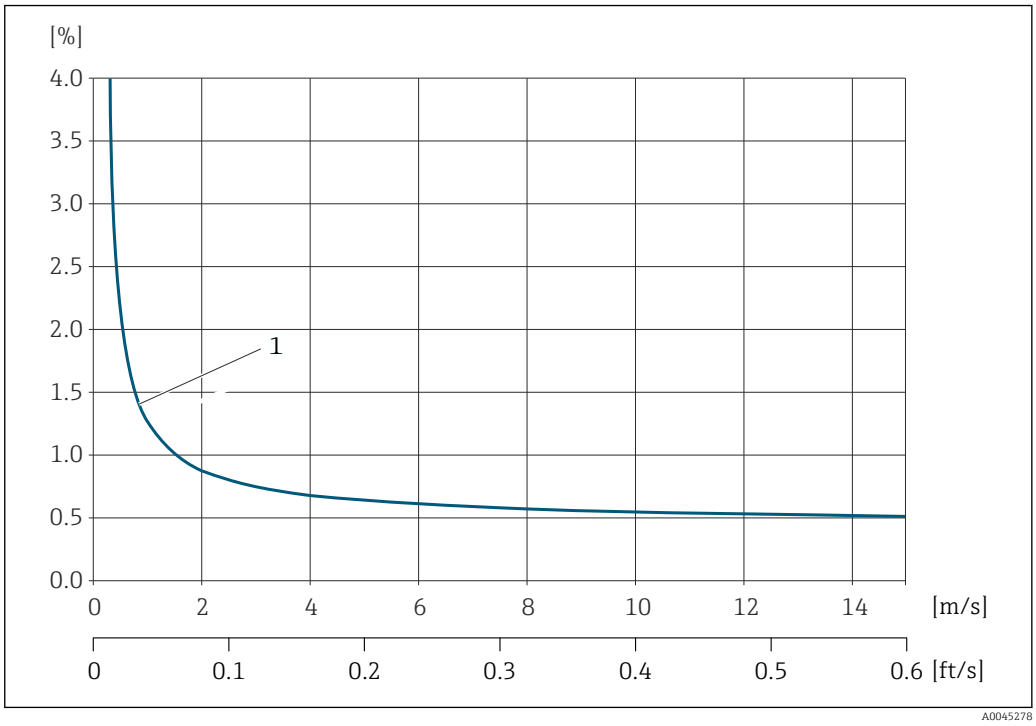
If required, the device can be supplied with a factory measurement report. A measurement is performed under reference conditions to verify the performance of the device. Here, the sensors are mounted on a pipe with a nominal diameter of DN 250 (10") or 400 (16").

With a flow velocity of > 0.3 m/s (1 ft/s) and a Reynolds number > 10 000, the following error limits are guaranteed with the measurement report:

Nominal diameter	Maximum permissible errors for device
250 (10"); single-path	±0.5% o.r. ± 3 mm/s (0.12 in/s)
400 (16"); dual-path	±0.5% o.r. ± 3 mm/s (0.12 in/s)

The specification applies to Reynolds numbers Re ≥ 10 000. Larger measurement errors may occur for Reynolds numbers Re < 10 000.

Example of max. measurement error (volume flow)



26 Example of max. measurement error (volume flow) in % o.r.

1 Pipe diameter ≥ 250 (10")

Accuracy of outputs

The outputs have the following base accuracy specifications.

Repeatability

o.r. = of reading

±0.3% for flow velocities >0.3 m/s (1 ft/s)

Influence of ambient temperature

Current output

o.r. = of reading

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

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

16.7 Mounting

Mounting requirements

→ 19

16.8 Environment

Ambient temperature range	→ 📄 23
Storage temperature	The storage temperature for all components (except display modules and order code for "Sensor version", options AG, AH) corresponds to the ambient temperature range→ 📄 23. **Display modules** −40 to +60 °C (−40 to +140 °F)
Relative humidity	The device is suitable for use outdoors and indoors with a relative humidity of 5 to 95 %.
Operating height	According to EN 61010-1 ▪ ≤ 2 000 m (6 562 ft) ▪ > 2 000 m (6 562 ft) with additional overvoltage protection (e.g. Endress+Hauser HAW Series)
Degree of protection	**Transmitter** ▪ IP66/67, type 4X enclosure, suitable for pollution degree 4 ▪ When the housing is open: IP20, type 1 enclosure, suitable for pollution degree 2 ▪ Display module: IP20, type 1 enclosure, suitable for pollution degree 2 **Sensor** ▪ Standard: IP66/67, type 4X enclosure, suitable for pollution degree 4 ▪ Optionally available: IP68, type 6P enclosure, suitable for pollution degree 4 **External WLAN antenna** IP67
Shock and vibration resistance	**Vibration sinusoidal, in accordance with IEC 60068-2-6** ▪ 2 to 8.4 Hz, 7.5 mm peak ▪ 8.4 to 2 000 Hz, 2 g peak **Vibration broad-band random, according to IEC 60068-2-64** ▪ 10 to 200 Hz, 0.01 g^2/Hz ▪ 200 to 2 000 Hz, 0.003 g^2/Hz ▪ Total: 2.70 g rms **Shock half-sine, according to IEC 60068-2-27** 6 ms 50 g **Rough handling shocks according to IEC 60068-2-31**

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4
- Complies with emission limits for industry as per EN 55011 (Class A)

Details are provided in the Declaration of Conformity.

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

16.9 Process

Medium temperature range

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

Sound velocity range

600 to 3 000 m/s (1 969 to 9 843 ft/s)

Medium pressure range

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

Flow limit

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

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value.
- In most applications, 10 to 50 % of the maximum full scale value can be considered ideal.

Pressure loss

There is no pressure loss.

16.10 Mechanical Construction

Design, dimensions

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

Weight

Weight specifications exclusive of packaging material.

Transmitter

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

Sensor

Including mounting material

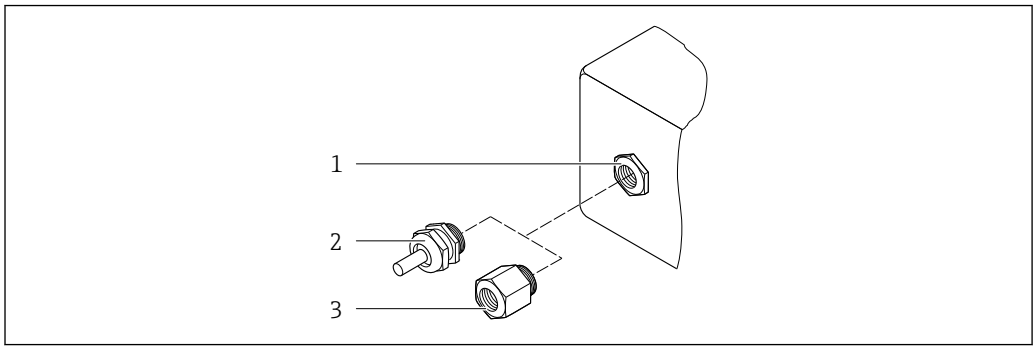
- Single path installation version: 4.5 kg (9.92 lb)
- Two path installation version: 9 kg (19.9 lb)

Materials

Remote version (wall-mount housing)

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

Cable entries/cable glands



27 *Possible cable entries/cable glands*

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

remote version

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

Sensor - transmitter cable

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

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

Ultrasonic transducer

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

Accessories

External WLAN antenna

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

Process connections

Flanges:
ASME B16.5

For information on the different materials used in the process connections → 161

16.11 Display and user interface

Languages

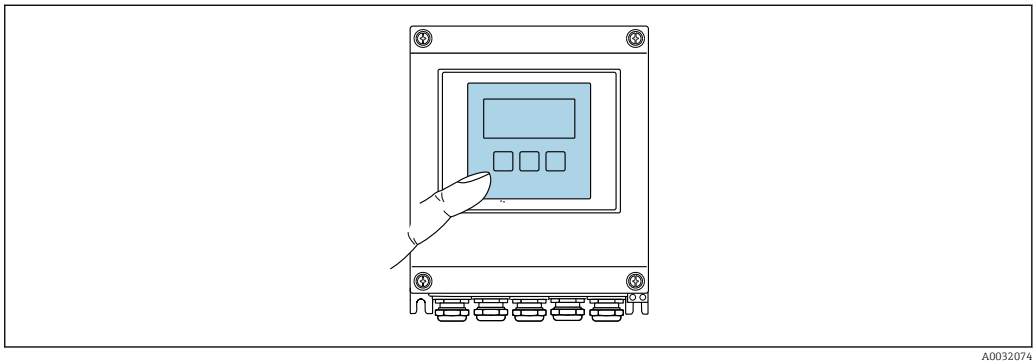
Can be operated in the following languages:
- Via local operation:
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool:
  English, German, French, Spanish,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

Onsite operation

Via display module

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

Information about WLAN interface → 63



A0032074

28 *Operation with touch control*

Display elements
- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

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

Remote operation

→ 63

Service interface

→ 63

Supported operating tools

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

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with web browser	▪ CDI-RJ45 service interface ▪ WLAN interface	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 150
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 150
Field Xpert	SMT70/77/50	▪ All Fieldbus protocols ▪ WLAN interface ▪ Bluetooth ▪ CDI-RJ45 service interface	Operating Instructions BA01202S Device description files: Use update function of handheld terminal
SmartBlue app	Smart phone or tablet with iOs or Android	WLAN	→ 🖹 150

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

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

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

Web server

With the integrated web server, the device can be operated and configured via a web browser service interface (CDI-RJ45) or WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is displayed and can be used to monitor device health. Furthermore the device data can be managed and the network parameters can be configured.

Supported functions
Data exchange between the operating unit (such as a notebook, for example,) and measuring device:
- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification report (PDF file, only available with the **Heartbeat Verification** → 🖹 167 application package)
- Flash firmware version for device firmware upgrade, for example
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package→ 🖹 167)

HistoROM data management

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

Additional information on the data storage concept

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

	HistoROM backup	T-DAT	S-DAT
Available data	▪ Event logbook, e.g. diagnostic events ▪ Device firmware package	▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Indicator (minimum/maximum values) ▪ Totalizer value	▪ Sensor data: e.g. ▪ Serial number ▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface PC board in the connection compartment	Can be plugged into the user interface PC board in the connection compartment	Fixed on the sensor connection board

Data backup

Automatically
- The most important device data (sensor and transmitter) are automatically saved in the DAT modules.
- If the transmitter or measuring device is replaced: Once the T-DAT containing the previous device data has been exchanged, the new measuring device goes into operation immediately, without any errors.
- If the sensor is replaced: Once the S-DAT has been replaced with new device data, the measuring device goes into operation immediately, without any errors.

Data transmission

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

Event list

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

Data logging

Manual
If the **Extended HistoROM** application package (order option) is enabled:
- Recording of 1 to 4 channels of up to 1 000 measured values (up to 250 measured values per channel)
- User configurable recording interval
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

16.12 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com 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 "Control Drawing" document. This is referenced on the nameplate.
Modbus RS485 certification	The measuring device meets all the requirements of the MODBUS RS485 conformity test and has the "MODBUS RS485 Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.
Radio approval	The measuring device has radio approval. For detailed information on the radio approval, see the Special Documentation → 169
External standards and guidelines	▪ EN 60529 Degrees of protection provided by enclosure (IP code) ▪ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements ▪ IEC/EN 61326-2-3 Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements). ▪ ANSI/ISA-61010-1 (82.02.01) Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements ▪ CAN/CSA-C22.2 No. 61010-1-12 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements

- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications
- 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 → 169

Diagnostic functionality	Order code for "Application package", option EA "Extended HistoROM" Comprises extended functions concerning the event log and the activation of the measured value memory. Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries. Data logging (line recorder): ▪ Memory capacity for up to 1000 measured values is activated. ▪ 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. ▪ Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server. For detailed information, see the Operating Instructions for the device.
Heartbeat Technology	Order code for "Application package", option EB "Heartbeat Verification + Monitoring"

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

Heartbeat Monitoring
Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:
- Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time.
- Schedule servicing in time.
- Monitor the process or product quality, e.g. gas pockets .

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

16.14 Accessories

Overview of accessories available to order → 148

16.15 Supplemental 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
Proline Prosonic Flow I	KA01511D

Brief operating instructions for transmitter

	Documentation code	
Measuring device	HART	Modbus RS485
Proline 400	KA01510D	KA01660D

Technical Information

Measuring device	Documentation code
Prosonic Flow I 400	TI01567D

Description of device parameters

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow I 400	GP01166D	GP01208D

Device-dependent additional documentation

Special documentation

Content	Documentation code
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
Heartbeat Technology	SD03132D

Installation instructions

Contents	Note
Installation instructions for spare part sets and accessories	▪ Access the overview of all the available spare part sets via *Device Viewer* → 🖹 146 ▪ Accessories available for order with Installation Instructions → 🖹 148

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