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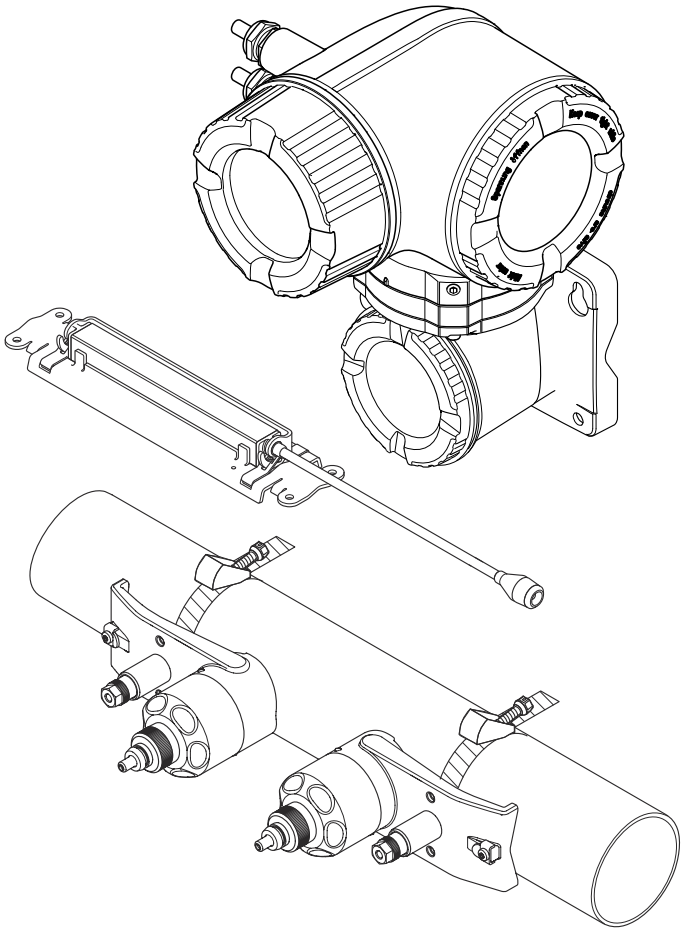
2021-05-10

Valid as of version
01.01.zz (Device firmware)

Operating Instructions
Proline Prosonic Flow P 500

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 Center will supply you with current information and updates to these instructions.

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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

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

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

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

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

1.2.2 Electrical symbols

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

1.2.3 Communication symbols

Symbol	Meaning
	Wireless Local Area Network (WLAN) Communication via a wireless, local network.
	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:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Detailed list of the individual documents along with the documentation code
→ 197

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	**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.
Sensor Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 1** The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device. ▪ Incoming acceptance and product identification ▪ Storage and transport ▪ Installation
Transmitter Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 2** The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value). ▪ Product description ▪ Installation ▪ Electrical connection ▪ Operation options ▪ System integration ▪ Commissioning ▪ Diagnostic information
Description of Device Parameters	**Reference for your parameters** The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. The document provides Modbus-specific information on each individual parameter in the Expert operating menu.

1.3.2 Supplementary device-dependent documentation

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

1.4 Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

2 Safety instructions

2.1 Requirements for the personnel

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

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

2.2 Designated use

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

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

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

To ensure that the measuring device remains in proper condition for the operation time:
- Keep within the specified pressure and temperature range.
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- If the ambient temperature of the measuring device is outside the atmospheric temperature, it is absolutely essential to comply with the relevant basic conditions as specified in the device documentation.→ 8
- Protect the measuring device permanently against corrosion from environmental influences.

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

Residual risks

WARNING

The electronics and the medium may cause the surfaces to heat up or freeze. This presents a burn hazard!
- For elevated or low fluid temperatures, ensure protection against contact.

2.3 Workplace safety

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

If mounting the sensors and tensioning bands:
- ▶ Due to the increased risk of cuts, gloves and goggles must be worn.

For welding work on the piping:
- ▶ Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:
- ▶ Due to the increased risk of electric shock, gloves must be worn.

2.4 Operational safety

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

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Repair

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

2.5 Product safety

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

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

2.6 IT security

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

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

2.7 Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-

operation safety if used correctly. An overview of the most important functions is provided in the following section.

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 🖹 12	Not enabled.	On an individual basis following risk assessment.
Access code (also applies for Web server login or FieldCare connection) → 🖹 12	Not enabled (0000).	Assign a customized access code during commissioning.
WLAN (order option in display module)	Enabled.	On an individual basis following risk assessment.
WLAN security mode	Enabled (WPA2-PSK)	Do not change.
WLAN passphrase (Password) → 🖹 13	Serial number	Assign an individual WLAN passphrase during commissioning.
WLAN mode	Access Point	On an individual basis following risk assessment.
Web server→ 🖹 13	Enabled.	On an individual basis following risk assessment.
Service interface CDI-RJ45 → 🖹 13	–	On an individual basis following risk assessment.

2.7.1 Protecting access via hardware write protection

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

Hardware write protection is disabled when the device is delivered → 🖹 137.

2.7.2 Protecting access via a password

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

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

User-specific access code

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 🖹 136).

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 (→ 81), which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter (→ 130).

Infrastructure mode

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

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.
- For information on configuring the access code or on what to do if you lose the password, for example, see the "Write protection via access code" section → 136

2.7.3 Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 73). The connection is via the service interface (CDI-RJ45) or the WLAN interface.

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

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

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

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.

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

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

3 Product description

The measuring system consists of a transmitter and two or one 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. Depending on the application and version, the sensors can be arranged for measurement via 1, 2, 3 or 4 traverses → 🖹 21.

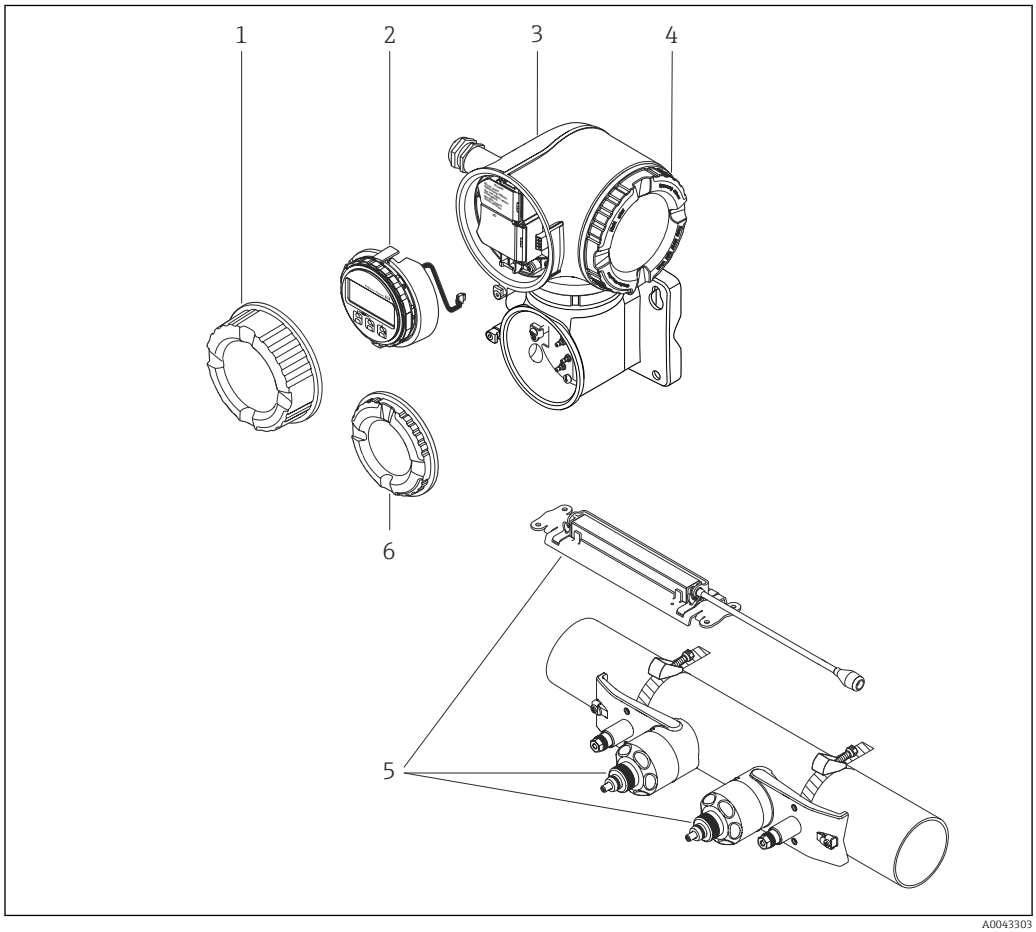
The transmitter serves to control the sensor sets, to prepare, process and evaluate the measuring signals, and to convert the signals to the desired output variable.

3.1 Product design

3.1.1 Proline 500

Signal transmission: analog
Order code for "Integrated ISEM electronics", option **B** "Transmitter"

The electronics are located in the transmitter.

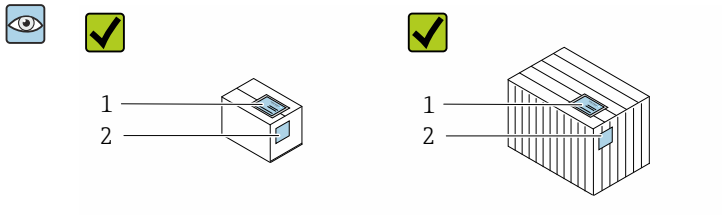


1 Important components of a measuring device

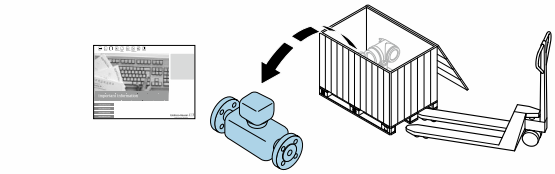
1 *Connection compartment cover*
2 *Display module*
3 *Transmitter housing with integrated ISEM electronics*
4 *Electronics compartment cover*
5 *Sensor (2 versions)*
6 *Connection compartment cover: sensor cable connection*

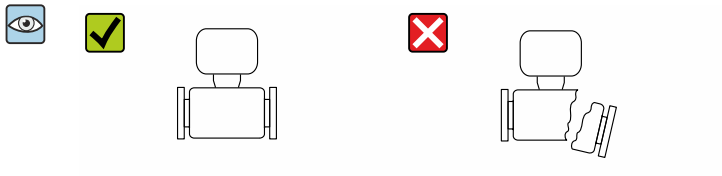
4 Incoming acceptance and product identification

4.1 Incoming acceptance

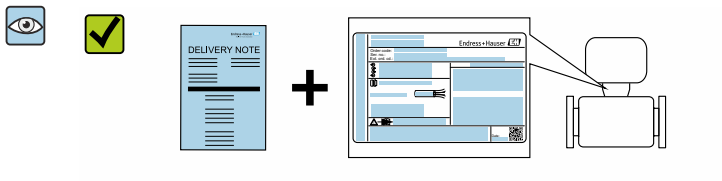


Are the order codes on the delivery note (1) and the product sticker (2) identical?





Are the goods undamaged?



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

Is the envelope present with accompanying documents?

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

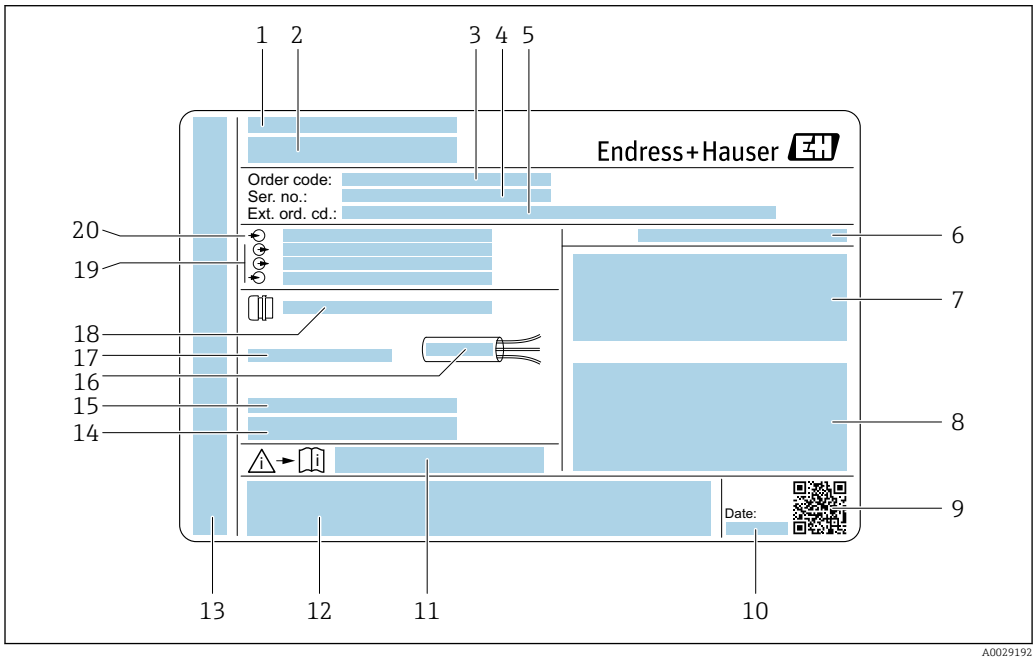
4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The "Additional standard documentation on the device"→ 8 and "Supplementary device-dependent documentation"→ 8 sections
- The *W@M Device Viewer*: enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Transmitter nameplate

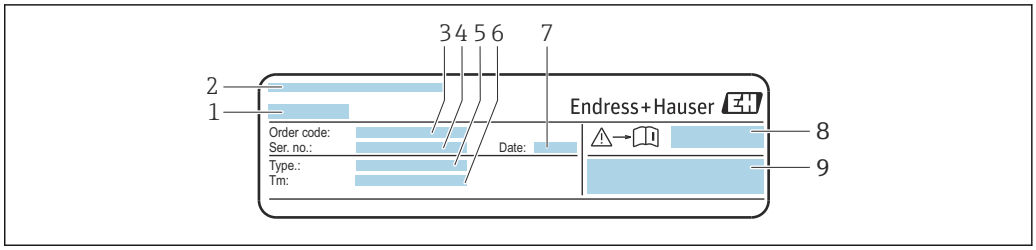
Proline 500



2 *Example of a transmitter nameplate*

1 *Manufacturing location*
2 *Name of the transmitter*
3 *Order code*
4 *Serial number (Ser. no.)*
5 *Extended order code (ext. ord. cd.)*
6 *Degree of protection*
7 *Space for approvals: use in hazardous areas*
8 *Electrical connection data: available inputs and outputs*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Document number of safety-related supplementary documentation*
12 *Space for approvals and certificates: e.g. CE mark, C-Tick*
13 *Space for degree of protection of connection and electronics compartment when used in hazardous areas*
14 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
15 *Space for additional information in the case of special products*
16 *Permitted temperature range for cable*
17 *Allowable ambient temperature (T_a)*
18 *Information on cable gland*
19 *Available inputs and outputs, supply voltage*
20 *Electrical connection data: supply voltage*

4.2.2 Sensor nameplate



3 *Example of sensor nameplate, "front"*

1 *Name of the sensor*
2 *Manufacturing location*
3 *Order code*
4 *Serial number (Ser. no.)*
5 *Type*
6 *Medium temperature range*
7 *Manufacturing date: year-month*
8 *Document number of safety-related supplementary documentation → 198*
9 *Additional information*

4 *Example of sensor nameplate, "back"*

1 *CE mark, C-Tick, approval information regarding 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 measuring device

Symbol	Meaning
⚠	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. To determine the nature of the potential hazard and the measures required to avoid it, consult the documentation accompanying the measuring device.
📖	**Reference to documentation** Refers to the corresponding device documentation.
⏚	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:
- ▶ Store in the original packaging to ensure protection from shock.
- ▶ Protect from direct sunlight to avoid unacceptably high surface temperatures.
- ▶ Store in a dry and dust-free place.
- ▶ Do not store outdoors.

Storage temperature → 🖹 189

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

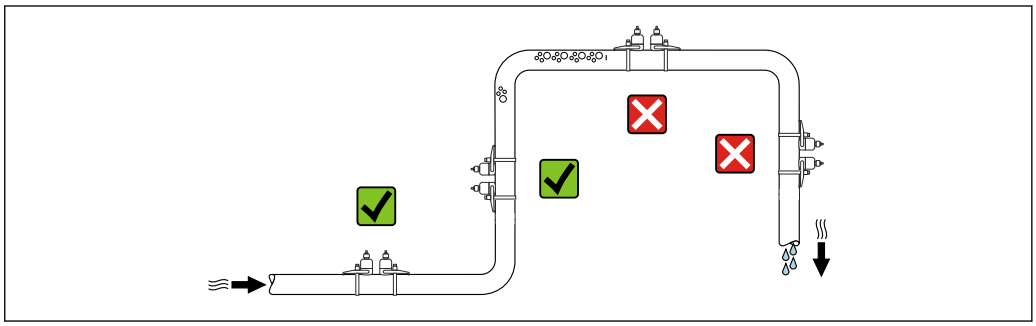
All packaging materials are environmentally friendly and 100 % recyclable:
- Outer packaging of device
  Polymer stretch wrap that complies with EU Directive 2002/95/EC (RoHS)
- Packaging
  - Wooden crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
  - Cardboard box in accordance with European packaging guideline 94/62EC, recyclability confirmed by Resy symbol
- Carrying and securing materials
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Filler material
  Paper pads

6 Installation

6.1 Installation conditions

6.1.1 Mounting position

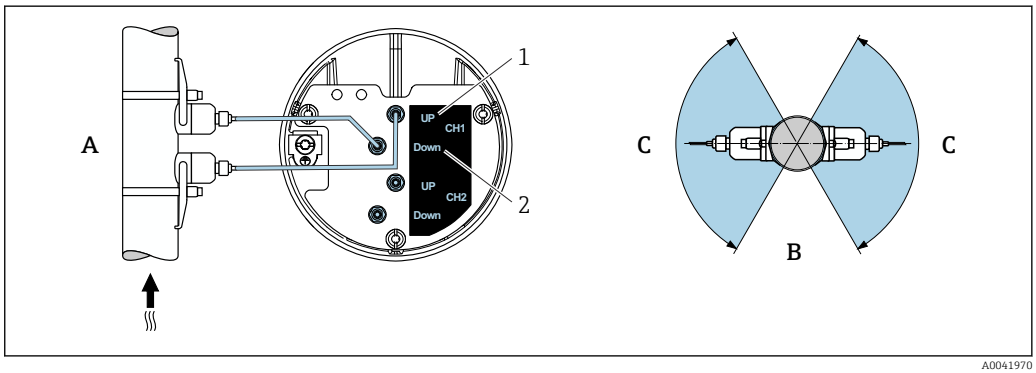
Mounting location



A0042039

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

Orientation



A0041970

5 *Orientation views*

1 Channel 1 upstream
2 Channel 1 downstream
A Recommended orientation with upward direction of flow
B Non-recommended installation range with horizontal orientation (30°)
C Recommended installation range max. 120°

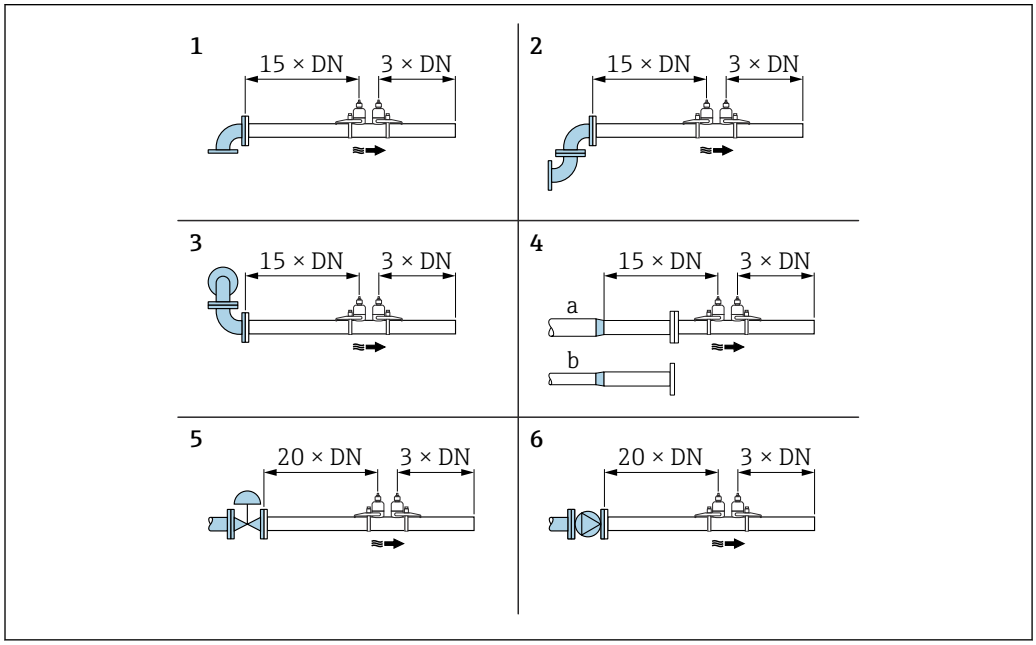
Vertical
Recommended orientation with upward direction of flow (View A). With this orientation, entrained solids will sink and gases will rise away from the sensor area when the medium is not flowing. Furthermore, the pipe can be completely drained and protected against the buildup of deposits.

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

Inlet and outlet runs

If possible, the sensor should be installed upstream from valves, T-sections, pumps etc. If this is not possible, the inlet and outlet runs indicated below must be maintained at the very minimum in order to attain the specified level of accuracy of the measuring device. If there are several flow disturbances present, the longest specified inlet run must be maintained.

Shorter inlet and outlet runs are possible with the following device versions:
Two-path measurement with 2 sensor sets [1] and FlowDC [2] (for item numbers 1 to 4b):
Up to minimum 2 × DN for inlet run, 2 × DN for outlet run



6 Minimum inlet and outlet runs with various flow obstructions

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

Measuring mode

Two-path measurement with FlowDC [2] (standard configuration)

In the case of two-path measurement with FlowDC, the flow is measured by two measurements at the measuring point.

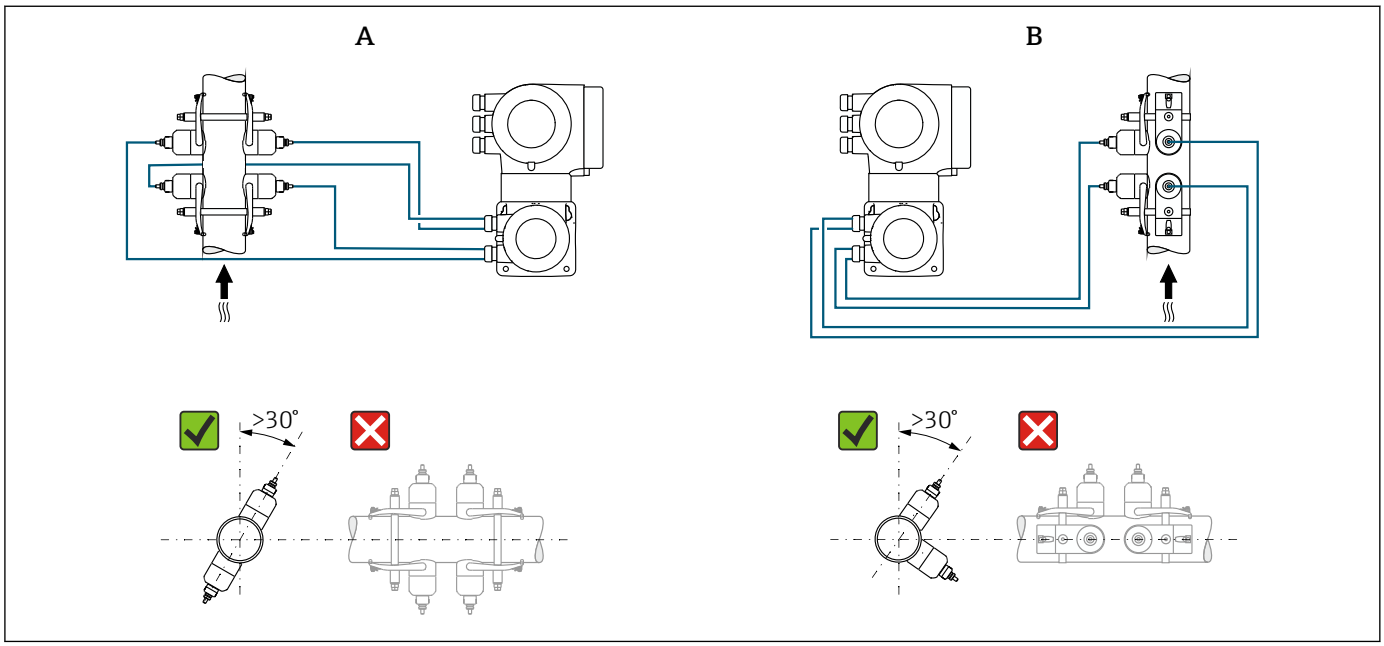
For this, the two sensor sets are installed on the measuring pipe, offset at a specific angle to one another (180° for 1 traverse, 90° for 2 traverses). This is independent of the rotation position of the two sensor sets on the measuring pipe.

The measured values of both sensor sets are averaged. Based on this average measurement value, the measured value is compensated depending on the type of disturbance and the distance from the measuring point to the disturbance point. This makes it possible to maintain the specified accuracy and repeatability for measurements in

1) Order code for "Mounting type", option A2 "Clamp-on, 2-channel, 2-sensor sets"
2) Flow disturbance compensation

non-ideal conditions (e.g. short inlet runs), with inlet runs up to only 2x DN before and after the measuring point.

The configuration of the two measuring paths is only performed once and is adopted for both measuring paths.



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

A Installation of the sensor sets for measurement via 1 traverse
B Installation of the sensor sets for measurement via 2 traverses

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 angle of +30° to the top of the measuring pipe to avoid incorrect measurements caused by empty space at the top of the pipe.

The sensors can be arranged in different ways:

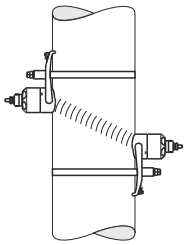
- Mounting arrangement for measurement with 1 sensor set (1 measuring path):
  - The sensors are located on opposite sides of the pipe (offset at 180°): measurement with 1 or 3 traverses
  - The sensors are located on the same side of the pipe: measurement with 2 or 4 traverses
- Mounting arrangement for measurement with 2 sensor sets (2 measuring paths):
  - 1 sensor of each sensor set is located on the opposite side of the pipe (offset at 180°): measurement with 1 or 3 traverses
  - The sensors are located on the same side of the pipe: measurement with 2 or 4 traverses

  The sensor sets are arranged on the pipe, offset by 90°.

Using 5 MHz sensors
Here, the rails of the two sensor sets are always arranged at an angle of 180° to one another and connected by cables for all measurements with 1, 2, 3 or 4 traverses. The sensor functions are assigned in the two rails via the transmitter electronics unit depending on the selected number of traverses. It is not necessary to swap the cables in the transmitter between the channels.

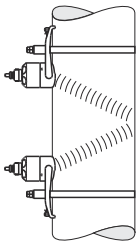
Single-path measurement (1 sensor set)

Vertical mounting



A0042013

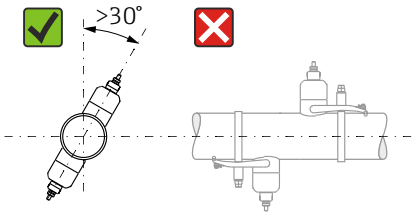
8 1 traverse



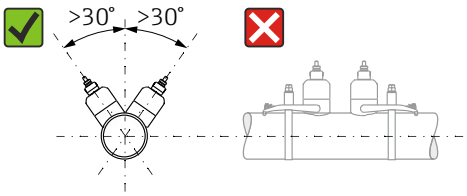
A0042014

9 2 traverses

Horizontal mounting



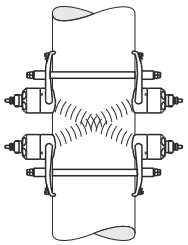
A0044304



A0044305

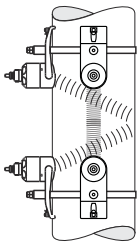
Two-path measurement (2 sensor sets)

Vertical mounting



A0042016

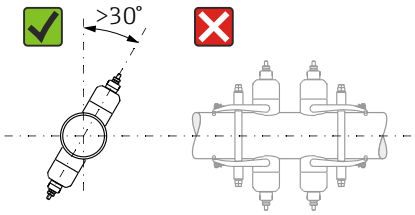
10 1 traverse



A0042017

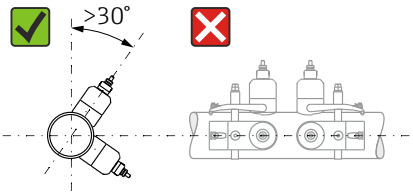
11 2 traverses

Horizontal mounting



A0043168

12 1 traverse



A0043309

13 2 traverses

Operating frequency selection

The sensors of the measuring device are available with adapted operating frequencies. These frequencies are optimized for different properties of measuring pipes (material, pipe wall thickness) and media (kinematic viscosity) for the resonance behavior of the

measuring pipes. If these properties are known, an optimum selection can be made according to the following tables [3]. If these properties are not (completely) known, the sensors can be assigned as follows:
- 5 MHz for DN 15 to 65 (½ to 2½")
- 2 MHz for DN 50 to 300 (2 to 12")
- 1 MHz for DN 100 to 4000 (4 to 160")
- 0.5 MHz for DN 150 to 4000 (6 to 160")
- 0.3 MHz for DN 1000 to 4000 (40 to 160")

Measuring pipe material	Measuring pipe nominal diameter	Recommendation
Steel, cast iron	< DN 65 (2½")	C-500-A
	≥ DN 65 (2½")	See table "Measuring pipe material: steel, cast iron" → 🖹 23
Plastic	< DN 50 (2")	C-500-A
	≥ DN 50 (2")	See table "Measuring pipe material: plastic" → 🖹 23
Glass-fiber reinforced plastic	< DN 50 (2")	C-500-A (with restrictions)
	≥ DN 50 (2")	See table "Measuring pipe material: glass-fiber reinforced plastic" → 🖹 24

Measuring pipe material: steel, cast iron

	Kinematic viscosity cSt [mm²/s]		
	0 < *v* ≤ 10	10 < *v* ≤ 100	100 < *v* ≤ 1000
Pipe wall thickness [mm (in)]	Transducer frequency (sensor version / number of traverses) [1]		
1.0 to 1.9 (0.04 to 0.07)	2 MHz (C-200 / 2)	2 MHz (C-200 / 1)	2 MHz (C-200 / 1)
1.9 to 2.2 (0.07 to 0.09)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	1 MHz (C-100 / 1)
2.2 to 2.8 (0.09 to 0.11)	2 MHz (C-200 / 2)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)
2.8 to 3.4 (0.11 to 0.13)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	1 MHz (C-100 / 1)
3.4 to 4.2 (0.13 to 0.17)	2 MHz (C-200 / 2)	2 MHz (C-200 / 1)	1 MHz (C-100 / 1)
4.2 to 5.9 (0.17 to 0.23)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 2)
5.9 to 10.0 (0.23 to 0.39)	2 MHz (C-200 / 2)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)
>10.0 (0.39)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 1)

1) The table shows a typical selection. In critical situations, the optimum sensor type may differ from these recommendations.

Measuring pipe material: plastic

	Kinematic viscosity cSt [mm²/s]		
	0 < *v* ≤ 10	10 < *v* ≤ 100	100 < *v* ≤ 1000
Nominal diameter [mm (")]	Transducer frequency (sensor version / number of traverses) [1]		
15 to 50 (½ to 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)
50 to 80 (2 to 3)	2 MHz (C-200 / 2)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)
80 to 150 (3 to 6)	1 MHz (C-100 / 2)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)
150 to 200 (6 to 8)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 2)
200 to 300 (8 to 12)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 2)
300 to 400 (12 to 16)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)

3) Recommendation: product design and sizing in Applicator → 🖹 175

Nominal diameter [mm (")]	Kinematic viscosity cSt [mm²/s]		
	0 < v ≤ 10	10 < v ≤ 100	100 < v ≤ 1000
	Transducer frequency (sensor version / number of traverses) [1]		
400 to 500 (16 to 20)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 1)	0.5 MHz (C-050 / 1)
500 to 1 000 (20 to 40)	0.5 MHz (C-050 / 1)	0.5 MHz (C-050 / 1)	–
1 000 to 4 000 (40 to 160)	0.3 MHz (C-030 / 1)	–	–

1) The table shows a typical selection. In critical situations, the optimum sensor type may differ from these recommendations.

Measuring pipe material: glass-fiber reinforced plastic

Nominal diameter [mm (")]	Kinematic viscosity cSt [mm²/s]		
	0 < v ≤ 10	10 < v ≤ 100	100 < v ≤ 1000
	Transducer frequency (sensor version / number of traverses) [1]		
15 to 50 (½ to 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)
50 to 80 (2 to 3)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)
80 to 150 (3 to 6)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 1)	0.5 MHz (C-050 / 1)
150 to 200 (6 to 8)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)	–
200 to 300 (8 to 12)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)	–
300 to 400 (12 to 16)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)	–
400 to 500 (16 to 20)	0.5 MHz (C-050 / 1)	–	–
500 to 1 000 (20 to 40)	0.5 MHz (C-050 / 1)	–	–
1 000 to 4 000 (40 to 160)	0.3 MHz (C-030 / 1)	–	–

1) The table shows a typical selection. In critical situations, the optimum sensor type may differ from these recommendations.

- If clamp-on sensors are used, a 2 traverse-type installation is recommended. This is the easiest and most convenient type of installation, particularly for measuring devices whose pipe can only be accessed from one side.
- A 1 traverse installation is recommended for the following installation conditions:
  - Certain plastic pipes with a wall thickness >4 mm (0.16 in)
  - Pipes made of composite materials (e.g. glass-fiber reinforced plastic)
  - Lined pipes
  - Applications with media with high acoustic damping

6.1.3 Environment and process requirements

Ambient temperature range

Transmitter	▪ Standard: –40 to +60 °C (–40 to +140 °F) ▪ Optional order code for "Test, certificate", option JN: –50 to +60 °C (–58 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	DN 15 to 65 (½ to 2½") −40 to +150 °C (−40 to +302 °F) DN 50 to 4000 (2 to 160") ▪ Standard:−40 to +80 °C (−40 to +176 °F) ▪ Optional: 0 to +170 °C (+32 to +338 °F)
Sensor cable (connection between transmitter and sensor)	DN 15 to 65 (½ to 2½") Standard (TPE [1]): −40 to +80 °C (−40 to +176 °F) DN 50 to 4000 (2 to 160") ▪ Standard (TPE halogen-free): −40 to +80 °C (−40 to +176 °F) ▪ Optional (PTFE [1]): −50 to +170 °C (−58 to +338 °F)

1) Armored version also available for order

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.

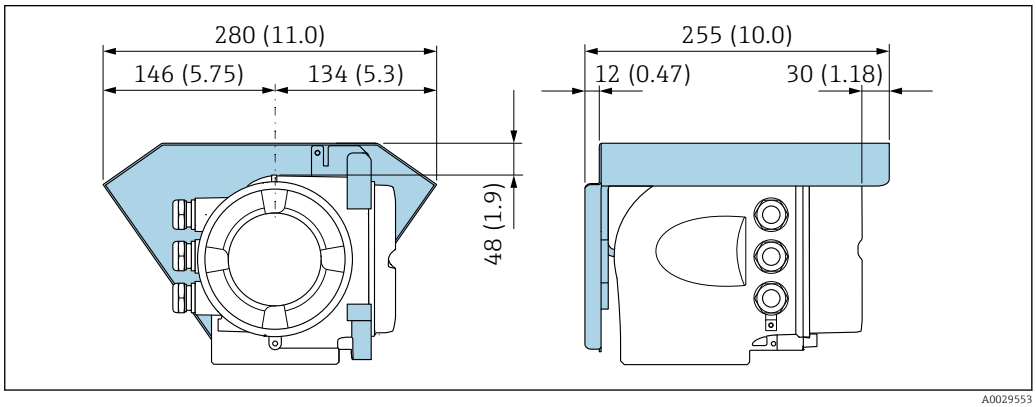
▶ If operating outdoors:
Avoid direct sunlight, particularly in warm climatic regions.

Medium pressure range

No pressure limitation. Nevertheless, for correct measurement, the static pressure of the medium must be higher than the vapor pressure.

6.1.4 Special mounting instructions

Protective cover



14 *Protective cover for Proline 500; engineering unit mm (in)*

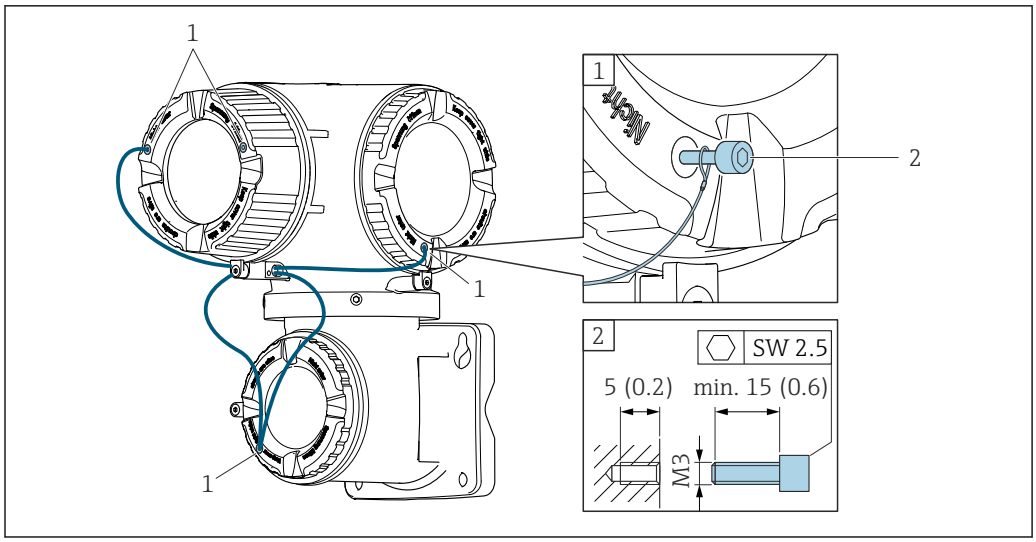
Cover locking: Proline 500

NOTICE

Order code for "Transmitter housing", option L "Cast, stainless": The covers of the transmitter housing are provided with a borehole to lock the cover.

The cover can be locked using screws and a chain or cable provided by the customer.

▶ It is recommended to use stainless steel cables or chains.
▶ If a protective coating is applied, it is recommended to use a heat shrink tube to protect the housing paint.



1 Cover borehole for the securing screw
2 Securing screw to lock the cover

6.2 Mounting the measuring device

6.2.1 Required tools

For transmitter

For mounting on a post:
Proline 500 transmitter
Open-ended wrench AF 13

For wall mounting:
Drill with drill bit Ø 6.0 mm

For sensor

For installation on the measuring pipe: use a suitable mounting tool

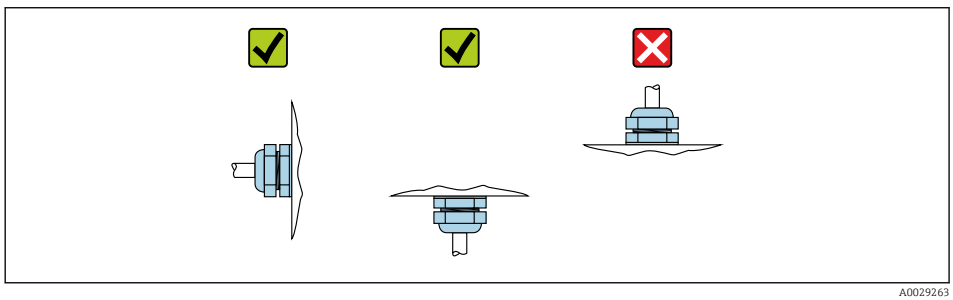
6.2.2 Preparing the measuring device

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

6.2.3 Mounting the measuring device

▶ Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.

↳



6.2.4 Mounting the sensor

⚠ WARNING

Risk of injury when mounting the sensors and strapping bands!

▶ Due to the increased risk of cuts, wear suitable gloves and protective goggles.

Sensor configuration and settings

DN 15 to 65 (½ to 2½")	DN 50 to 4000 (2 to 160")			
Strapping band	Strapping band		Welded bolt	
2 traverses [mm (in)]	1 traverse [mm (in)]	2 traverses [mm (in)]	1 traverse [mm (in)]	2 traverses [mm (in)]
Sensor distance [1]	Sensor distance [1]	Sensor distance [1]	Sensor distance [1]	Sensor distance [1]
–	Wire length → 📄 35	Measuring rail [1] [2]	Wire length	Measuring rail [1] [2]

1) Depends on the conditions at the measuring point (measuring pipe, medium etc.). The dimension can be determined via FieldCare or Applicator. See also the **Result sensor distance / measuring aid** parameter in the **Measuring point** submenu

2) Only up to DN 600 (24")

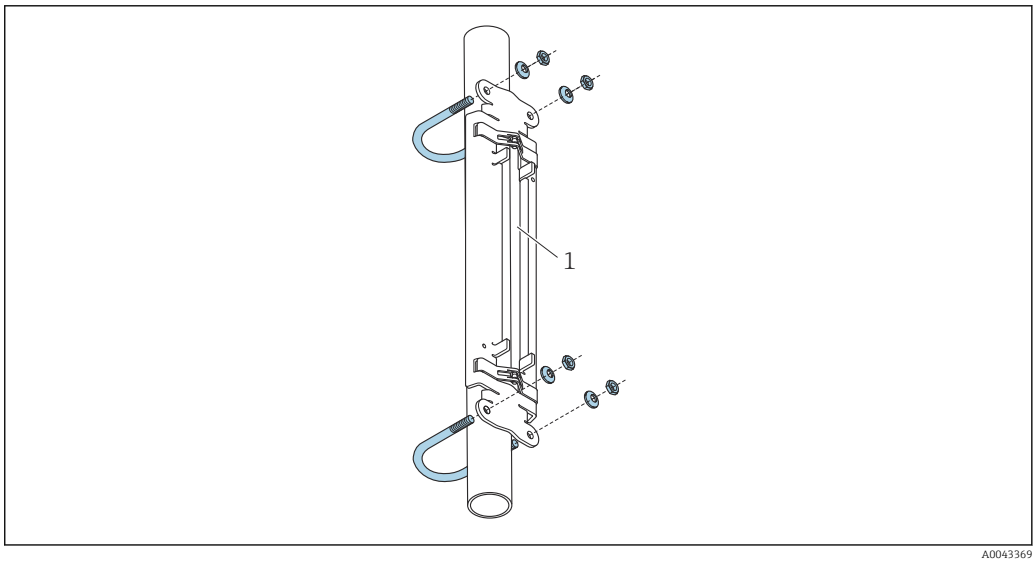
Mounting types

Sensor holder with U-shaped screws

Can be used for
- Measuring devices with measuring range DN 15 to 65 (½ to 2½")
- Mounting on pipes DN 15 to 32 (½ to 1¼")

Procedure:

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the measuring pipe.
3. Fit the U-shaped screws through the sensor holder and lightly grease the thread.
4. Screw the nuts onto the U-shaped screws.
5. Position the sensor holder correctly and tighten the nuts uniformly.



15 Holder with U-shaped screws

1 Sensor holder

⚠ CAUTION

Risk of damaging plastic or glass pipes if the nuts on the U-shaped screws are tightened too much!

► The use of a metal half-shell (on the opposite side of the sensor) is recommended for plastic or glass pipes.

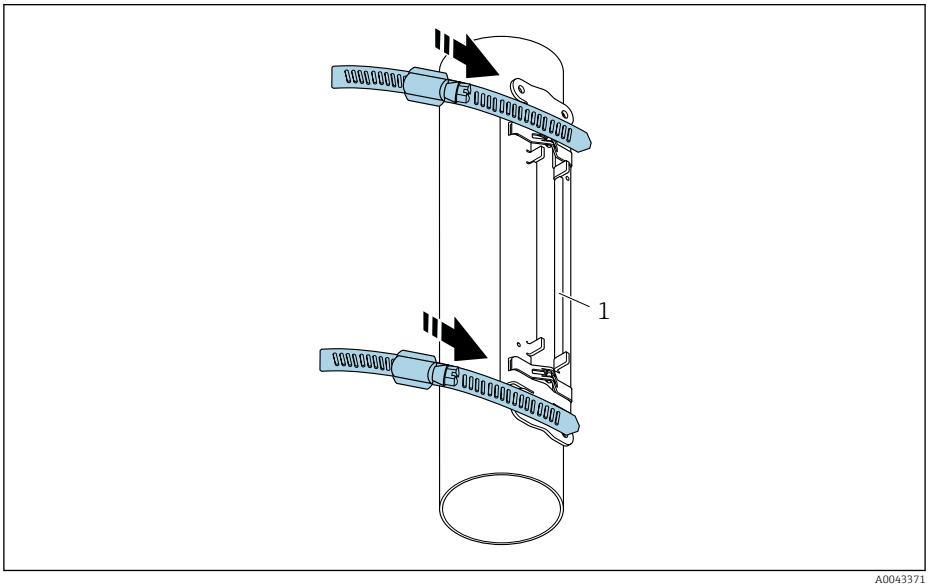
The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.

Sensor holder with strapping bands (small nominal diameters)

Can be used for
- Measuring devices with measuring range DN 15 to 65 (½ to 2½")
- Mounting on pipes DN > 32 (1¼")

Procedure:

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the measuring pipe.
3. Wrap the strapping bands around the sensor holder and measuring pipe without twisting them.

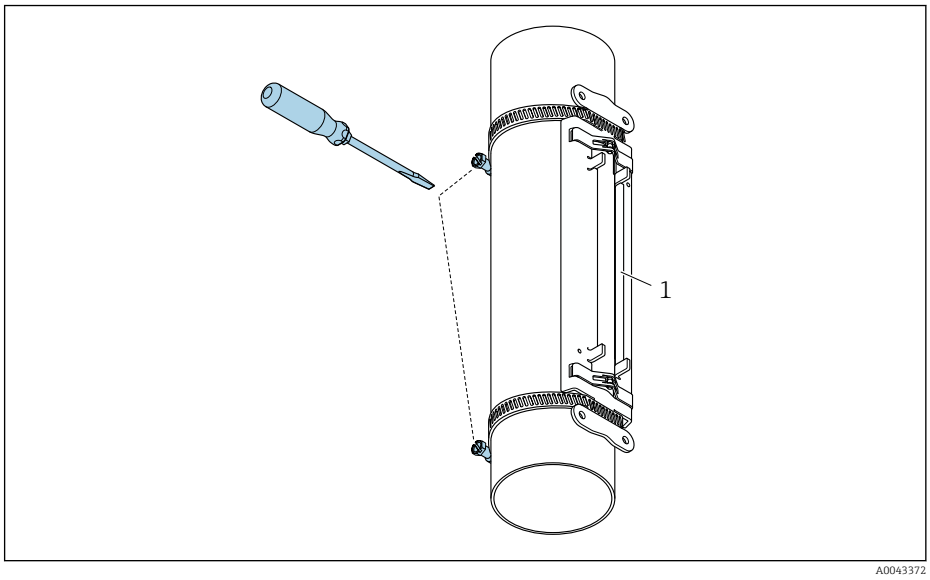


16 *Positioning the sensor holder and mounting the strapping bands*

1 Sensor holder

4. Guide the strapping bands through the strapping band locks.
5. Tighten the strapping bands as tightly as possible by hand.
6. Set the sensor holder to the desired position.

7. Push down the tensioning screw and tighten the strapping bands so they cannot slip.



17 *Tightening the tensioning screws of the strapping bands*

1 Sensor holder

8. If necessary, shorten the strapping bands and trim the cut edges.

WARNING

Risk of injury!

- To avoid sharp edges, trim the cut edges after shortening the strapping bands. Wear suitable gloves and protective goggles.

The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.

Sensor holder with strapping bands (medium nominal diameters)

Can be used for
- Measuring devices with measuring range DN 50 to 4000 (2 to 160")
- Mounting on pipes DN ≤ 600 (24")

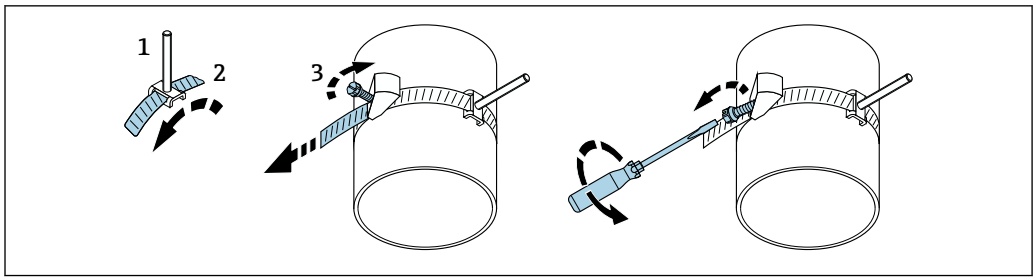
Procedure:

1. Fit the mounting bolt over strapping band 1.
2. Position strapping band 1 as perpendicular as possible to the measuring pipe axis without twisting it.
3. Guide the end of strapping band 1 through the strapping band lock.
4. Tighten strapping band 1 as tightly as possible by hand.
5. Set strapping band 1 to the desired position.
6. Push down the tensioning screw and tighten strapping band 1 so it cannot slip.
7. Strapping band 2: proceed as for strapping band 1 (steps 1 to 6).
8. Only slightly tighten strapping band 2 for final mounting. It must be possible to move strapping band 2 for final alignment.
9. If necessary, shorten both strapping bands and trim the cut edges.

WARNING

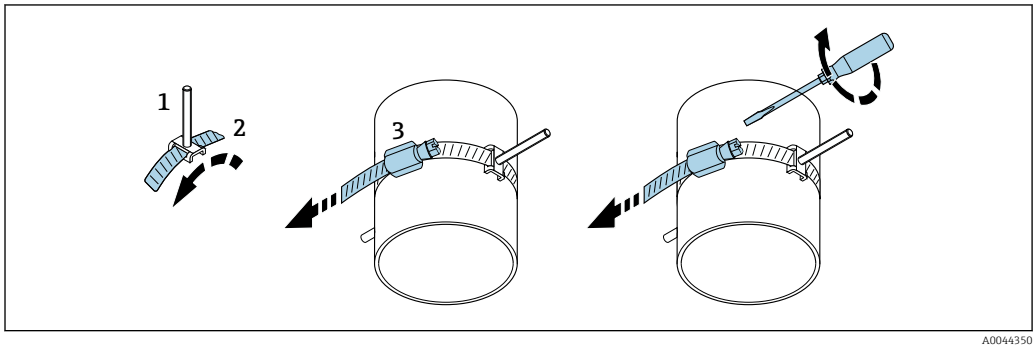
Risk of injury!

- To avoid sharp edges, trim the cut edges after shortening the strapping bands. Wear suitable gloves and protective goggles.



18 *Holder with strapping bands (medium nominal diameters), with hinged screw*

1 *Mounting bolts*
2 *Strapping band*
3 *Tensioning screw*

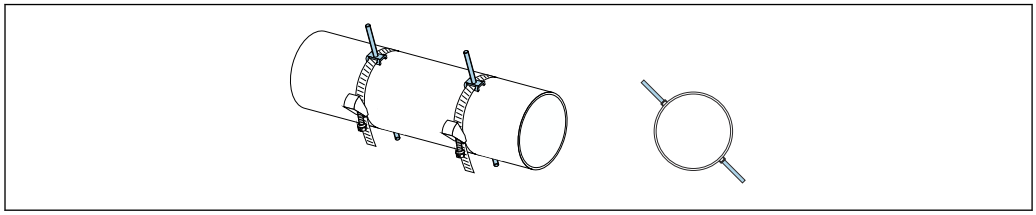


19 *Holder with strapping bands (medium nominal diameters), without hinged screw*

1 *Mounting bolts*
2 *Strapping band*
3 *Tensioning screw*

Sensor holder with strapping bands (large nominal diameters)

Can be used for
- Measuring devices with measuring range DN 50 to 4000 (2 to 160")
- Mounting on pipes DN > 600 (24")
- 1-traverse mounting or 2-traverse mounting with 180° arrangement
- 2-traverse mounting with two-path measurement and 90° arrangement (instead of 180°)



Procedure:

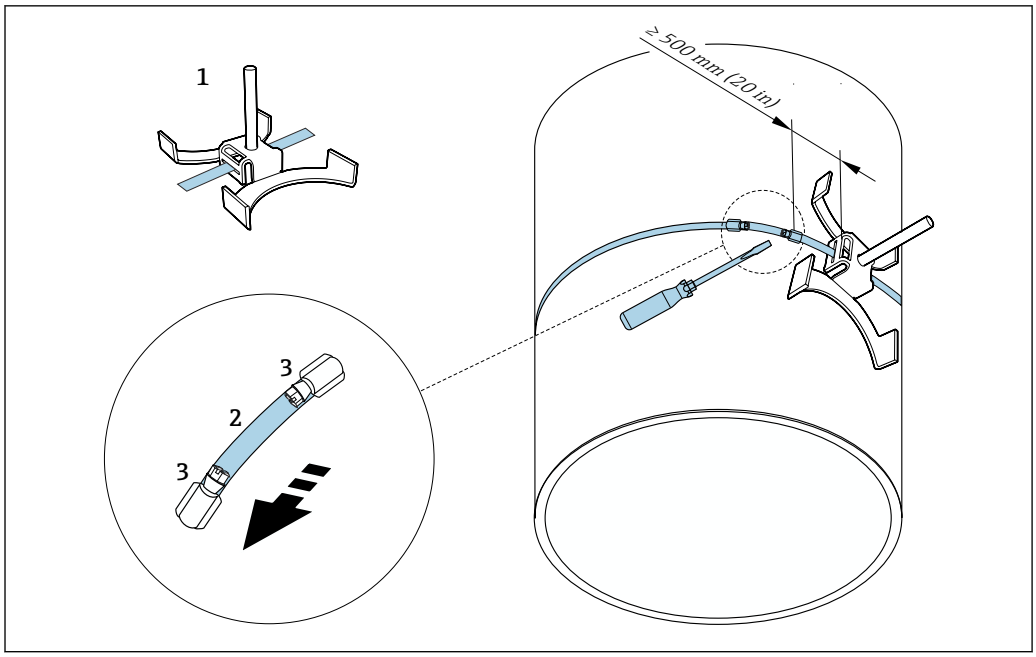
1. Measure the pipe circumference. Note down the full/half or quarter circumference.
2. Shorten the strapping bands to the required length (= pipe circumference) and trim the cut edges.
3. Select the mounting location of the sensors with the given sensor distance and optimum inlet run conditions, while ensuring there is nothing impeding sensor mounting over the entire circumference of the measuring pipe.

4. Fit two strap bolts over strapping band 1 and guide approx. 50 mm (2 in) of one of the strapping band ends through one of the two strapping band locks and into the buckle. Then guide the protective flap over this strapping band end and lock in place.
5. Position strapping band 1 as perpendicular as possible to the measuring pipe axis without twisting it.
6. Guide the second strapping band end through the strapping band lock that is still free and proceed in the same way as for the first strapping band end. Guide the protective flap over the second strapping band end and lock in place.
7. Tighten strapping band 1 as tightly as possible by hand.
8. Set strapping band 1 to the desired position, ensuring that it is as perpendicular as possible to the measuring pipe axis.
9. Position the two strap bolts on strapping band 1, arranging them at a half circumference in relation to one another (180° arrangement, e.g. 10 o'clock and 4 o'clock) or quarter circumference (90° arrangement, e.g. 10 o'clock and 7 o'clock).
10. Tighten strapping band 1 so that it cannot slip.
11. Strapping band 2: proceed as for strapping band 1 (steps 4 to 8).
12. Only slightly tighten strapping band 2 for final mounting so that it can still be adjusted. The distance/offset from the center of strapping band 2 to the center of strapping band 1 is indicated by the sensor distance of the device.
13. Align strapping band 2 so that it is perpendicular to the measuring pipe axis and parallel to strapping band 1.
14. Position the two strap bolts on tensioning strap 2 on the measuring pipe so they are parallel to one another and offset at the same height/clock position (e.g. 10 and 4 o'clock) in relation to the two strap bolts on tensioning strap 1. A line drawn on the measuring pipe wall that is parallel to the measuring pipe axis can be helpful here. Now set the distance between the center of the strap bolts at the same level so that it exactly matches the sensor distance. An alternative method is to use the wire length → 35.
15. Tighten strapping band 2 so that it cannot slip.

⚠ WARNING

Risk of injury!

- To avoid sharp edges, trim the cut edges after shortening the strapping bands. Wear suitable gloves and protective goggles.



20 Holder with strapping bands (large nominal diameters)

*1 Strap bolt with guide**
*2 Strapping band**
3 Tensioning screw

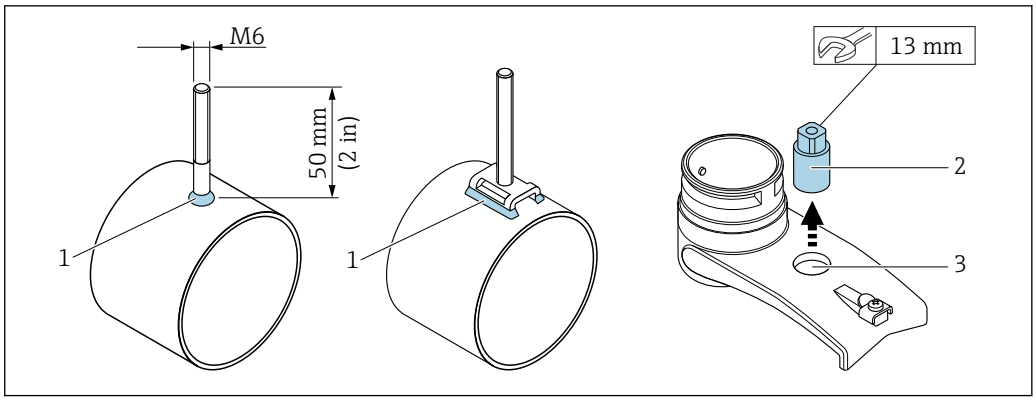
*The distance between the strap bolt and strapping band lock must be at least 500 mm (20 in).

- For 1-traverse mounting with 180° (opposite) → 22 (single-path measurement, A0044304), → 12, 22(two-path measurement, A0043168)
- For 2-traverse mounting → 22 (single-path measurement, A0044305), → 13, 22(two-path measurement, A0043309)
- Electrical connection → 7, 21

Sensor holder with welded bolts

Can be used for
- Measuring devices with measuring range DN 50 to 4000 (2 to 160")
- Mounting on pipes DN 50 to 4000 (2 to 160")

Procedure:
- The welded bolts must be fixed at the same installation distances as the mounting bolts with strapping bands. The following sections explain how to align the mounting bolts, depending on the mounting method and measurement method:
  - Installation for measurement via 1 traverse → 35
  - Installation for measurement via 2 traverses → 37
- The sensor holder is secured as standard with a locking nut with a metric M6 ISO thread. If another thread should be used for fastening purposes, a sensor holder with a detachable locking nut must be used.



21 *Holder with welded bolts*

1 Welding seam
2 Locking nut
3 Hole diameter max. 8.7 mm (0.34 in)

Sensor installation – small nominal diameters DN 15 to 65 (½ to 2½")

Requirements

- The installation distance is known → 27
- The sensor holder is pre-assembled

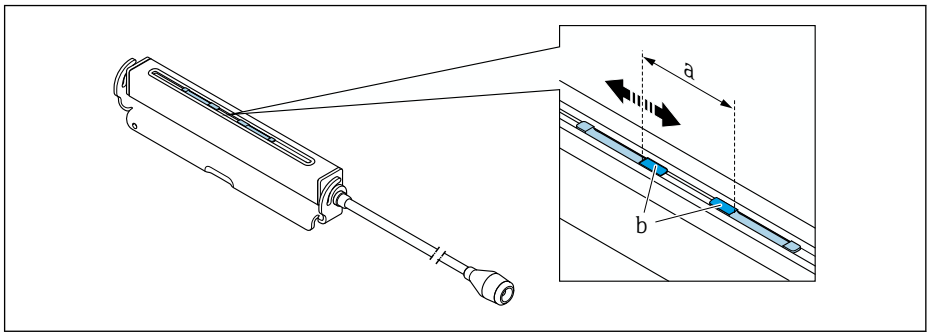
Material

The following material is required for mounting:

- Sensor incl. adapter cable
- Sensor cable for connecting to the transmitter
- Coupling medium (coupling pad or coupling gel) for an acoustic connection between the sensor and pipe

Procedure:

1. Set the distance between the sensors to the value determined for the sensor distance. Press the movable sensor down slightly to move it.

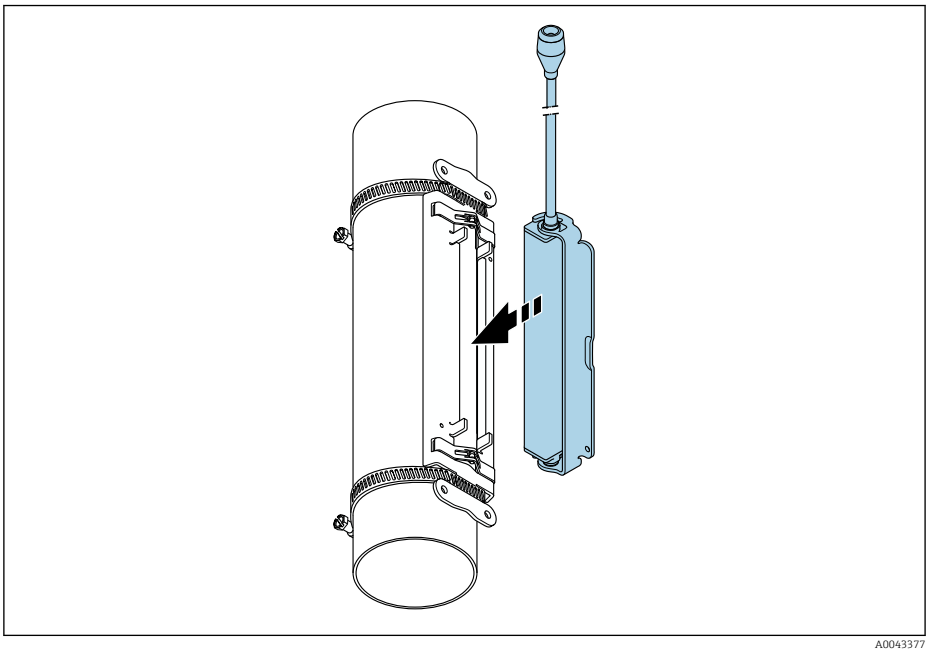


22 *Distance between sensors as per the installation distance → 27*

a Sensor distance (back of sensor must touch the surface)
b Sensor contact surfaces

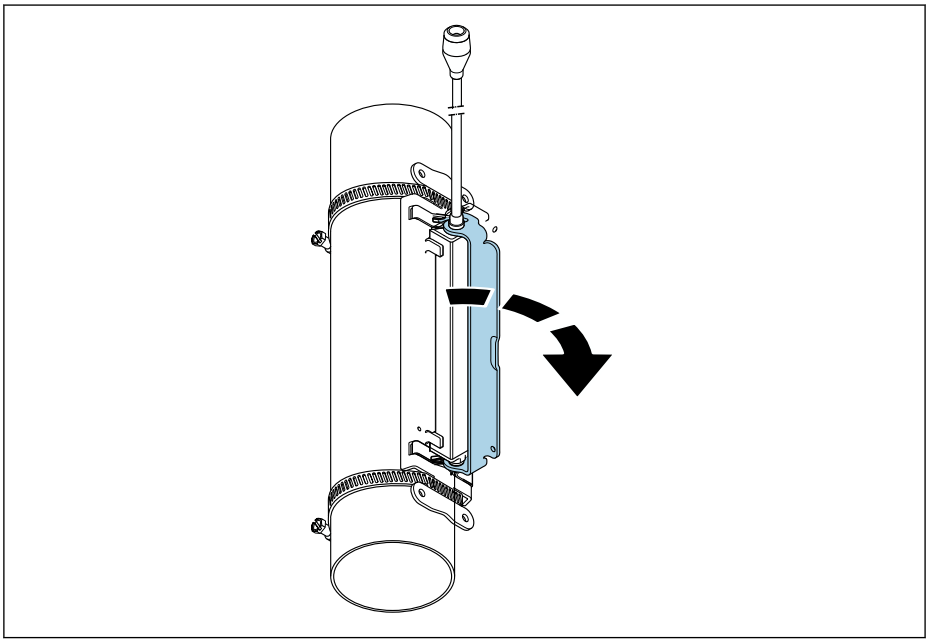
2. Stick the coupling pad under the sensor to the measuring pipe or coat the contact surfaces of the sensor (b) with an even layer of coupling gel (approx. 0.5 to 1 mm (0.02 to 0.04 in)).

3. Fit the sensor housing on the sensor holder.



23 *Fitting the sensor housing*

4. Lock the bracket in place to fix the sensor housing on the sensor holder.



24 *Fixing the sensor housing*

5. Connect the sensor cable to the adapter cable.

↳ This completes the mounting procedure. The sensors can now be connected to the transmitter via the connecting cables.

- The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.
- If necessary, the holder and sensor housing can be secured with a screw/nut or a lead seal (not supplied).
- The bracket can only be released using an auxiliary tool (e.g. screwdriver).

Sensor installation – medium/large nominal diameters DN 50 to 4000 (2 to 160")

Installation for measurement via 1 traverse

Requirements

- The installation distance and wire length are known → 27
- Strapping bands are pre-assembled

Material

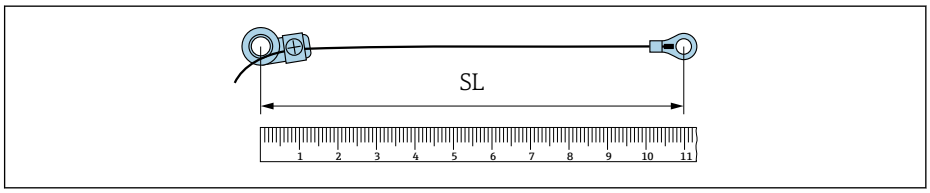
The following material is required for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already pre-assembled → 29, → 30)
- Two measuring wires, each with a cable lug and a fixer to fix the strapping bands
- Two sensor holders
- Coupling medium (coupling pad or coupling gel) for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables

Installation is unproblematic up to DN 400 (16"), as of DN 400 (16") check the distance and angle (180°) diagonally with the wire length.

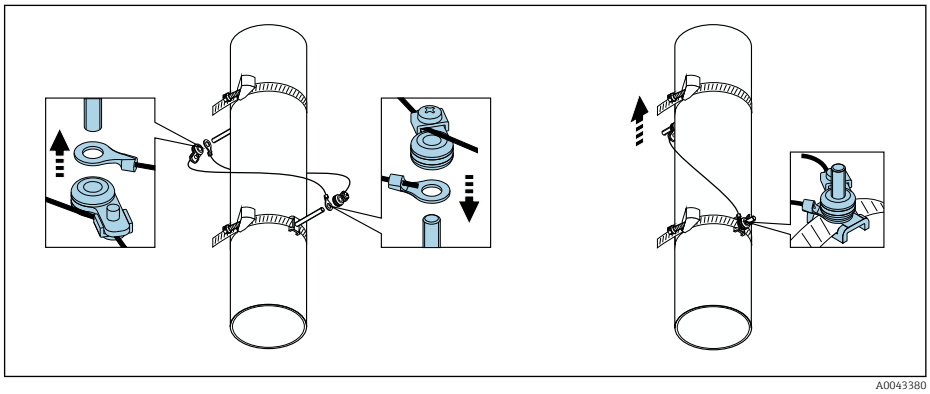
Procedure:

1. Prepare the two measuring wires: arrange the cable lugs and fixer such that the distance they are apart corresponds to the wire length (SL). Screw the fixer onto the measuring wire.



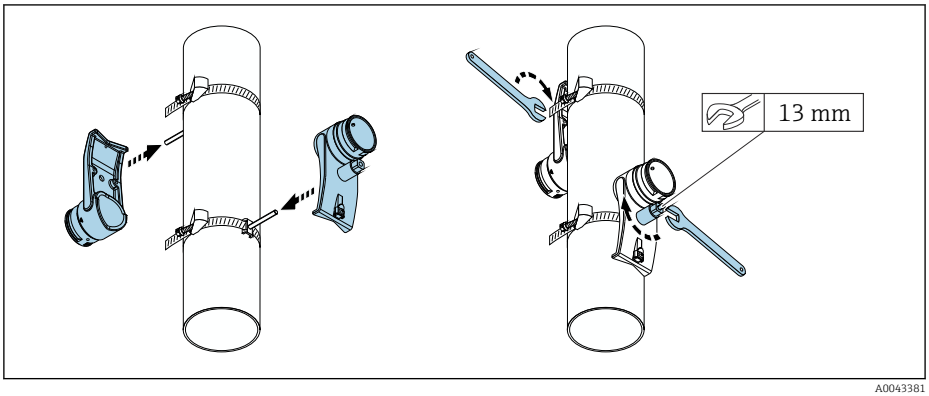
25 *Fixer and cable lugs at a distance that corresponds to the wire length (SL)*

2. With measuring wire 1: fit the fixer over the mounting bolt of strapping band 1 that is already securely mounted. Run measuring wire 1 clockwise around the measuring pipe. Fit the cable lug over the mounting bolt of strapping band 2 that can still be moved.
3. With measuring wire 2: fit the cable lug over the mounting bolt of strapping band 1 that is already securely mounted. Run measuring wire 2 counterclockwise around the measuring pipe. Fit the fixer over the mounting bolt of strapping band 2 that can still be moved.
4. Take the still movable strapping band 2, incl. the mounting bolt, and move it until both measuring wires are evenly tensioned and then tighten strapping band 2 so that it cannot slip. Then check the sensor distance from the center of the strapping bands. If the distance is too small, release strapping band 2 again and position it better. Both strapping bands should be as perpendicular as possible to the measuring pipe axis and parallel to one another.



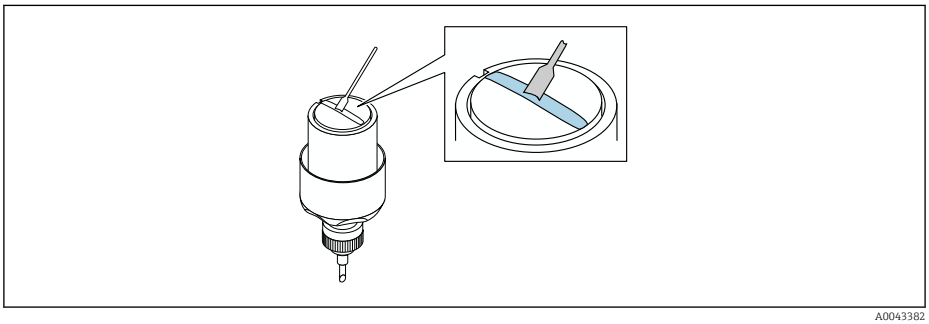
26 *Positioning the strapping bands (steps 2 to 4)*

5. Loosen the screws of the fixers on the measuring wires and remove the measuring wires from the mounting bolt.
6. Fit the sensor holders over the individual mounting bolts and tighten securely with the locking nut.



27 *Mounting the sensor holders*

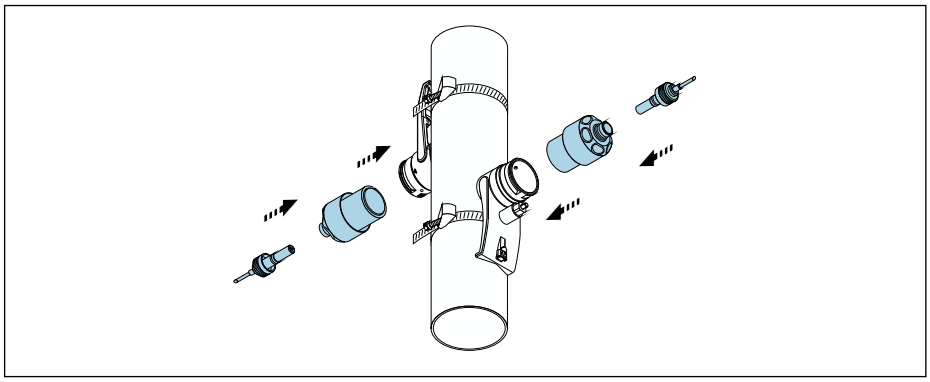
7. Attach the coupling pad with the adhesive side facing down on the sensors (→ 198). Alternatively coat the contact surfaces with an even layer of coupling gel (approx. 1 mm (0.04 in)), going from the groove through the center to the opposite edge.



28 *Coating the contact surfaces of the sensor with coupling gel (if there is no coupling pad)*

8. Insert the sensor into the sensor holder.
9. Fit the sensor cover on the sensor holder and turn until the sensor cover engages with a click and the arrows (▲ / ▼ "close") are pointing towards one another.

10. Insert the sensor cable into the sensor until the end stop.



29 *Mounting the sensor and connecting the sensor cable*

The sensors can now be connected to the transmitter via the sensor cables and the error message can be checked in the sensor check function. This completes the mounting procedure.

- The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.
- If the sensor is removed from the measuring pipe, it must be cleaned and new coupling gel applied (if there is no coupling pad).
- On rough measuring pipe surfaces, the gaps in the rough surface must be filled with sufficient amounts of coupling gel if the use of the coupling pad does not suffice (installation quality check).

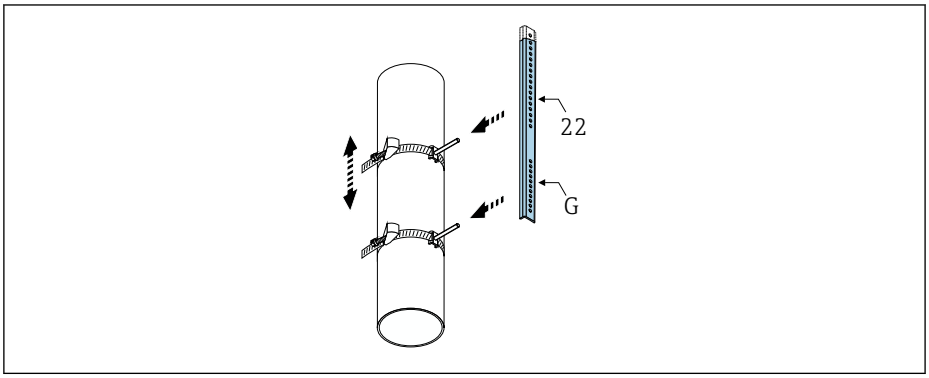
Installation for measurement via 2 traverses

Requirements
- The installation distance is known → 27
- Strapping bands are pre-assembled

Material
The following material is required for mounting:
- Two strapping bands incl. mounting bolts and centering plates where necessary (already pre-assembled → 29, → 30)
- A mounting rail to position the strapping bands:
  - Short rail up to DN 200 (8")
  - Long rail up to DN 600 (24")
  - No rail > DN 600 (24"), as distance measured by sensor distance between the mounting bolts
- Two mounting rail holders
- Two sensor holders
- Coupling medium (coupling pad or coupling gel) for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables
- Open-ended wrench (13 mm)
- Screwdriver

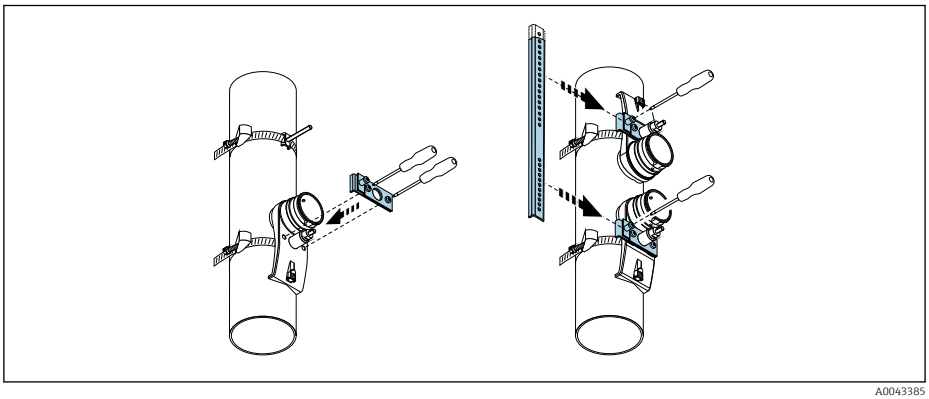
Procedure:

1. Position the strapping bands using the mounting rail [only DN50 to 600 (2 to 24"), for larger nominal diameters, measure the distance between the center of the strap bolts directly]: Fit the mounting rail with the bore identified by the letter (from the **Result sensor distance / measuring aid** parameter) over the mounting bolt of strapping band 1 that is fixed in place. Position the adjustable strapping band 2 and fit the mounting rail with the bore identified by the numerical value over the mounting bolt.



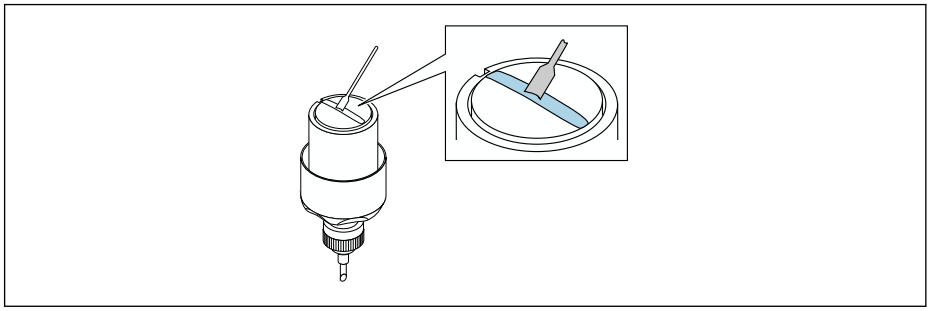
30 *Determining the distance according to the mounting rail (e.g. G22)*

2. Tighten strapping band 2 so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the locking nut.
5. Screw the mounting rail holders onto the sensor holder.
6. Screw the mounting rail onto the sensor holders.



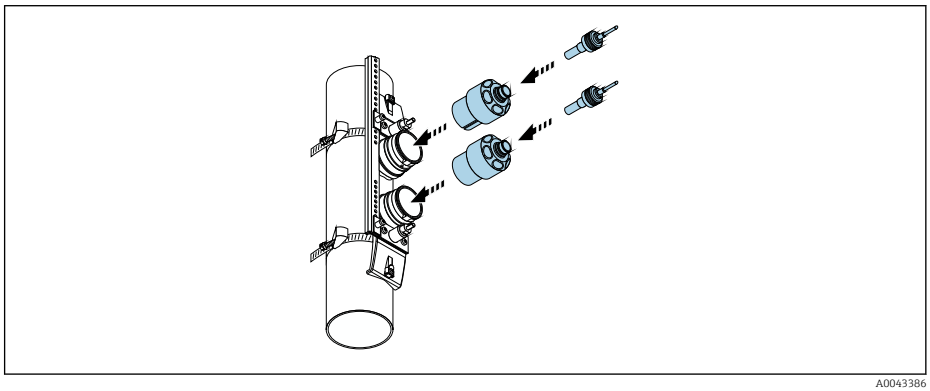
31 *Mounting the sensor holders and mounting rail*

7. Attach the coupling pad with the adhesive side facing down on the sensors (→ 198). Alternatively coat the contact surfaces with an even layer of coupling gel (approx. 1 mm (0.04 in)), going from the groove through the center to the opposite edge.



32 *Coating the contact surfaces of the sensor with coupling gel (if there is no coupling pad)*

8. Insert the sensor into the sensor holder.
9. Fit the sensor cover on the sensor holder and turn until the sensor cover engages with a click and the arrows (▲ / ▼ "close") are pointing towards one another.
10. Insert the sensor cable into the sensor until the end stop.



33 *Mounting the sensor and connecting the sensor cable*

The sensors can now be connected to the transmitter via the sensor cables and the error message can be checked in the sensor check function. This completes the mounting procedure.

- The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.
- If the sensor is removed from the measuring pipe, it must be cleaned and new coupling gel applied (if there is no coupling pad).
- On rough measuring pipe surfaces, the gaps in the rough surface must be filled with sufficient amounts of coupling gel if the use of the coupling pad does not suffice (installation quality check).

6.2.5 Mounting the transmitter housing: Proline 500

⚠ CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature → 24.
- ▶ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

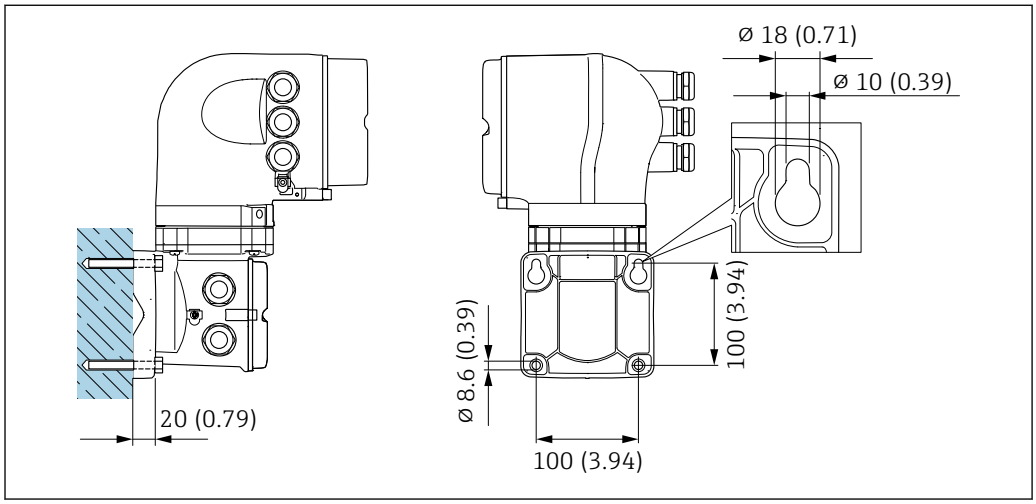
⚠ CAUTION

Excessive force can damage the housing!

- ▶ Avoid excessive mechanical stress.

The transmitter can be mounted in the following ways:
- Post mounting
- Wall mounting

Wall mounting



34 *Engineering unit mm (in)*

1. Drill the holes.
2. Insert wall plugs into the drilled holes.
3. Screw in the securing screws slightly at first.
4. Fit the transmitter housing over the securing screws and mount in place.
5. Tighten the securing screws.

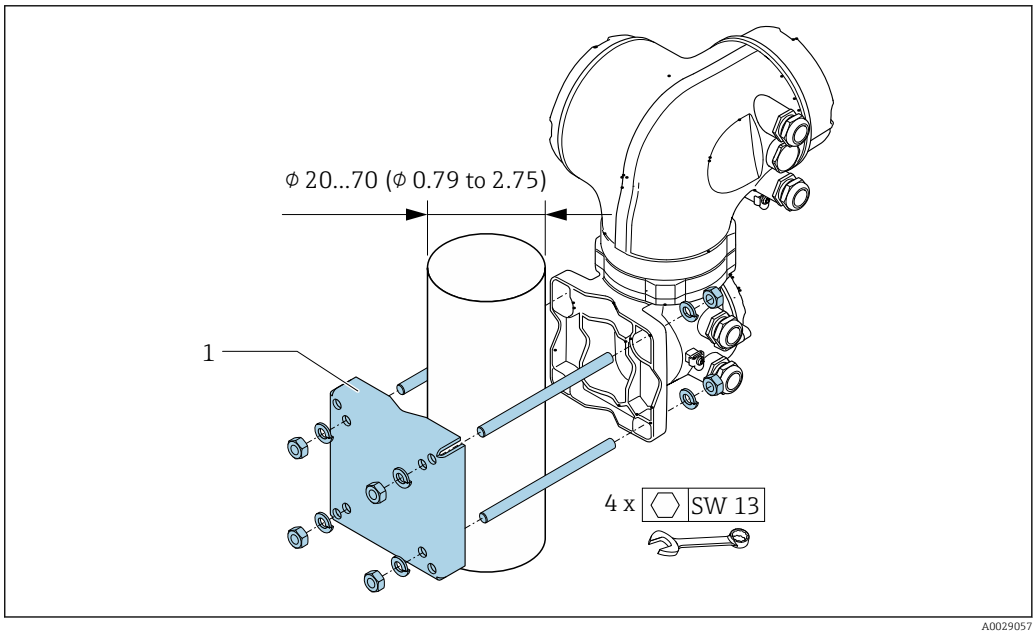
Post mounting

WARNING

Order code for "Transmitter housing", option L "Cast, stainless": cast transmitters are very heavy.

They are unstable if they are not mounted on a secure, fixed post.

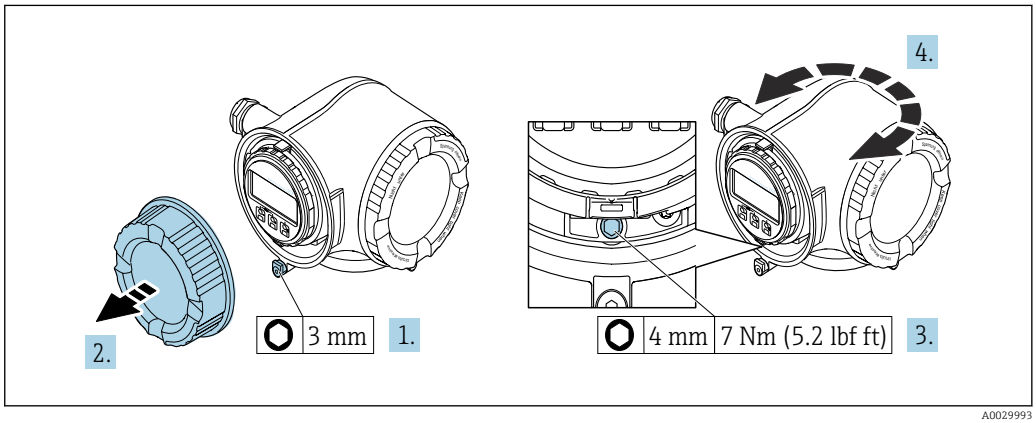
- Only mount the transmitter on a secure, fixed post on a stable surface.



35 *Engineering unit mm (in)*

6.2.6 Turning the transmitter housing: Proline 500

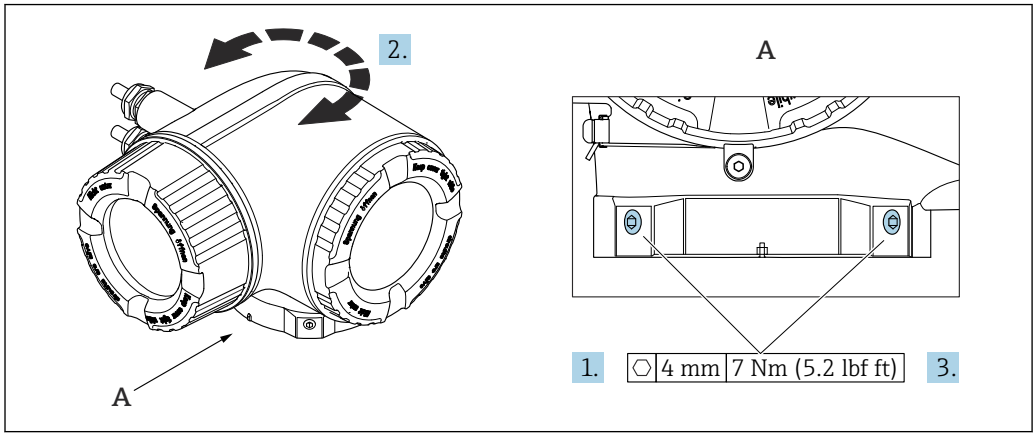
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



36 *Non Ex housing*

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

7. Depending on the device version: Attach the securing clamp of the connection compartment cover.

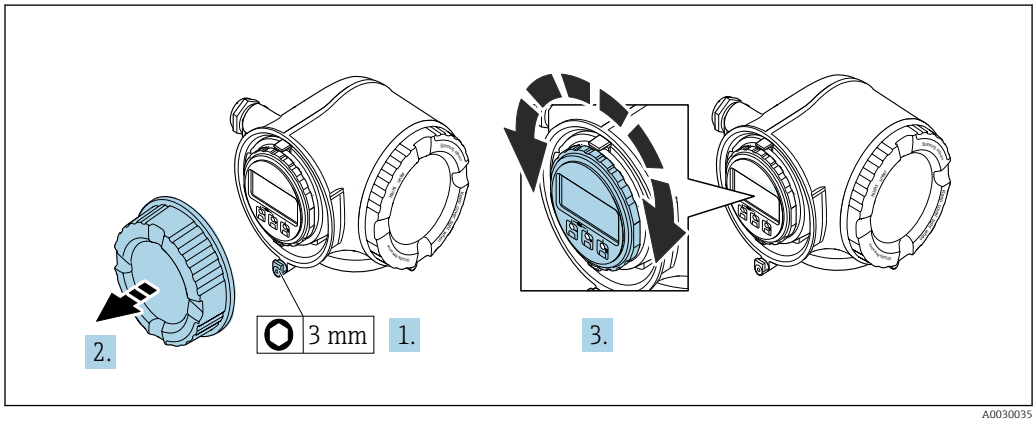


37 *Ex housing*

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

6.2.7 Turning the display module: Proline 500

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



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

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Inlet run conditions ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected → 🖹 19? ▪ 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, 🖹 19?	❑
Are the sensors correctly mounted (distance, 1 traverse, 2 traverses) → 🖹 21?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately 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) → 🖹 54?	❑

7 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

- ▶ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
- ▶ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 10 A) should be integrated into the system installation.

7.1 Electrical safety

In accordance with applicable federal/national regulations.

7.2 Connection conditions

7.2.1 Required tools

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

7.2.2 Requirements for connecting cable

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

Protective grounding cable for the outer ground terminal

Conductor cross-section ≤2.08 mm² (14 AWG)

Grounding impedance must be less than 2 Ω.

Permitted temperature range

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

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

Standard installation cable is sufficient.

Signal cable

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 mm² (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.

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Pulse output, phase-shifted

Standard installation cable is sufficient.

Relay output

Standard installation cable is sufficient.

Current input 0/4 to 20 mA

Standard installation cable is sufficient.

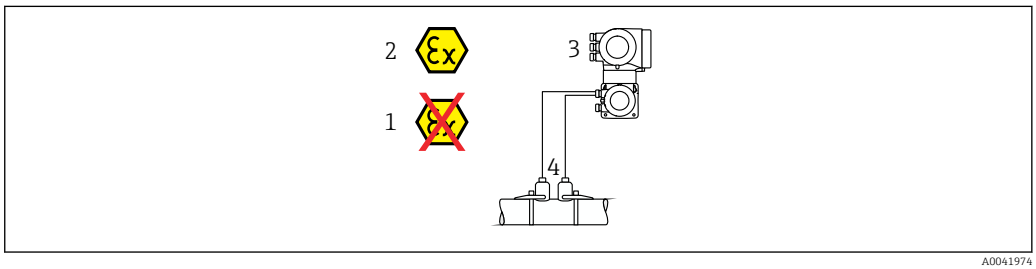
Status input

Standard installation cable is sufficient.

Cable diameter

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

Connecting cable between the transmitter and sensor



A0041974

1 *Non-hazardous area*
2 *Hazardous area: Zone 1; Class I, Division 1 or Zone 2; Class I, Division 2*
3 *Proline 500 transmitter*
4 *sensor set with sensor cable to transmitter 500* → 🖹 45
Transmitter and sensor installed in the hazardous area: Zone 1; Class I, Division 1 oder Zone 2; Class I, Division 2

Sensor cable for sensor - Proline 500 transmitter

Standard cable	▪ TPE: -40 to +80 °C (-40 to +176 °F) ▪ TPE armored: -40 to +80 °C (-40 to +176 °F) ▪ TPE halogen-free: -40 to +80 °C (-40 to +176 °F) ▪ PTFE: -50 to +170 °C (-58 to +338 °F) ▪ PTFE armored: -50 to +170 °C (-58 to +338 °F)
Cable length (max.)	30 m (100 ft)

Cable lengths (available for order)	5 m (15 ft), 10 m (32 ft), 15 m (50 ft), 30 m (100 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) or −50 °C (−58 °F) ▪ Cable - movable: minimum −25 °C (−13 °F)

1) Compare details under the "Standard cable" row

7.2.3 Terminal assignment

Transmitter: supply voltage, input/outputs

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

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

Transmitter and sensor connection housing: connecting cable

The sensor and transmitter, which are mounted in separate locations, are interconnected by a connecting cable. The cable is connected via the sensor connection housing and the transmitter housing.

Terminal assignment and connection of the connecting cable:
Proline 500 → 🖹 48

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. Connection housing, sensor: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect signal cable and cable for supply voltage.

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

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

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 44.

7.3 Connecting the measuring device: Proline 500

NOTICE

Limitation of electrical safety due to incorrect connection!

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

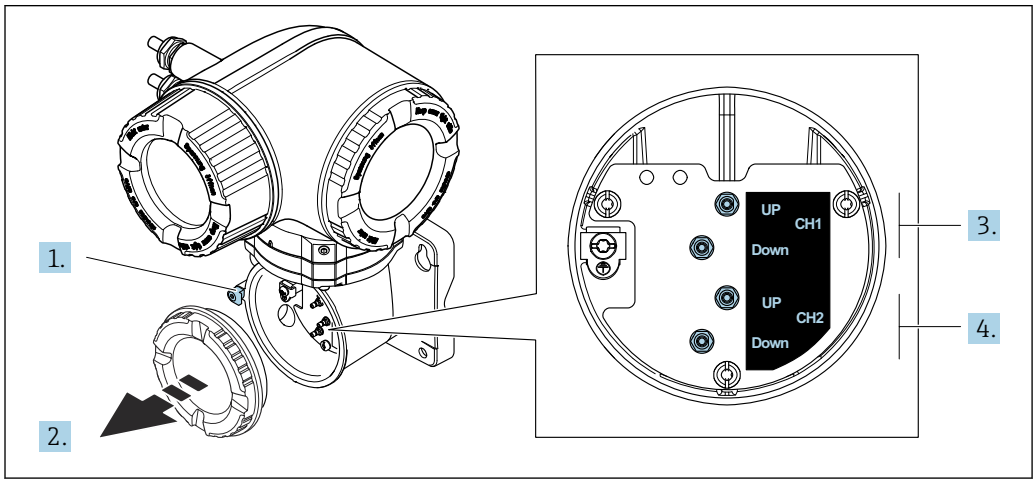
7.3.1 Attaching the connecting cable

⚠ WARNING

Risk of damaging the electronic components!

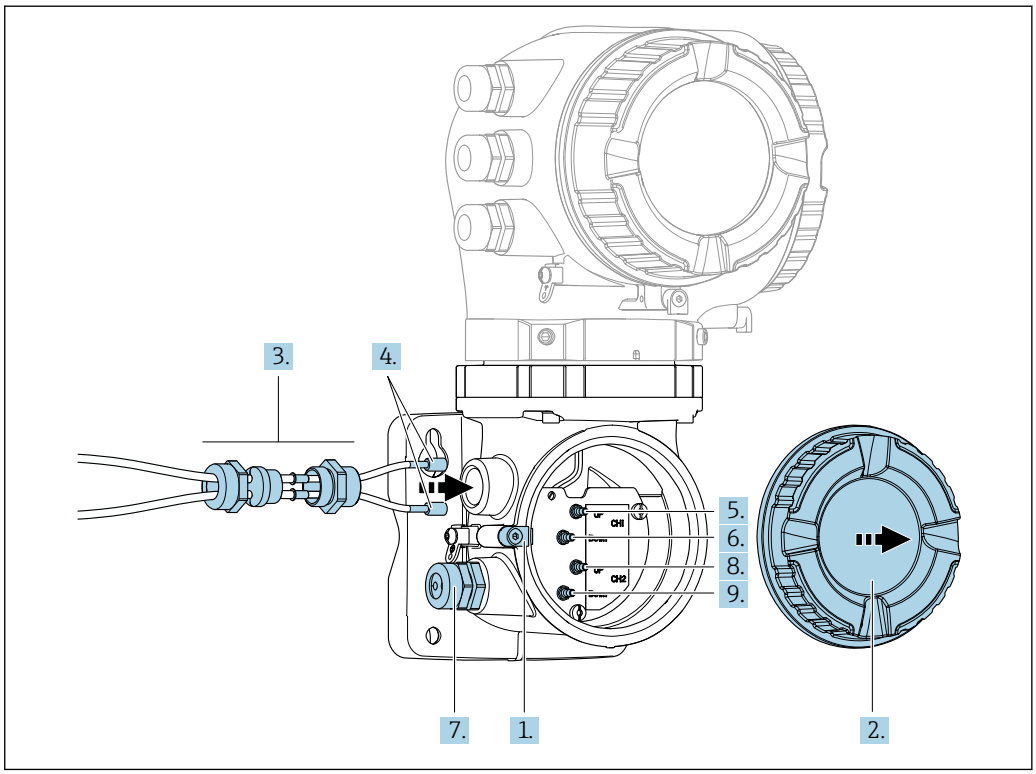
- ▶ Connect the sensor and transmitter to the same potential equalization.
- ▶ Only connect the sensor to a transmitter with the same serial number.
- ▶ Ground the connection housing of the sensor via the external screw terminal.

Connecting cable terminal assignment



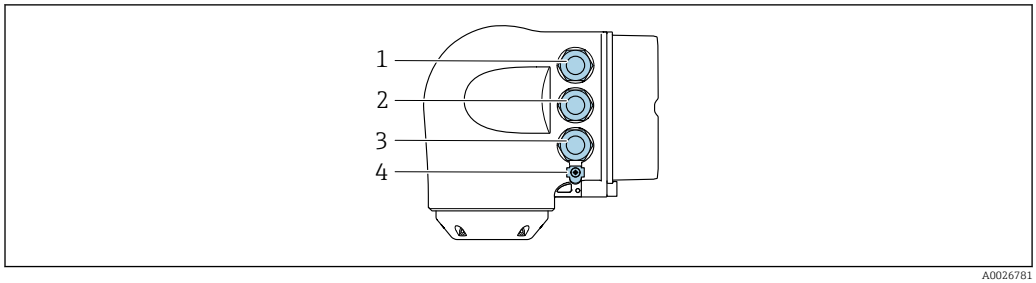
1 *Securing clamp*
2 *Connection compartment cover: sensor cable connection*
3 *Channel 1 upstream / downstream*
4 *Channel 2 upstream / downstream*

Connecting the sensor cable to the transmitter



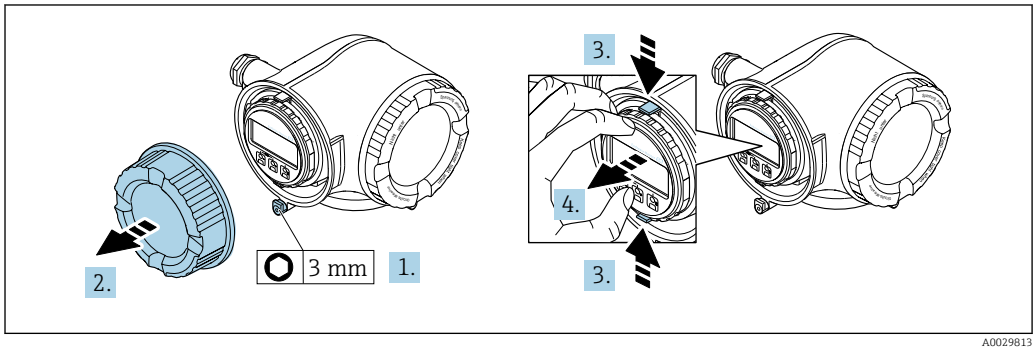
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Route the two sensor cables of channel 1 through the slackened top union nut of the cable entry. To ensure tight sealing, mount a sealing insert on the sensor cables.
4. Mount the screw part of the cable entry in the top housing opening 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. Screw on the connection compartment cover.
12. Tighten the securing clamp of the connection compartment cover.
13. After connecting the sensor cable(s):
    Connect the signal cable and the supply voltage cable → 50.

7.3.2 Connecting the signal cable and the supply voltage cable



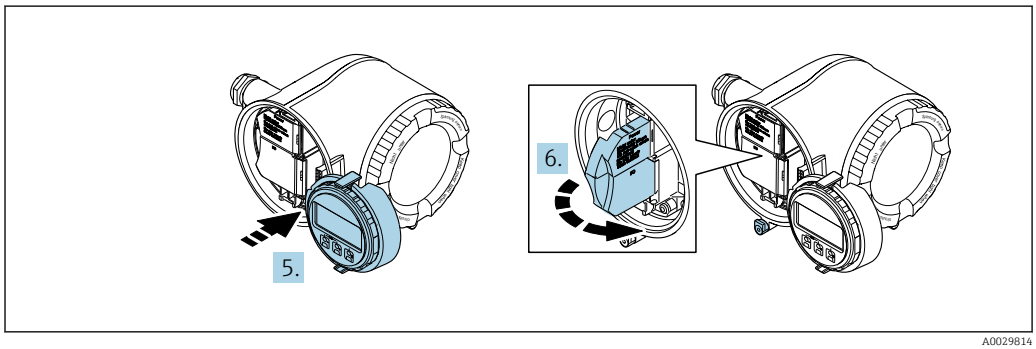
A0026781

1 Terminal connection for supply voltage
2 Terminal connection for signal transmission, input/output
3 Terminal connection for signal transmission, input/output or terminal connection for network connection via service interface (CDI-RJ45; non-Ex)
4 Protective earth (PE)



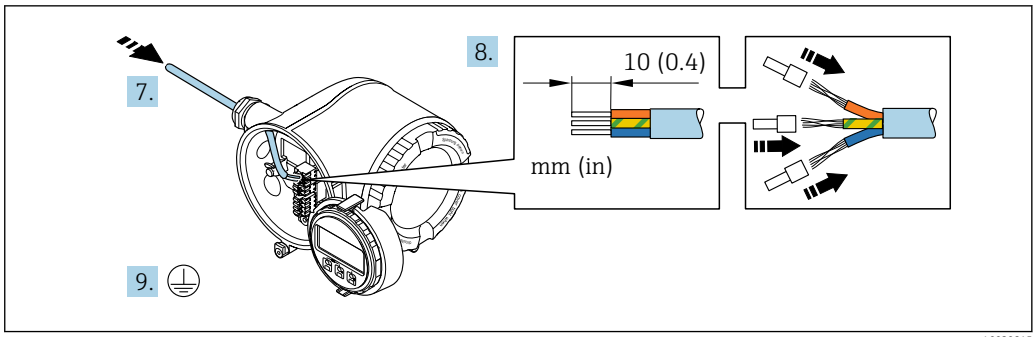
A0029813

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



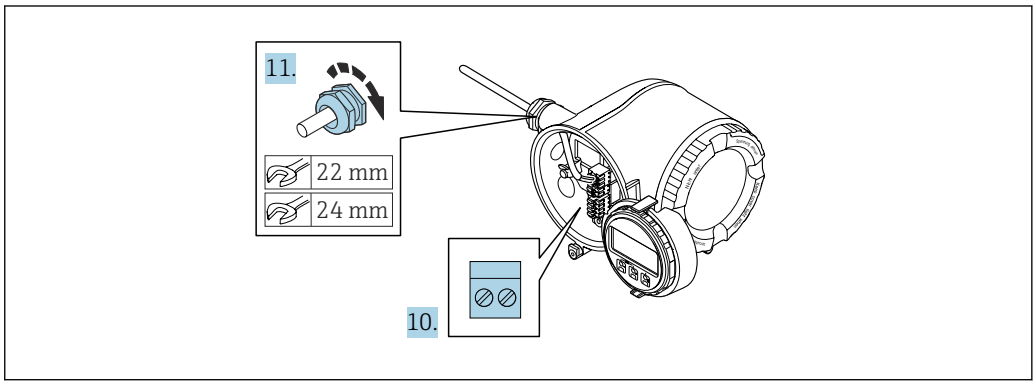
A0029814

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



A0029815

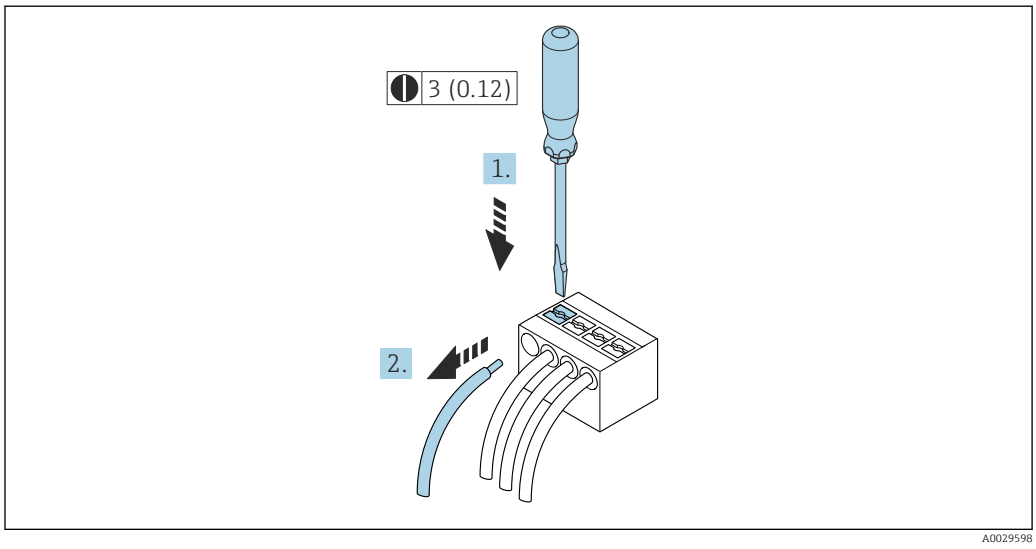
7. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
8. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
9. Connect the protective ground.



A0029816

10. Connect the cable in accordance with the terminal assignment .
    ↳ **Signal cable terminal assignment:** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
    Supply voltage terminal assignment: Adhesive label in the terminal cover or → 46.
11. Firmly tighten the cable glands.
    ↳ This concludes the cable connection process.
12. Close the terminal cover.
13. Fit the display module holder in the electronics compartment.
14. Screw on the connection compartment cover.
15. Secure the securing clamp of the connection compartment cover.

Removing a cable



38 *Engineering unit mm (in)*

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

7.3.3 Integrating the transmitter into a network

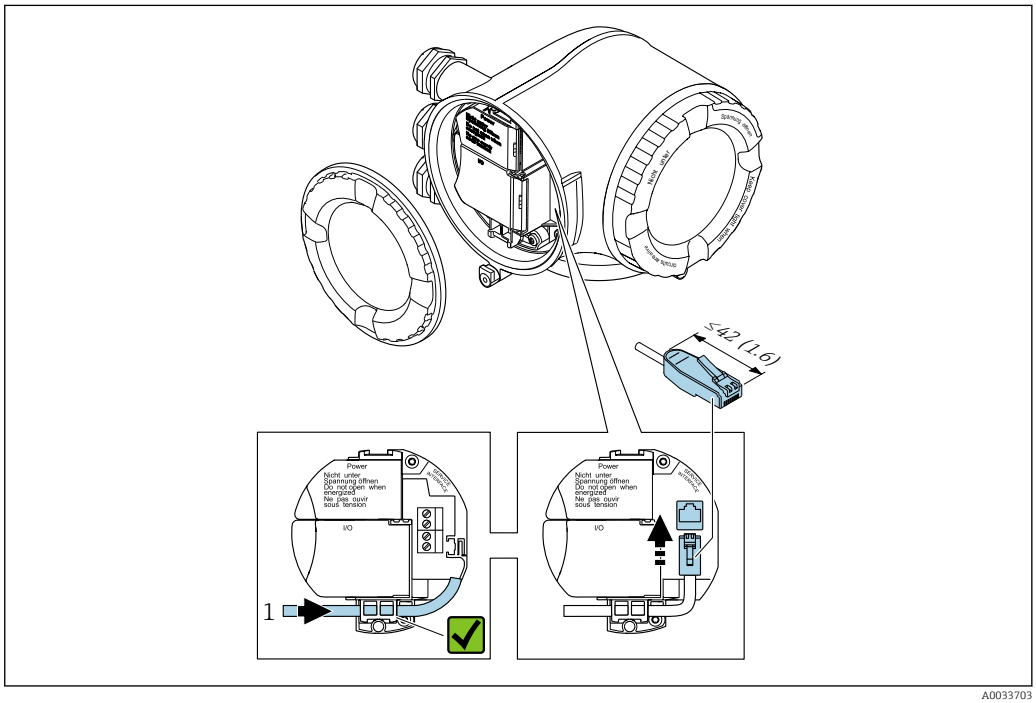
This section only presents the basic options for integrating the device into a network.

For information on the procedure to follow to connect the transmitter correctly → 48.

Integrating via the service interface

The device is integrated via the connection to the service interface (CDI-RJ45).

Note the following when connecting:
- Recommended cable: CAT 5e, CAT 6 or CAT 7, with shielded connector (e.g. brand: YAMAICHI ; Part No Y-ConProfixPlug63 / Prod. ID: 82-006660)
- Maximum cable thickness: 6 mm
- Length of connector including bend protection: 42 mm
- Bending radius: 5 x cable thickness



1 Service interface (CDI-RJ45)

An adapter for RJ45 (non-Ex) and the M12 connector is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

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

7.4 Ensuring potential equalization

7.4.1 Requirements

For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Connect the medium, sensor and transmitter to the same electrical potential
- Use a ground cable with a minimum cross-section of 6 mm^2 (0.0093 in^2) for potential matching connections

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

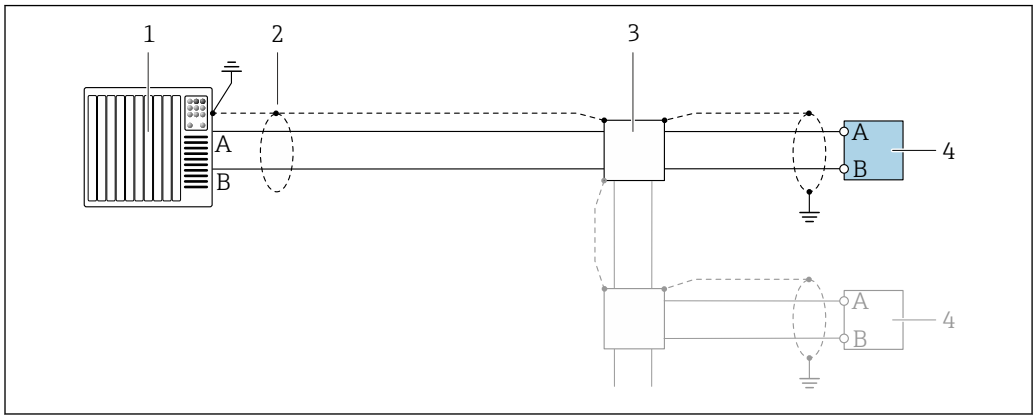
Abbreviations used

- PE: Protective Earth
- P_{FL}: Potential Flanges
- P_M: Potential Medium

7.5 Special connection instructions

7.5.1 Connection examples

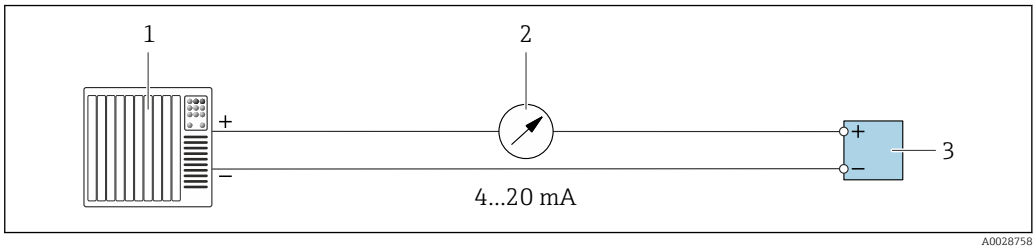
Modbus RS485



39 *Connection example for Modbus RS485, non-hazardous area and Zone 2; Class I, Division 2*

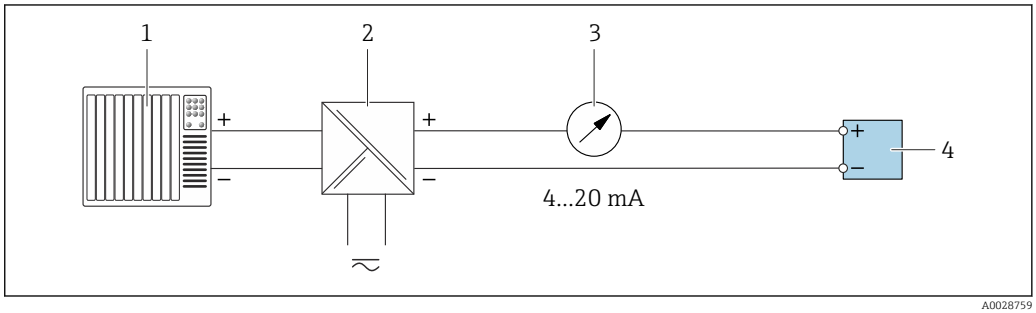
1 *Control system (e.g. PLC)*
2 *Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Distribution box*
4 *Transmitter*

Current output 4-20 mA



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

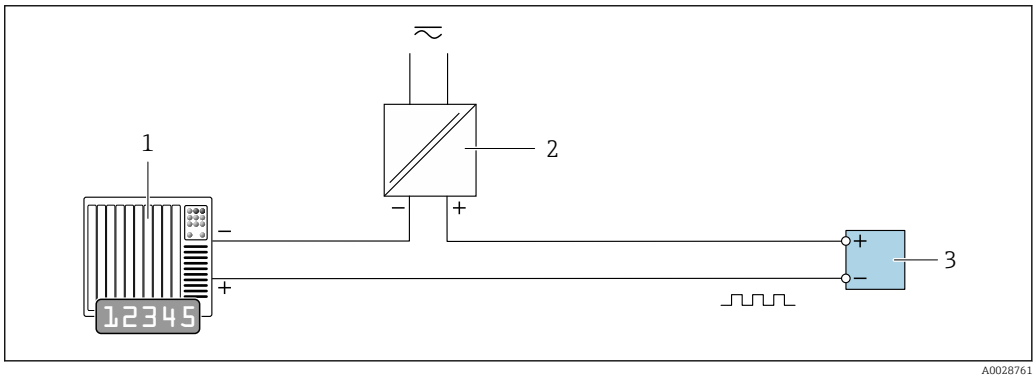
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load*
3 *Transmitter*



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

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

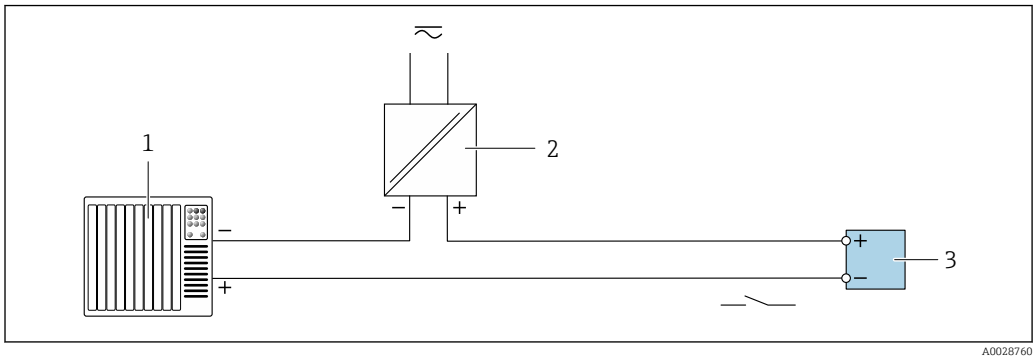
Pulse/frequency output



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

1 *Automation system with pulse/frequency input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 180*

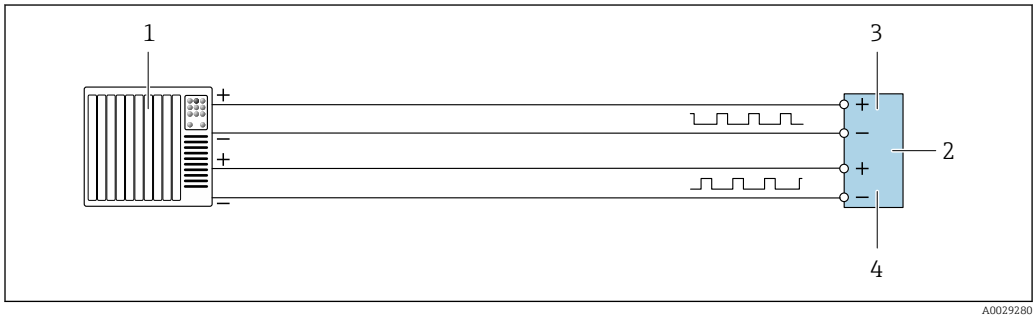
Switch output



43 *Connection example for switch output (passive)*

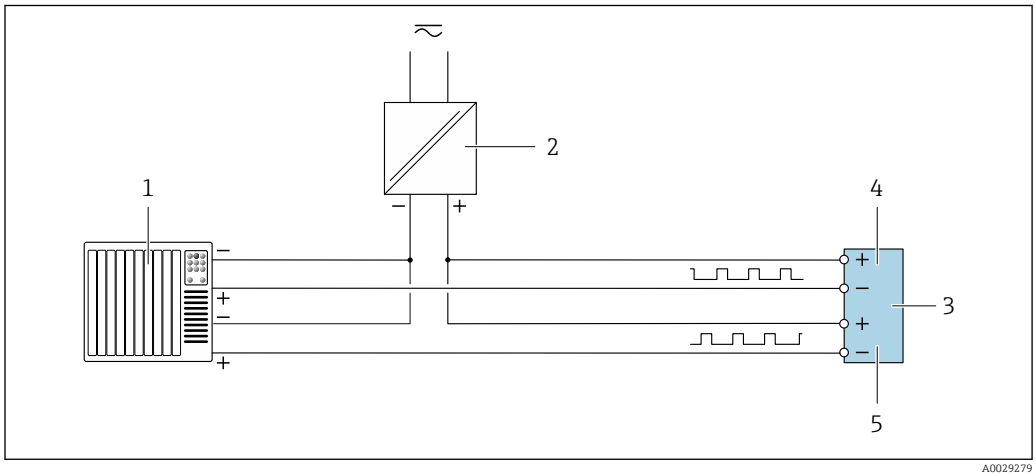
1 *Automation system with switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values* → 180

Pulse output, phase-shifted



44 *Connection example for pulse output, phase-shifted (active)*

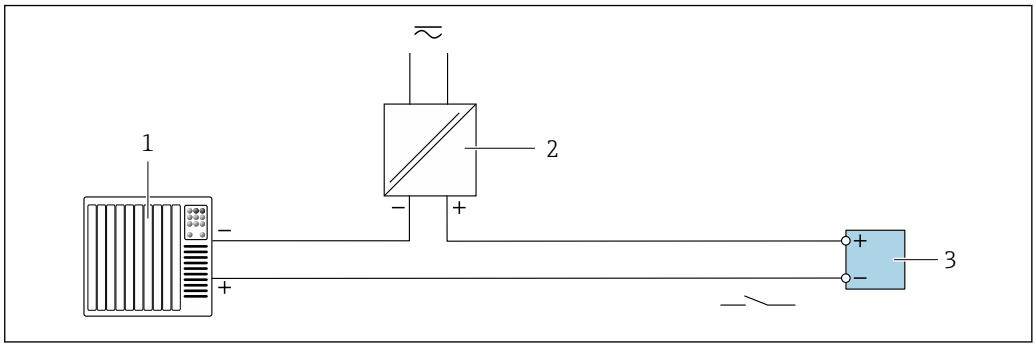
1 *Automation system with pulse input, phase-shifted (e.g. PLC)*
2 *Transmitter: Observe input values*
3 *Pulse output*
4 *Pulse output (slave), phase-shifted*



45 *Connection example for pulse output, phase-shifted (passive)*

1 *Automation system with pulse output, phase-shifted (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values*
4 *Pulse output*
5 *Pulse output (slave), phase-shifted*

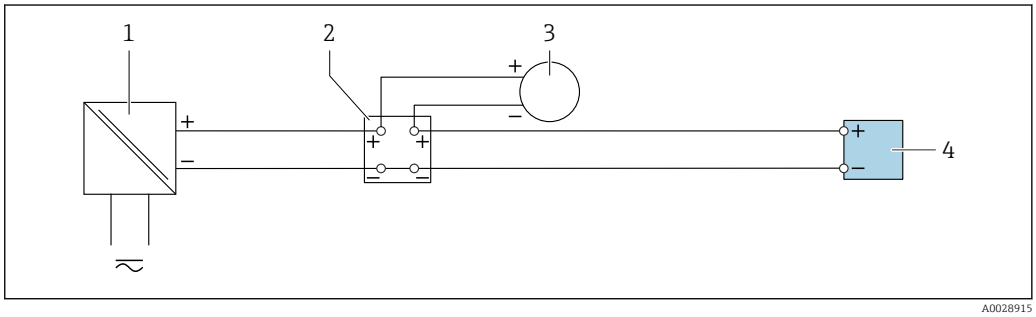
Relay output



46 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 182*

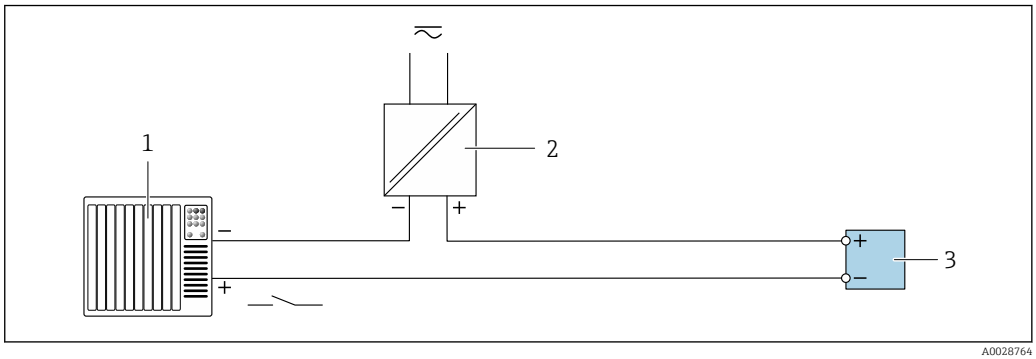
Current input



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

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

Status input



48 *Connection example for status input*

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

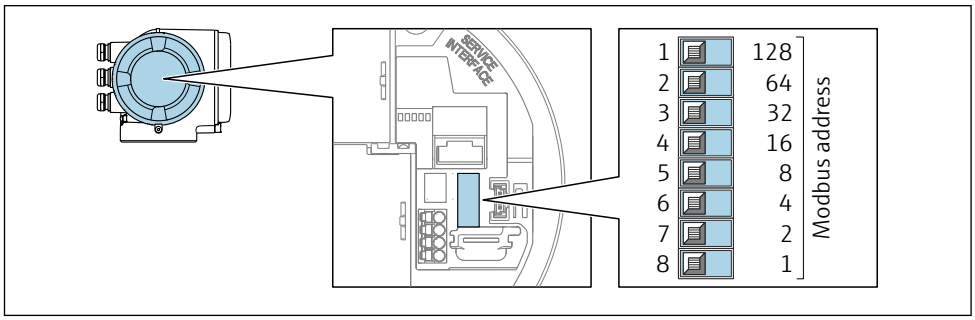
7.6 Hardware settings

7.6.1 Setting the device address

The device address must always be configured for a Modbus slave. The valid device addresses are in the range from 1 to 247. Each address may only be assigned once in a Modbus RS485 network. If an address is not configured correctly, the measuring device is not recognized by the Modbus master. All measuring devices are delivered from the factory with the device address 247 and with the "software addressing" address mode.

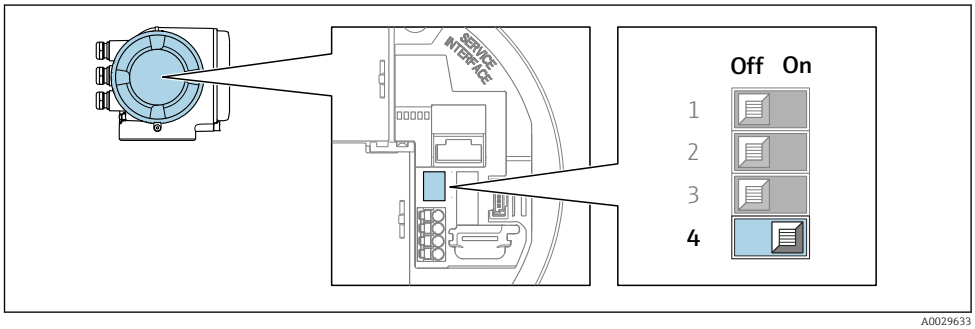
Hardware addressing

1.



Set the desired device address using the DIP switches in the connection compartment.

2.



To switch addressing from software addressing to hardware addressing: set the DIP switch to **On**.

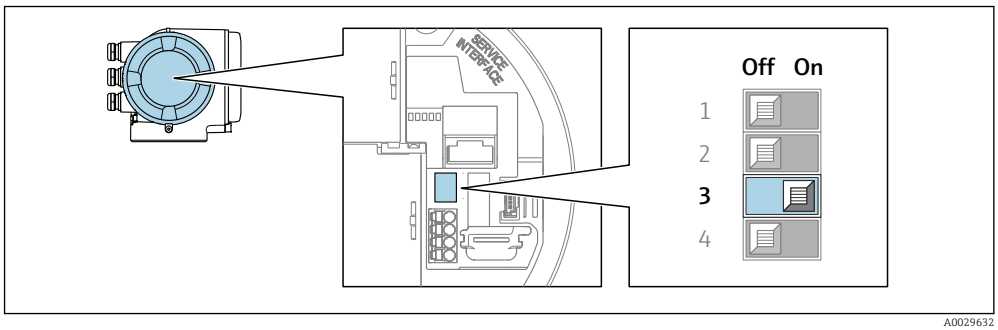
↳ The change of device address takes effect after 10 seconds.

Software addressing

- To switch addressing from hardware addressing to software addressing: set the DIP switch to **Off**.
  ↳ The device address configured in the **Device address** parameter takes effect after 10 seconds.

7.6.2 Enabling the terminating resistor

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



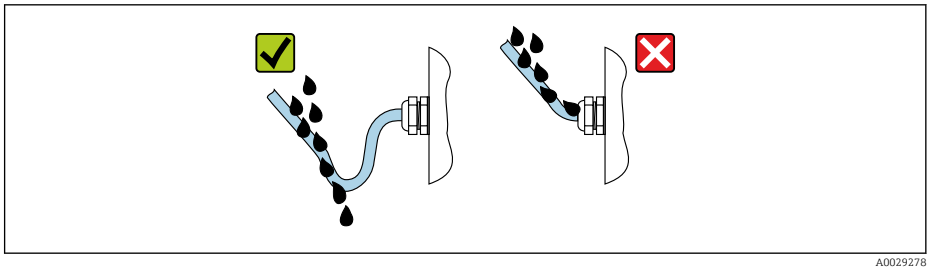
Switch DIP switch No. 3 to **On**.

7.7 Ensuring the degree of protection

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

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

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



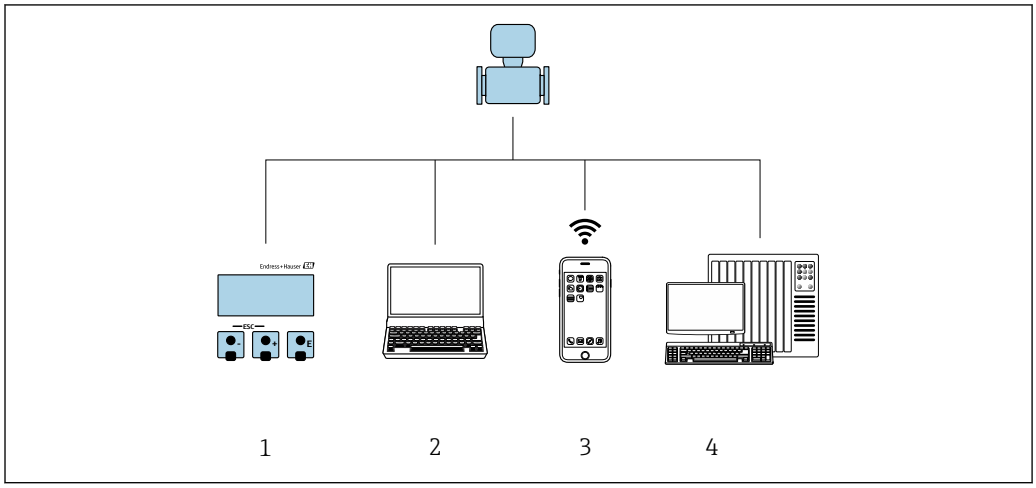
6. Insert dummy plugs (corresponding to the housing degree of protection) into unused cable entries.

7.8 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used meet the requirements ?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 59?	❑

8 Operation options

8.1 Overview of operation options



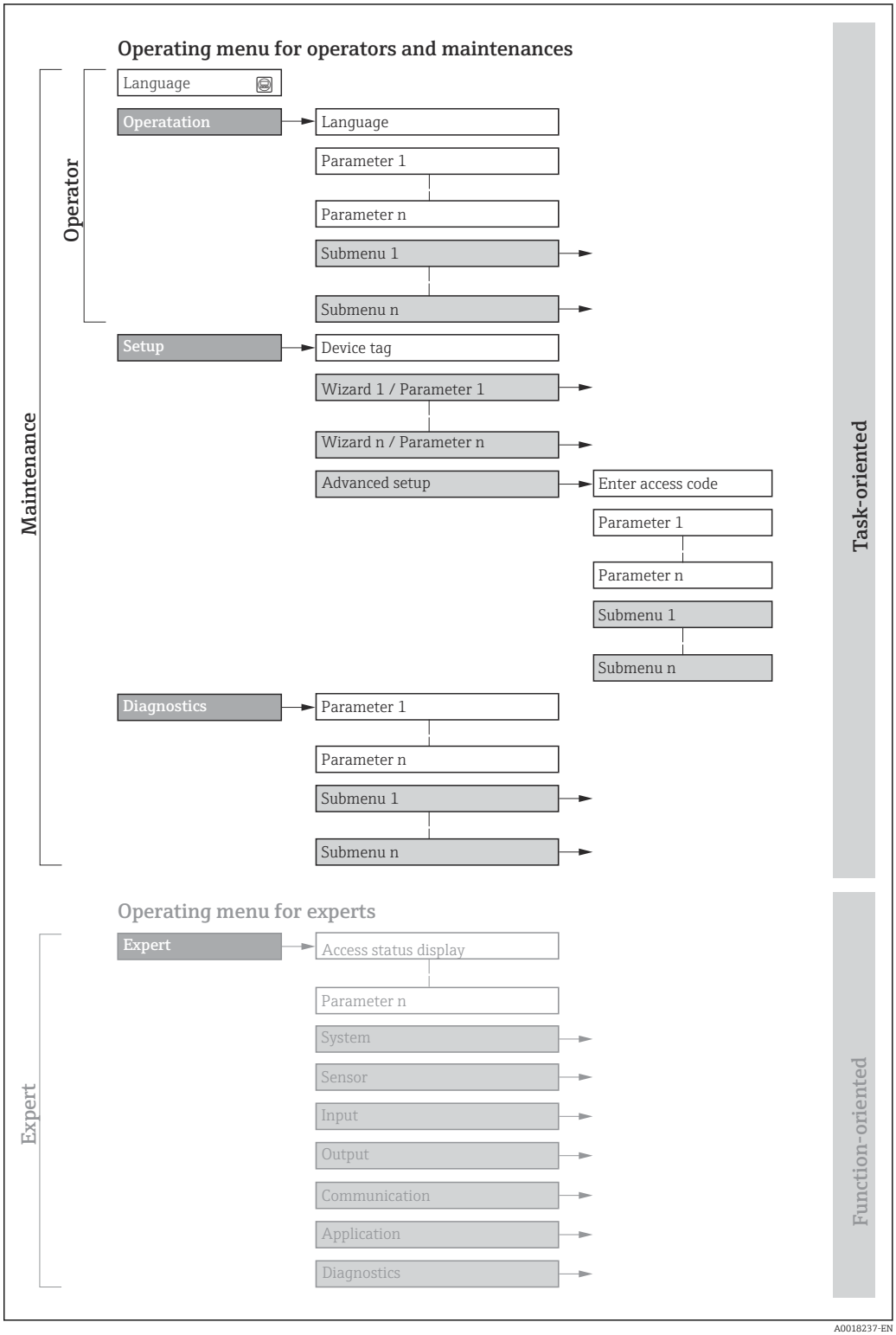
A0030213

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 *Mobile handheld terminal with SmartBlue App*
4 *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 → 198



49 *Schematic structure of the operating menu*

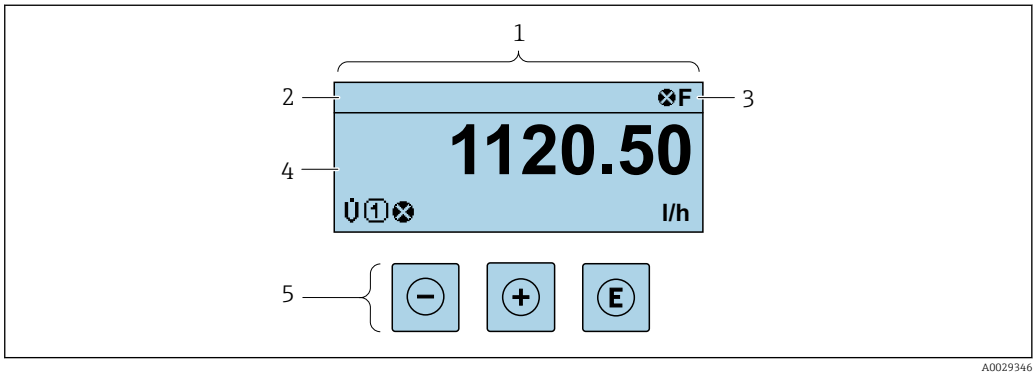
8.2.2 Operating philosophy

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

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	**Role "Operator", "Maintenance"** 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			▪ Configuring the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: ▪ Configuration of the measurement ▪ Configuration of the inputs and outputs ▪ Configuration of the communication interface	Wizards for fast commissioning: ▪ Setting the system units ▪ Displaying the I/O/configuration ▪ Configuring the measuring point ▪ Configuring the inputs ▪ Configuring the outputs ▪ Configuration of the operational display ▪ Setting the low flow cut off Advanced setup ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configuring the WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		**"Maintenance" role** Fault elimination: ▪ 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 "Extended HistoROM" order option Storage and visualization of measured values ▪ Heartbeat The functionality of the device is checked on demand and the verification results are documented. ▪ Simulation Is 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 the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: ▪ System Contains all higher-order device parameters which do not concern the measurement or the communication interface. ▪ Sensor Configuration of the measurement. ▪ Input Configuring 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 the operating menu via the local display

8.3.1 Operational display



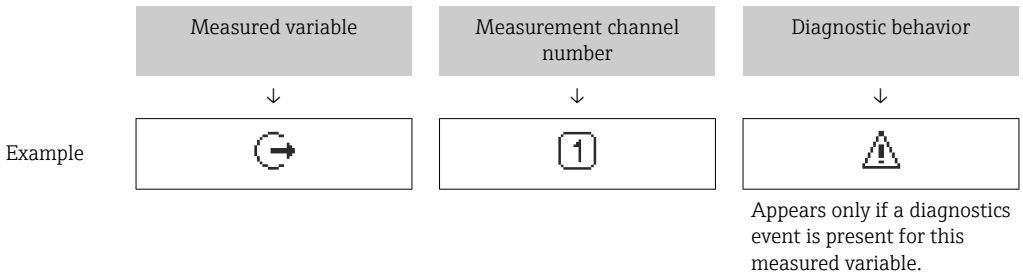
1 *Operational display*
2 *Device tag* → 🖹 *93*
3 *Status area*
4 *Display area for measured values (4-line)*
5 *Operating elements* → 🖹 *68*

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 🖹 153
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 🖹 154
  - ⊗: 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
$\dot{V}$	Volume flow
$\dot{m}$	Mass flow

C	Sound velocity
	Flow velocity
SNR	Signal to noise ratio
	Signal strength
Σ	Totalizer The measurement channel number indicates which of the three totalizers is displayed.
	Output The measurement channel number indicates which of the outputs is displayed.
	Status input

Measurement channel numbers

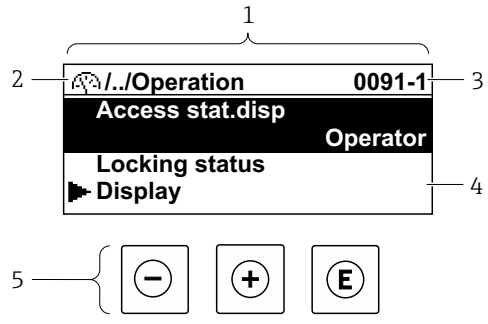
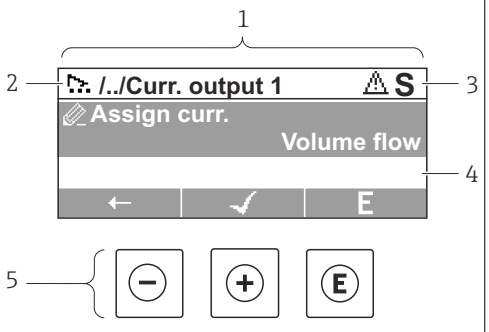
Symbol	Meaning
1 ... 4	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).	

Diagnostic behavior

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable. For information on the symbols → 154

The number and display format of the measured values can be configured via the **Format display** parameter (→ 116).

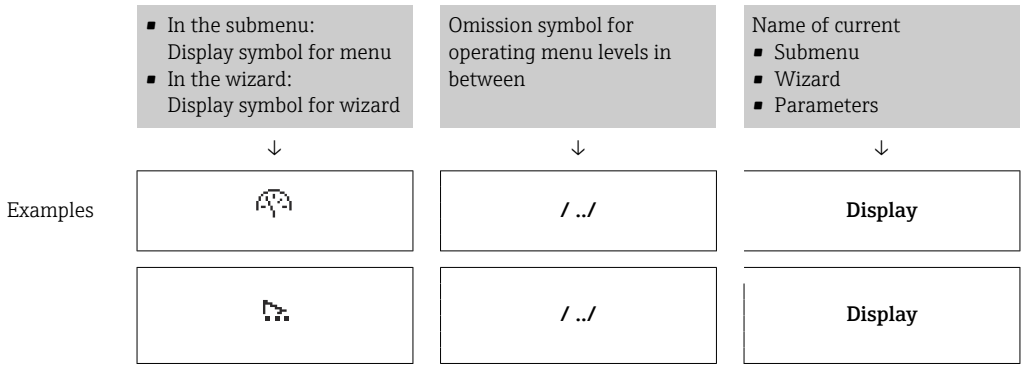
8.3.2 Navigation view

In the submenu	In the wizard
	

1 Navigation view
2 Navigation path to current position
3 Status area
4 Display area for navigation
5 Operating elements → 68

Navigation path

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



For more information about the icons in the menu, refer to the "Display area" section → 🖹 65

Status area

The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code for the parameter you are navigating to (e.g. 0022-1)
  - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard
  If a diagnostic event is present, the diagnostic behavior and status signal

- For information on the diagnostic behavior and status signal → 🖹 153
- For information on the function and entry of the direct access code → 🖹 70

Display area

Menus

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

Locking

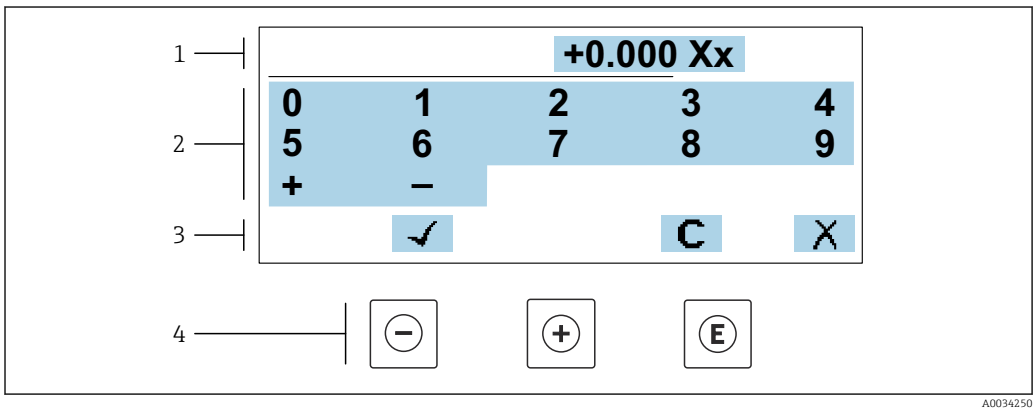
Symbol	Meaning
	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. ▪ By a user-specific access code ▪ By the hardware write protection switch

Wizard operation

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

8.3.3 Editing view

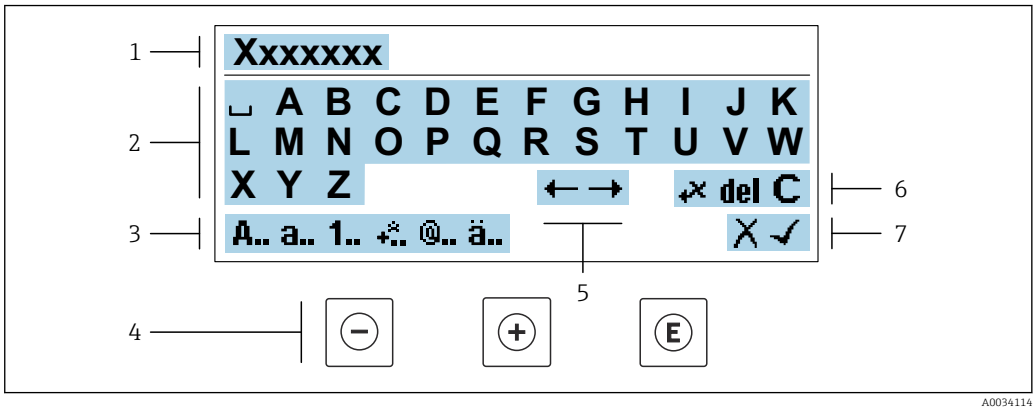
Numeric editor



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

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

Text editor



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

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

Using the operating elements in the editing view

Operating key(s)	Meaning
⊖	**Minus key** Move the entry position to the left.
⊕	**Plus key** Move the entry position to the right.
Ⓔ	**Enter key** ▪ Press the key briefly: confirm your selection. ▪ Press the key for 2 s: confirm the entry.
⊖ + ⊕	**Escape key combination (press keys simultaneously)** Close the editing view without accepting the changes.

Input screens

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

Controlling data entries

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

8.3.4 Operating elements

Operating key(s)	Meaning
⊖	**Minus key** *In a menu, submenu* Moves the selection bar upwards in a picklist. *With a Wizard* Confirms the parameter value and goes to the previous parameter. *With a text and numeric editor* Move the entry position to the left.
⊕	**Plus key** *In a menu, submenu* Moves the selection bar downwards in a picklist. *With a Wizard* Confirms the parameter value and goes to the next parameter. *With a text and numeric editor* Move the entry position to the right.

Ⓔ	**Enter key**
	For operational display
	Pressing the key briefly opens the operating menu.
	In a 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 for parameter:
	  If present, opens the help text for the function of the parameter.
	With a Wizard
	Opens the editing view of the parameter.
	With a text and numeric editor
	▪ Press the key briefly: confirm your selection.
	▪ Press the key for 2 s: confirm the entry.

Operating key(s)	Meaning

⊖ + ⊕	**Escape key combination (press keys simultaneously)**
	In a 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").
	With a Wizard
	Exits the wizard and takes you to the next higher level.
	With a text and numeric editor
	Close the editing view without accepting the changes.

⊖ + E	**Minus/Enter key combination (press the keys simultaneously)** ▪ If the keypad lock is active: Press the key for 3 s: deactivate the keypad lock. ▪ If the keypad lock is not active: Press the key for 3 s: the context menu opens along with the option for activating the keypad lock.

8.3.5 Opening the context menu

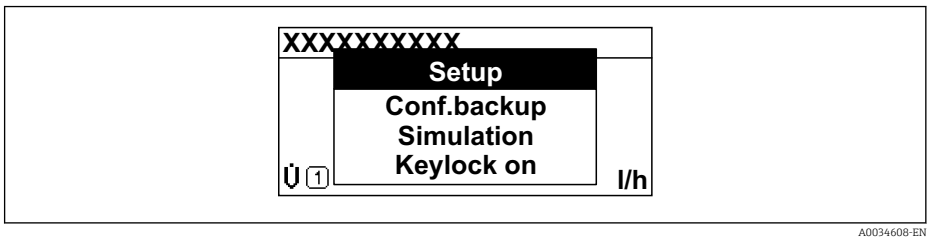
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Data backup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

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



A0034608-EN

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

Calling up the menu via the context menu

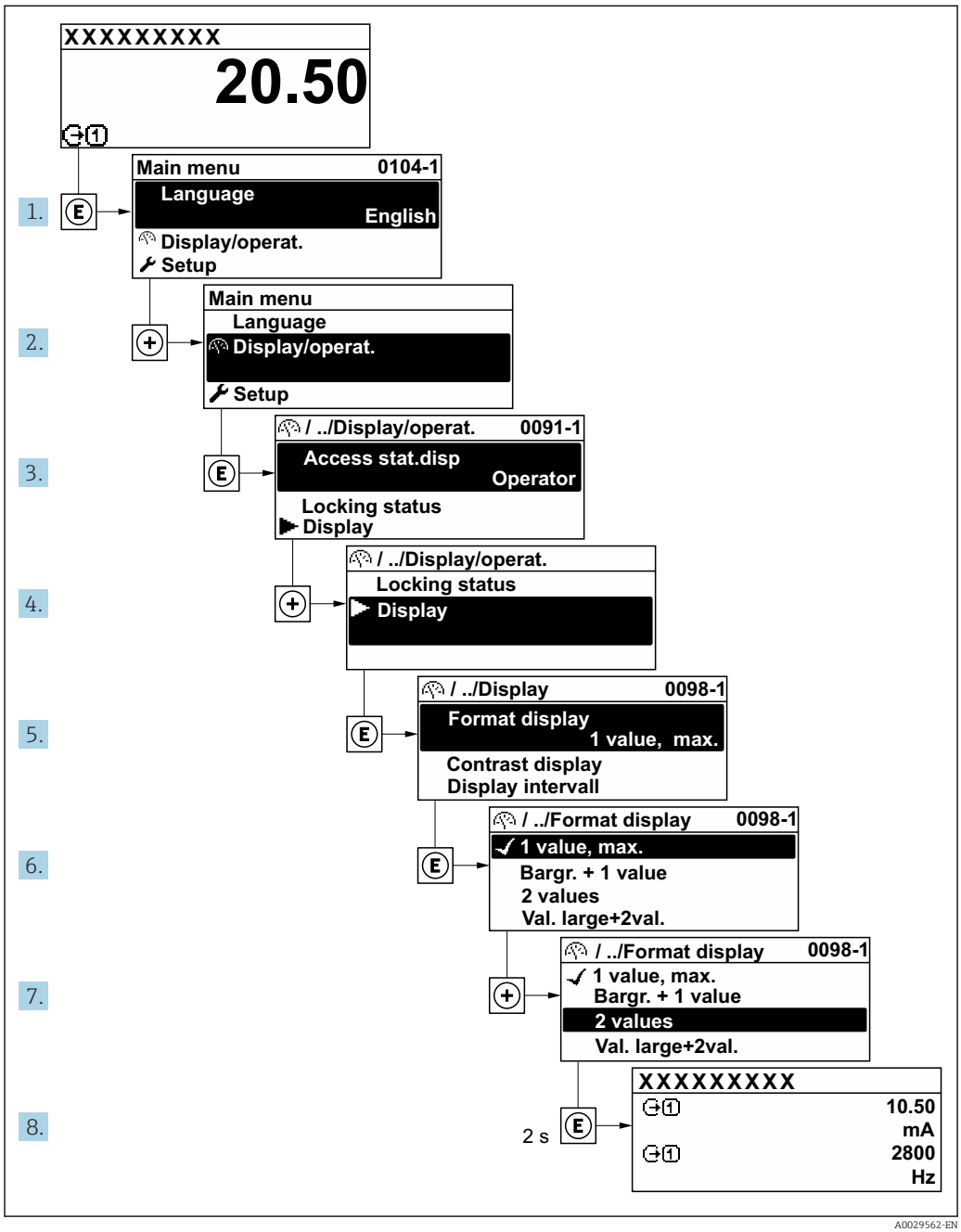
1. Open the context menu.
2. Press ⊕ to navigate to the desired menu.
3. Press E to confirm the selection.
   ↳ The selected menu opens.

8.3.6 Navigating and selecting from list

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

For an explanation of the navigation view with symbols and operating elements
→ 64

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

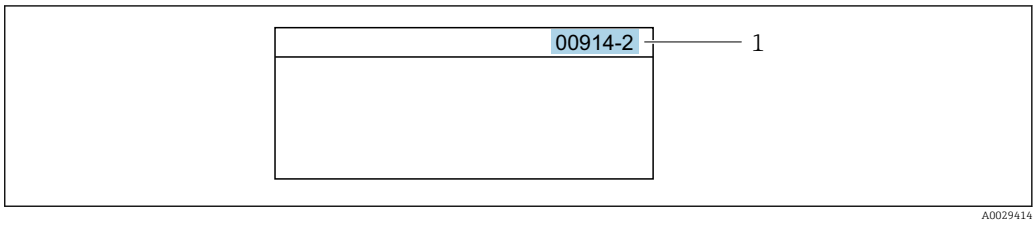


8.3.7 Calling the parameter directly

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

Navigation path
Expert → Direct access

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



1 Direct access code

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

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

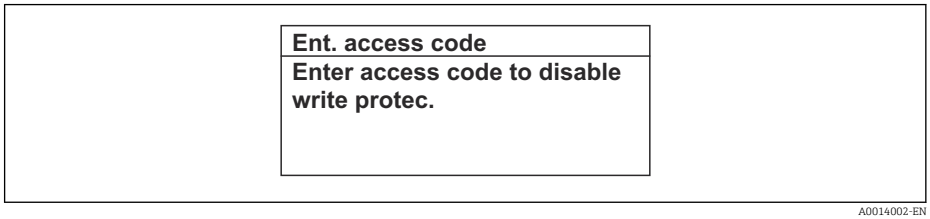
8.3.8 Calling up help text

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

Calling up and closing the help text

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

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



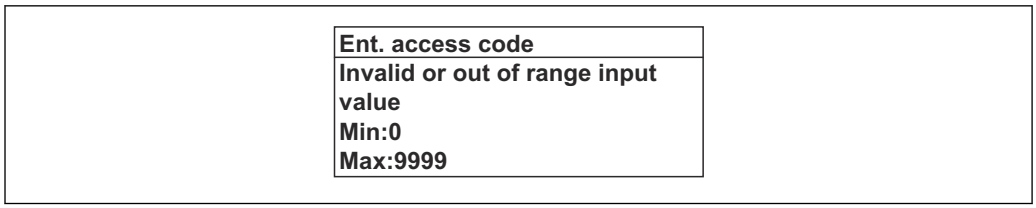
52 Example: Help text for parameter "Enter access code"

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

8.3.9 Changing the parameters

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

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



For a description of the editing view - consisting of the text editor and numeric editor - with symbols → 66, for a description of the operating elements → 68

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 → 136.

Defining access authorization for user roles

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

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

Access authorization to parameters: "Maintenance" user role

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

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

Access authorization to parameters: "Operator" user role

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

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

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

8.3.11 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 136.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 120) via the respective access option.

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

2. Enter the access code.
   ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

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

To activate the keylock manually:

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

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

Switching off the keypad lock

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

8.4 Access to the operating menu via the Web browser

8.4.1 Function range

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

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

For additional information on the Web server, refer to the Special Documentation for the device → 198

8.4.2 Prerequisites

Computer hardware

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

Computer software

Software	Interface	
	CDI-RJ45	WLAN

Recommended operating systems	▪ Microsoft Windows 8 or higher.
	▪ Mobile operating systems:
	  ▪ iOS
	  ▪ Android
	Microsoft Windows XP is supported.
	Microsoft 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 (for adjusting the IP address, subnet mask etc.).	
Proxy server settings of the Web browser	The Web browser setting *Use a Proxy Server for Your LAN* must be **deselected** .	
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser. When installing a new firmware version: To enable correct data display, clear the temporary memory (cache) of the Web browser under **Internet options**.	
Network connections	Only the active network connections to the measuring device should be used.	
	Switch off all other network connections such as WLAN.	Switch off all other network connections.

In the event of connection problems: → 150

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 → 79

Measuring device: via WLAN interface

Device	WLAN interface
Measuring device	The measuring device has a WLAN antenna: ▪ Transmitter with integrated WLAN antenna ▪ Transmitter with external WLAN antenna
Web server	Web server and WLAN must be enabled; factory setting: ON For information on enabling the Web server → 79

8.4.3 Establishing a connection

Via service interface (CDI-RJ45)

Preparing the measuring device

Proline 500

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

Configuring the Internet protocol of the computer

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

IP address of the device: 192.168.1.212 (factory setting)

1. Switch on the measuring device.
2. Connect to the computer using a cable → 80.
3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

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

Via WLAN interface

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

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

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

Preparing the mobile terminal

- Enable WLAN reception on the mobile terminal.

Establishing a connection from the mobile terminal to the measuring device

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Prosonic Flow_500_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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

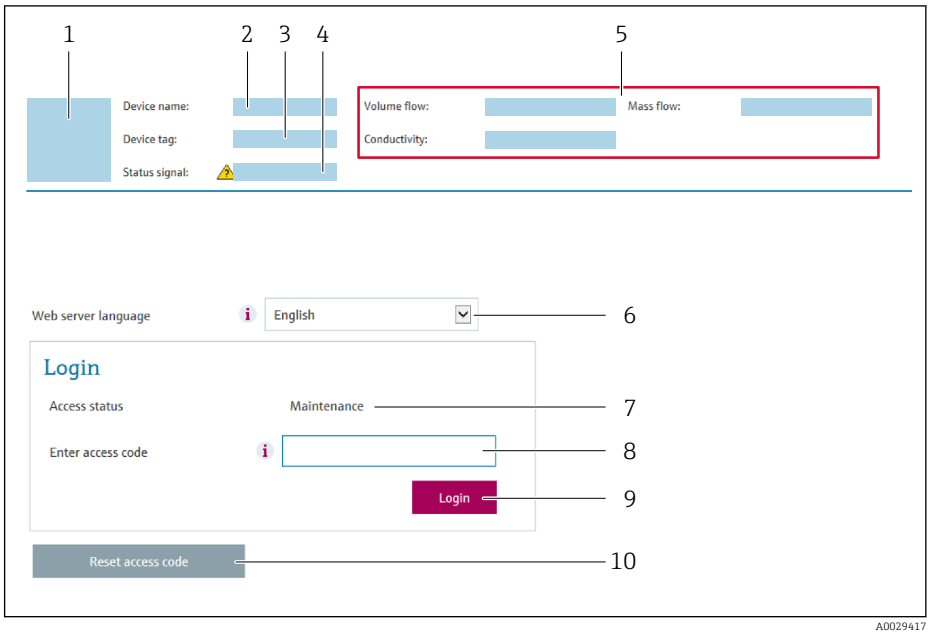
Disconnecting

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

Starting the Web browser

1. Start the Web browser on the computer.

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



1 *Picture of device*
2 *Device name*
3 *Device tag*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 133)*

If a login page does not appear, or if the page is incomplete → 150

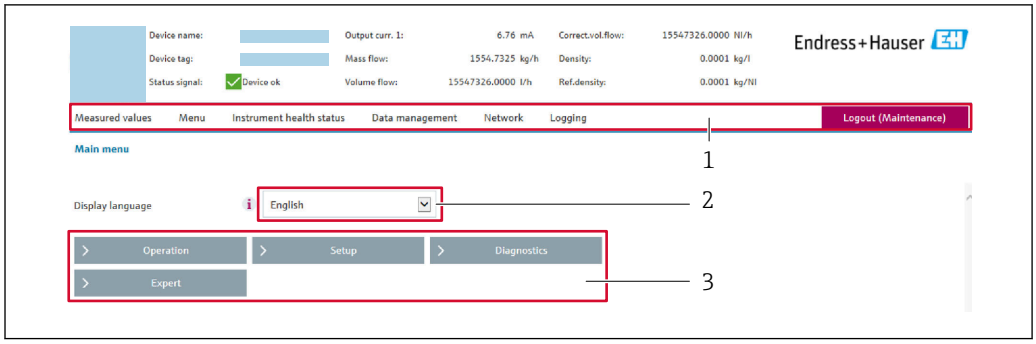
8.4.4 Logging on

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



A0029418

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

Header

The following information appears in the header:
- Device name
- Device tag
- Device status with status signal → 156
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring 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 For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device
Device status	Displays the diagnostic messages currently pending, listed in order of priority

Data management	Data exchange between PC and measuring device:
	▪ 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)
	▪ Firmware update - Flashing a firmware version

Network configuration	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

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

Working area

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

8.4.6 Disabling the Web server

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

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection
Web server functionality	Switch the Web server on and off.	▪ Off ▪ HTML 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 functionality of the web server 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 modified properties of the Internet protocol (TCP/IP) → 75.

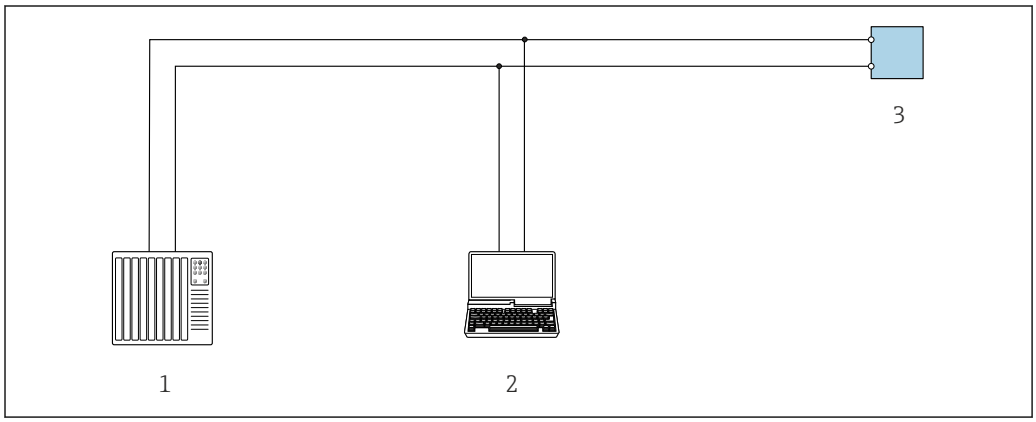
8.5 Access to the operating menu via the operating tool

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

8.5.1 Connecting the operating tool

Via Modbus RS485 protocol

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



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

1 Control system (e.g. PLC)
2 Computer with Web browser (e.g. Internet Explorer) for accessing 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

Service interface

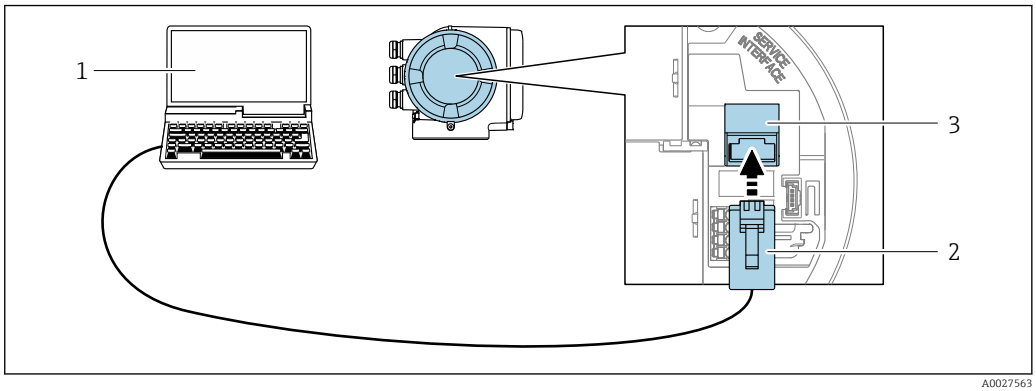
Via service interface (CDI-RJ45)

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

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

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

Proline 500 transmitter

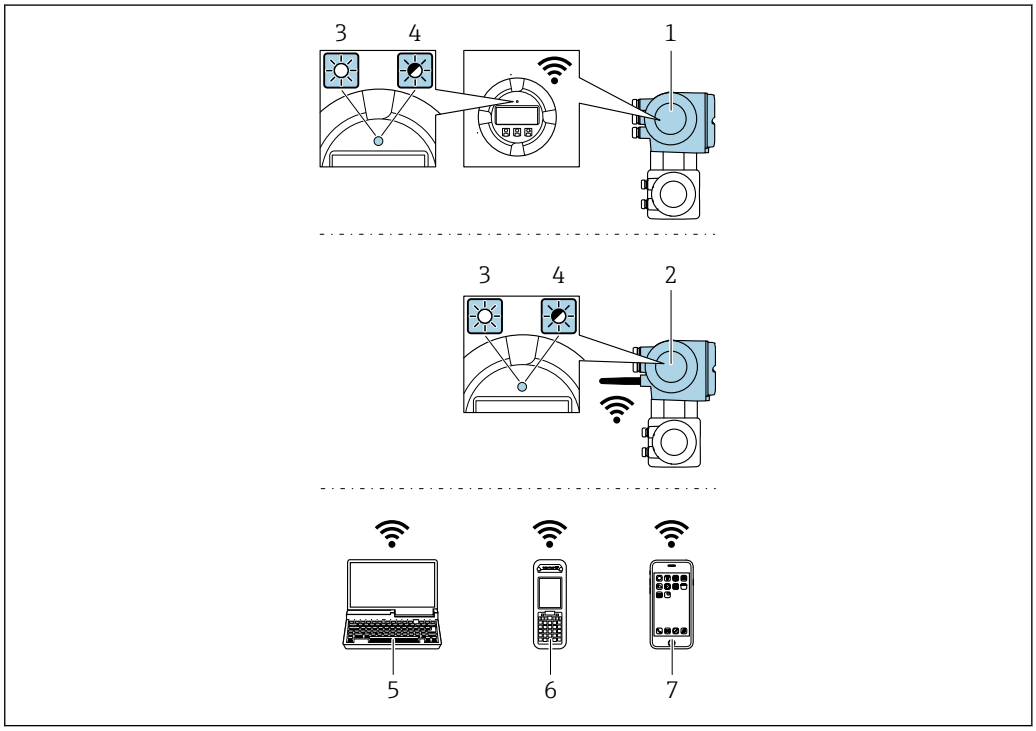


54 *Connection via service interface (CDI-RJ45)*

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

Via WLAN interface

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



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

Function	WLAN: IEEE 802.11 b/g (2.4 GHz)
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antennas	▪ Internal antenna ▪ External antenna (optional) In the event of poor transmission/reception conditions at the place of installation. Only one antenna active in each case!
Range	▪ Internal antenna: typically 10 m (32 ft) ▪ External antenna: typically 50 m (164 ft)
Materials (external antenna)	▪ Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass ▪ Adapter: Stainless steel and nickel-plated brass ▪ Cable: Polyethylene ▪ Connector: Nickel-plated brass ▪ Angle bracket: Stainless steel

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

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

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

Preparing the mobile terminal

▶ Enable WLAN reception on the mobile terminal.

Establishing a connection from the mobile terminal to the measuring device

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Prosonic Flow_500_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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

Disconnecting

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

8.5.2 FieldCare

Function scope

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

Access is via:
- CDI-RJ45 service interface → 80
- WLAN interface→ 81

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

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

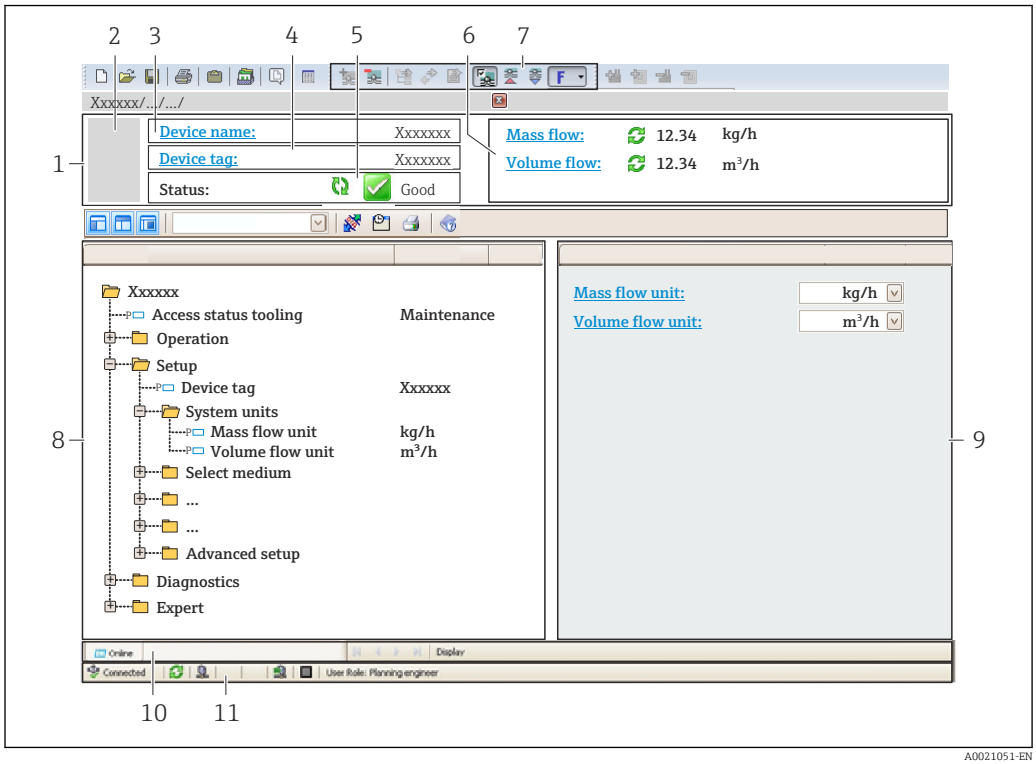
Source for device description files

See information → 85

Establishing a connection

For additional information, see Operating Instructions BA00027S and BA00059S

User interface



1 *Header*
2 *Picture of device*
3 *Device name*
4 *Device tag*
5 *Status area with status signal→ 156*
6 *Display area for current measured values*
7 *Edit toolbar with additional functions such as save/restore, event list and create documentation*
8 *Navigation area with operating menu structure*
9 *Working area*
10 *Range of action*
11 *Status area*

8.5.3 DeviceCare

Function scope

Tool to connect and configure Endress+Hauser field devices.

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

For details, see Innovation Brochure IN01047S

Source for device description files

See information → 85

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.01.zz	▪ On the title page of the Operating Instructions ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	05.2021	---

For an overview of the different firmware versions for the device → 169

9.1.2 Operating tools

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

Operating tool via service interface (CDI) or Modbus interface	Sources for obtaining device descriptions
FieldCare	▪ www.endress.com → Download Area ▪ CD–ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	▪ www.endress.com → Download Area ▪ CD–ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)

9.2 Compatibility with earlier model

If the device is replaced, the measuring device Prosonic Flow 500 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 → 159.

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 → 88	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 → 198.

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 → 198.

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 Function check

Before commissioning the measuring device:

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

- "Post-installation check" checklist→ 43
- "Post-connection check" checklist→ 59

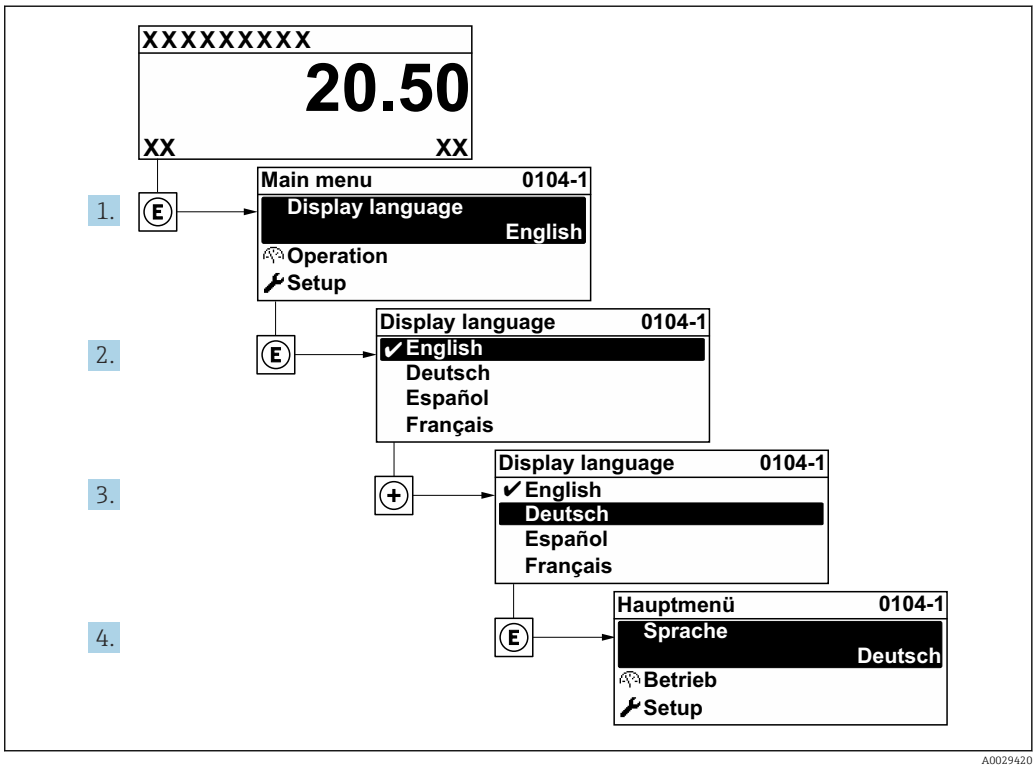
10.2 Switching on the measuring device

▶ After a successful function check, switch on the measuring device.
  ↳ After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 149.

10.3 Setting the operating language

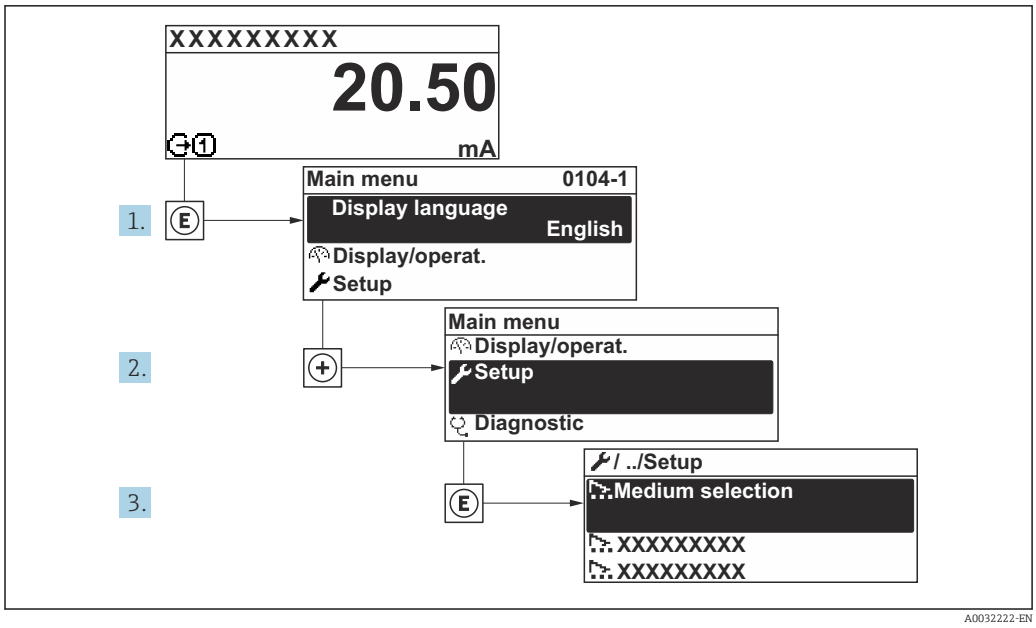
Factory setting: English or ordered local language



55 *Taking the example of the local display*

10.4 Configuring the measuring device

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

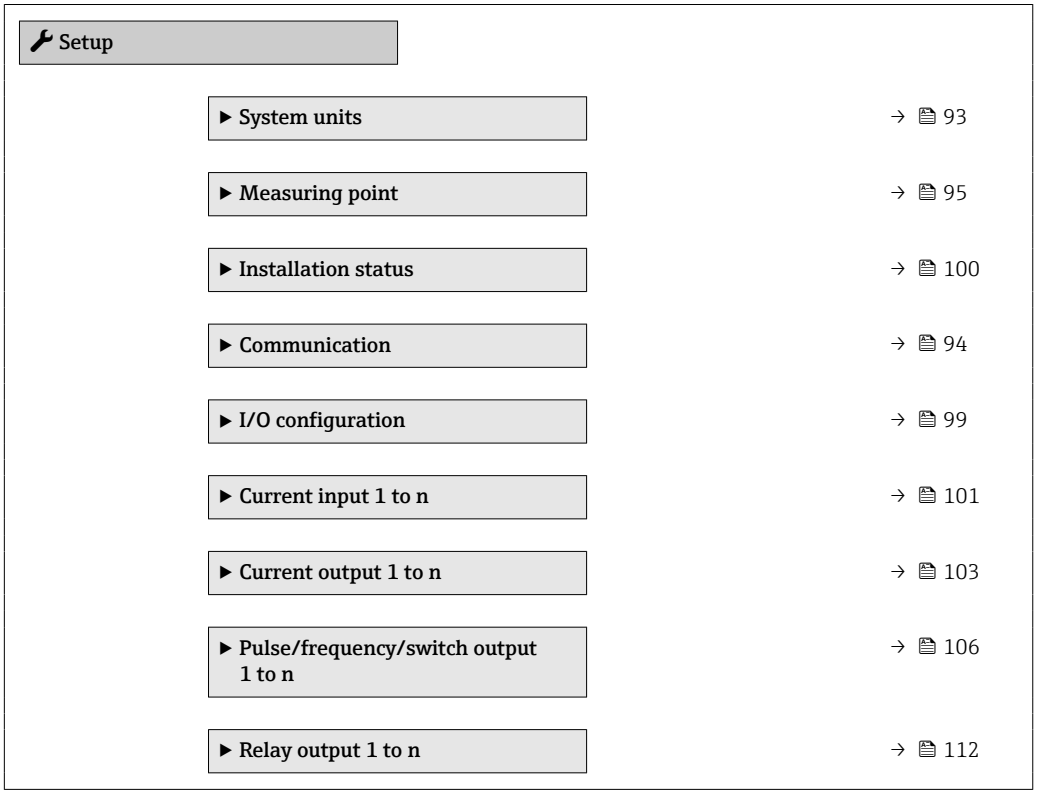


56 *Taking the example of the local display*

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

Navigation

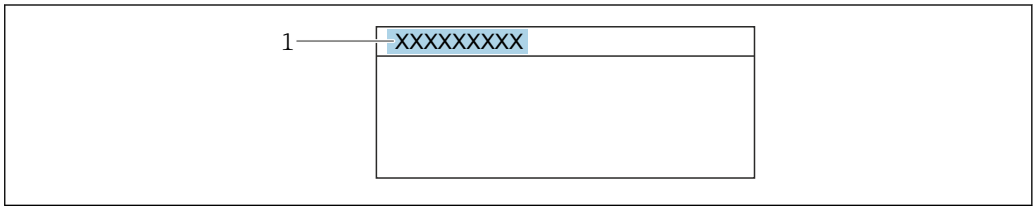
"Setup" menu



▶ Display	→ 115
▶ Advanced setup	→ 119

10.4.1 Defining the tag name

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



57 *Header of the operational display with tag name*

1 Tag name

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

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

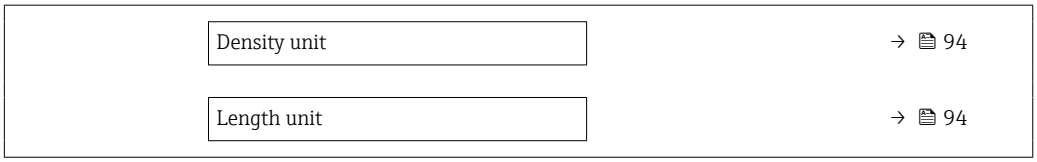
Parameter	Description	User entry
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).

10.4.2 Setting the system units

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

Navigation
"Setup" menu → System units

▶ System units	
Volume flow unit	→ 94
Volume unit	→ 94
Mass flow unit	→ 94
Mass unit	→ 94
Velocity unit	→ 94
Temperature unit	→ 94



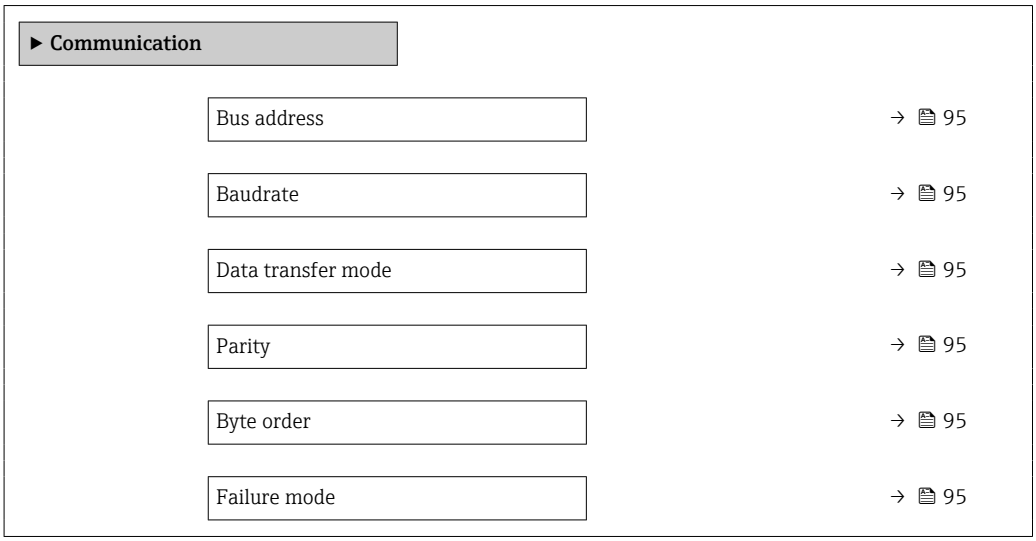
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ m^3/h ▪ ft^3/min
Volume unit	Select volume unit.	Unit choose list	Country-specific: ▪ m^3 ▪ ft^3
Mass flow unit	Select mass flow unit. *Result* The selected unit applies for: ▪ 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. *Result* The selected unit applies for: ▪ Flow velocity ▪ Sound velocity	Unit choose list	Country-specific: ▪ m/s ▪ ft/s
Temperature unit	Select temperature unit. *Result* The selected unit applies for: ▪ 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 for: ▪ Output ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/dm^3 ▪ lb/ft^3
Length unit	Select the unit of length.	Unit choose list	Country-specific: ▪ mm ▪ in

10.4.3 Configuring the communication interface

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

Navigation
"Setup" menu → Communication



Parameter overview with brief description

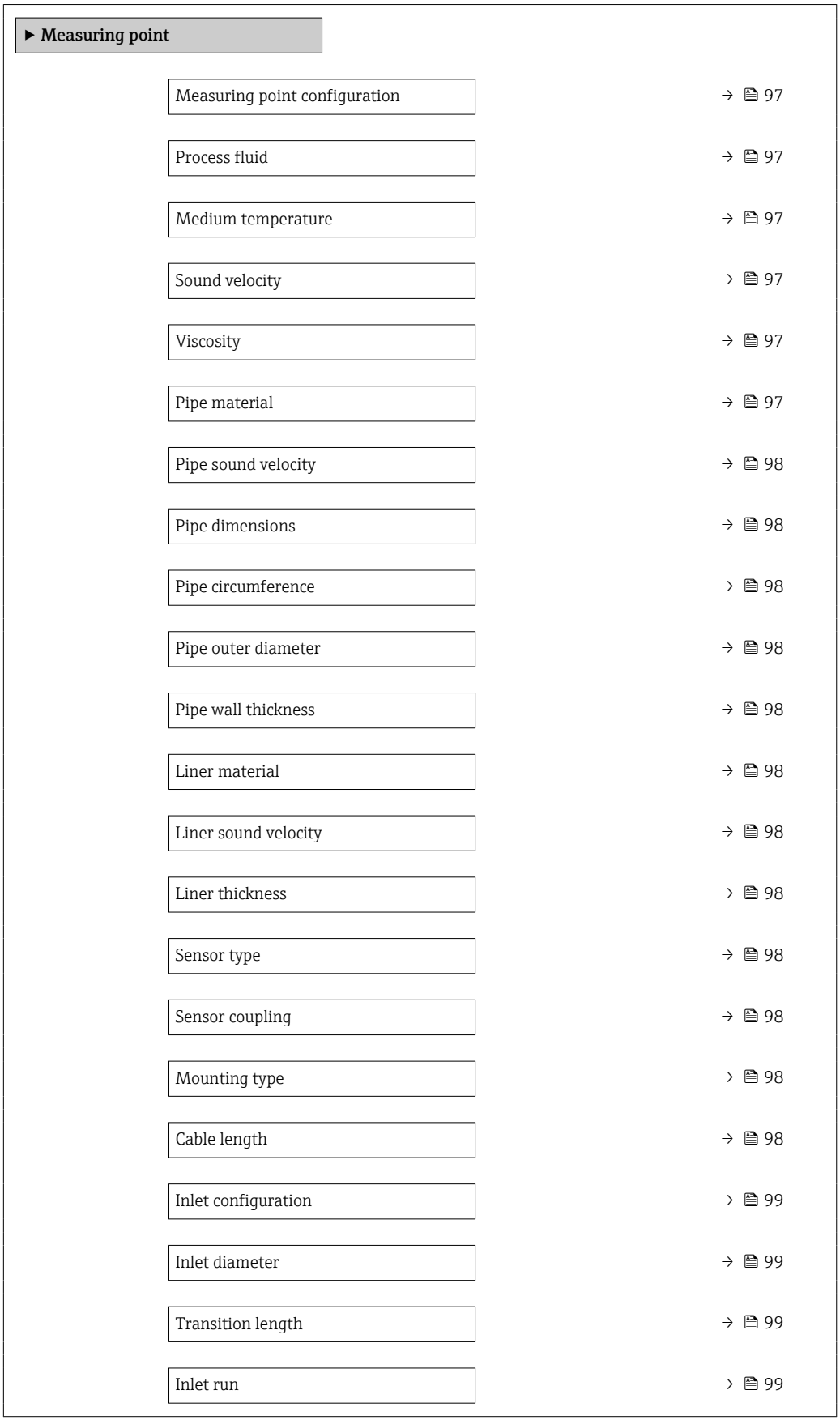
Parameter	Description	User entry / Selection
Bus address	Enter device address.	1 to 247
Baudrate	Define data transfer speed.	▪ 1200 BAUD ▪ 2400 BAUD ▪ 4800 BAUD ▪ 9600 BAUD ▪ 19200 BAUD ▪ 38400 BAUD ▪ 57600 BAUD ▪ 115200 BAUD
Data transfer mode	Select data transfer mode.	▪ ASCII ▪ RTU
Parity	Select parity 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

10.4.4 Configuring the measuring point

The **"Measuring point 1" wizard** guides the user systematically through all the parameters that have to be set for configuring the measuring point.

Navigation
"Setup" menu → Measuring point 1



Relative sensor position	→ 99
Result sensor type / mounting type	→ 99
Result sensor distance / measuring aid	→ 99

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
Process fluid	–	Select process fluid.	▪ Water ▪ Sea water ▪ Distilled water ▪ Ammonia NH3 ▪ Benzene ▪ Ethanol ▪ Glycol ▪ Kerosene ▪ Milk ▪ Methanol ▪ User-specific liquid	Water
Medium temperature	–	Enter a fixed value for process temperature.	−200 to 550 °C	–
Sound velocity	The **User-specific liquid** option is selected in the **Process fluid** parameter.	Enter sound velocity of fluid.	200 to 3 000 m/s	–
Viscosity	The **User-specific liquid** option is selected in the **Process fluid** parameter.	Enter medium viscosity at installation temperature.	1E-10 to 0.01 m²/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	–

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
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	–
Pipe outer diameter	The **Diameter** option is selected in the **Pipe dimensions** parameter.	Define the outer diameter of the pipe.	10 to 5 000 mm	100 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	One of the following options is selected in the **Liner material** parameter: ▪ Cement ▪ Rubber ▪ Epoxy resin ▪ Unknown liner material	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*	As per order
Sensor coupling	–	Select coupling medium.	▪ Coupling pad ▪ Coupling paste	–
Mounting type	–	Select how the sensors are arranged to each other. ▪ **(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) direct ▪ (2) V-mounting ▪ (3) Z-Mounting ▪ (4) W-mounting ▪ 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
Inlet configuration	The **1 measuring point - 2 signal paths** option is selected in the **Measuring point configuration** parameter.	Select inlet configuration.	▪ Off ▪ Single elbow ▪ Double elbow ▪ Double elbow 3D ▪ Concentric diameter change	–
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	▪ 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 length of the concentric diameter change.	0 to 10 000 mm	–
Inlet run	The **1 measuring point - 2 signal paths** option is selected in the **Measuring point configuration** parameter.	Enter length of the available straight inlet run.	0 to 50 000 mm	–
Relative sensor position	The **1 measuring point - 2 signal paths** option is selected in the **Measuring point 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	–

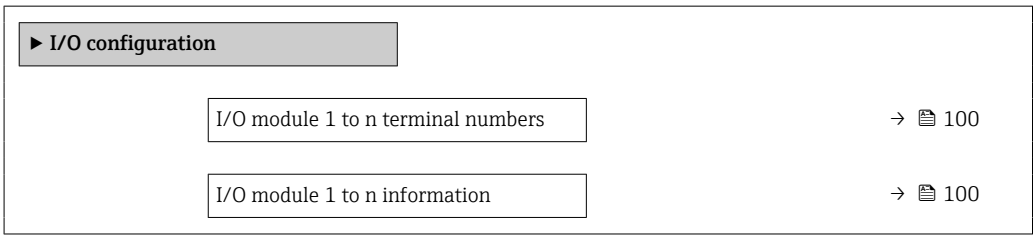
* Visibility depends on order options or device settings

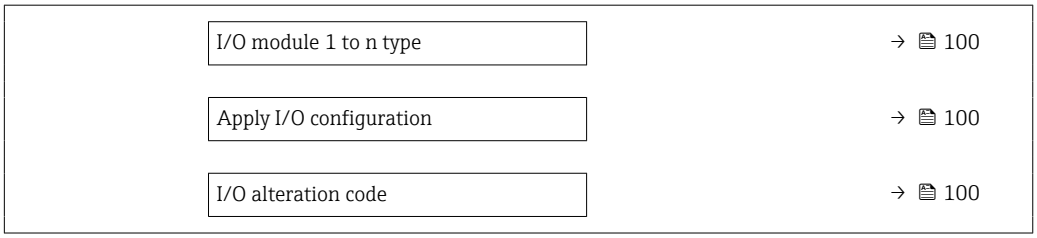
10.4.5 Displaying the I/O configuration

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

Navigation

"Setup" menu → I/O configuration





Parameter overview with brief description

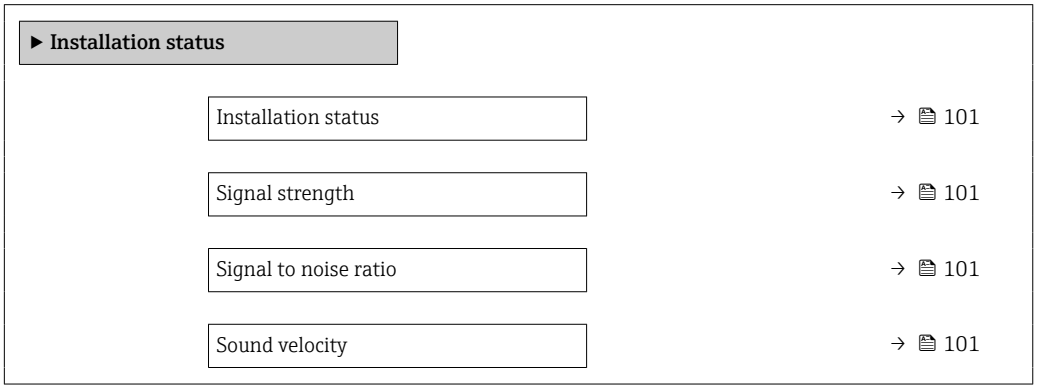
Parameter	Description	User interface / Selection / User entry
I/O module 1 to n terminal numbers	Shows the terminal numbers used by the I/O module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)
I/O module 1 to n information	Shows information of the plugged I/O module.	▪ Not plugged ▪ Invalid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

* Visibility depends on order options or device settings

10.4.6 Checking the installation status

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

Navigation
"Setup" menu → Installation status



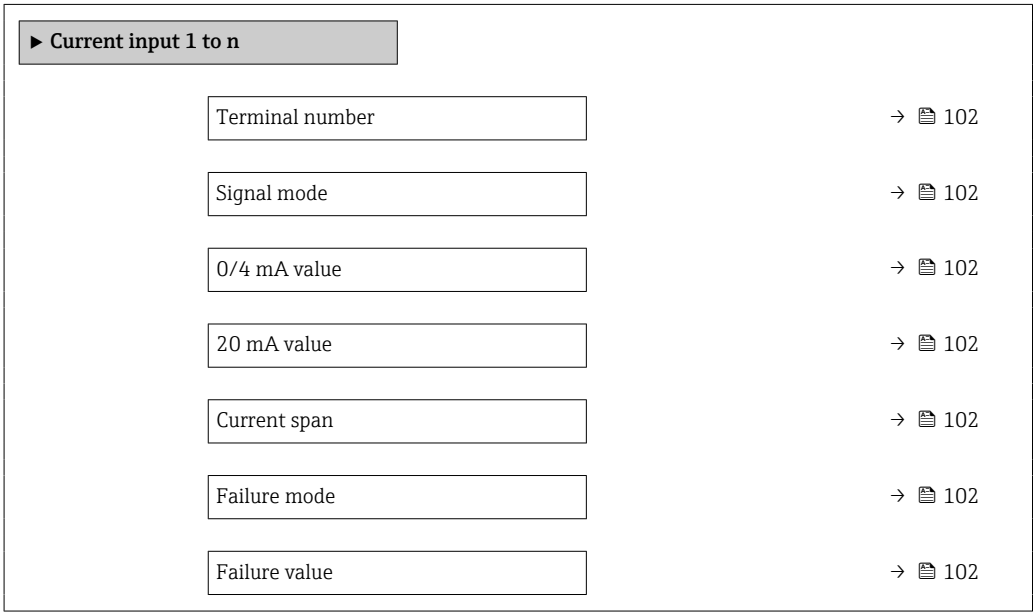
Parameter overview with brief description

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 additional optimization necessary ▪ **Acceptable** option: measuring performance ok, optimize if possible. Always strive to have the **Good** option. ▪ **Bad** option: optimization is necessary, bad and unstable measuring performance. Check the following points to optimize the sensor installation: ▪ Number of traverses, change if necessary (e.g. from 2 traverses to 1 traverse) ▪ Sensor distance ▪ Alignment of sensors ▪ Sufficient coupling medium available (coupling pad or coupling gel) ▪ 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	Shows the sound velocity currently measured.	Signed floating-point number

10.4.7 Configuring the current input

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

Navigation
"Setup" menu → Current input



Parameter overview with brief description

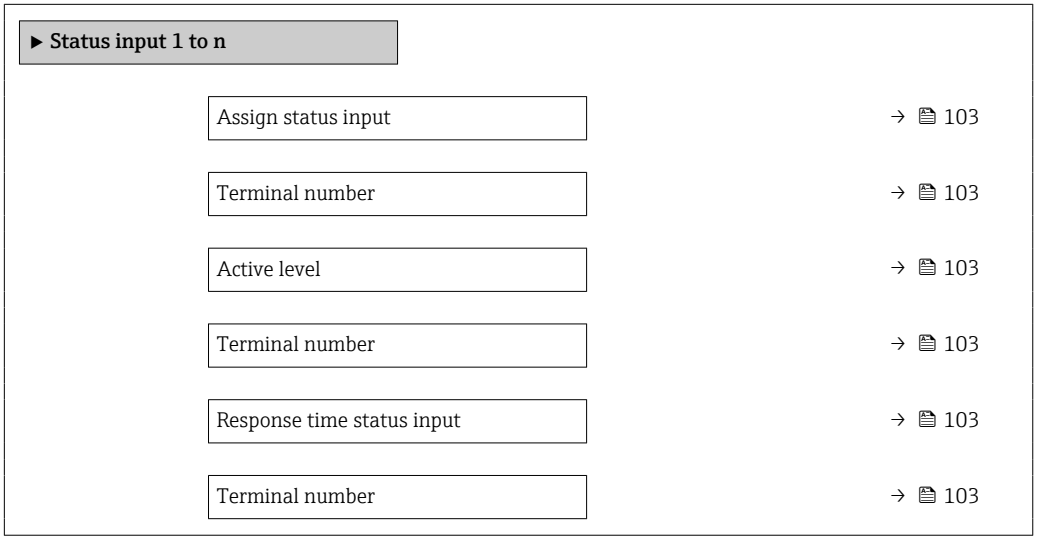
Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the current input.	▪ Passive ▪ Active *	–
0/4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

* Visibility depends on order options or device settings

10.4.8 Configuring the status input

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

Navigation
"Setup" menu → Status input



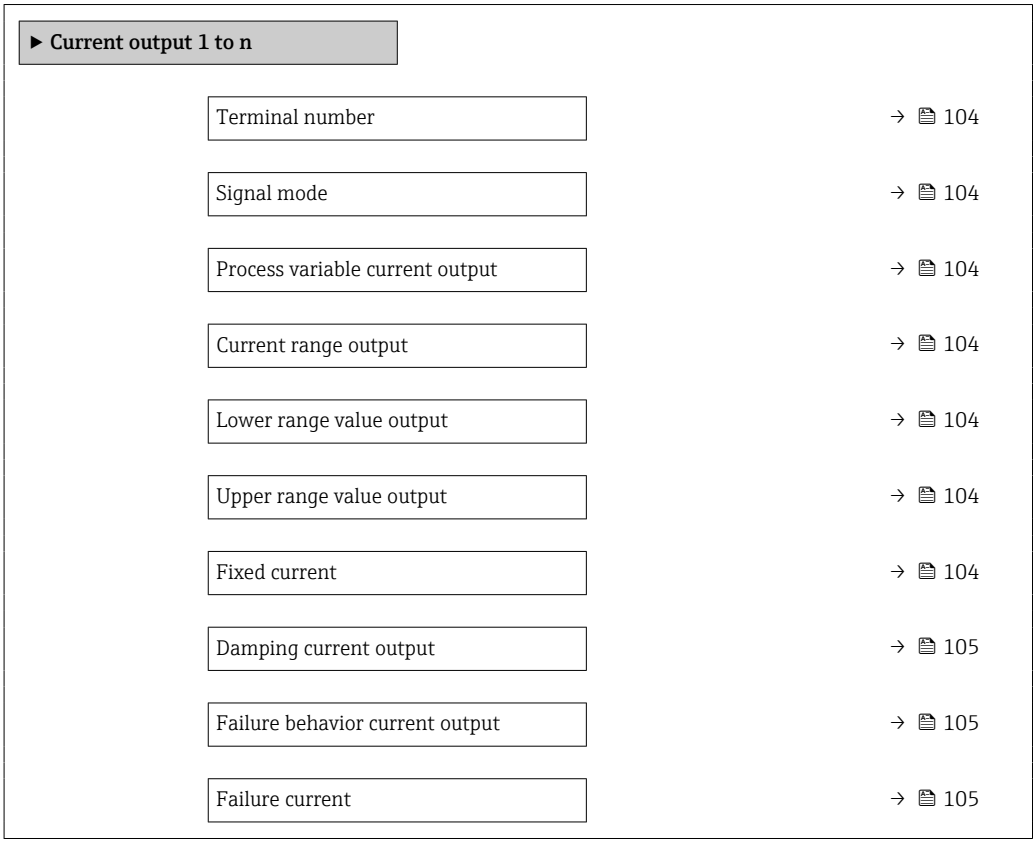
Parameter overview with brief description

Parameter	Description	Selection / User interface / User entry
Assign status input	Select function for the status input.	▪ Off ▪ Reset totalizer 1 ▪ Reset totalizer 2 ▪ Reset totalizer 3 ▪ Reset all totalizers ▪ Flow override
Terminal number	Shows the terminal numbers used by the status input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)
Active level	Define input signal level at which the assigned function is triggered.	▪ High ▪ Low
Response time status input	Define the minimum amount of time the input signal level must be present before the selected function is triggered.	5 to 200 ms

10.4.9 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



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the current output.	▪ Active * ▪ Passive *	Active
Process variable current output	–	Select process variable for current output.	▪ Off * ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Acceptance rate * ▪ Temperature * ▪ Density * ▪ Electronics temperature	–
Current range output	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA NAMUR (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	Country-specific: ▪ 4...20 mA NAMUR (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA)
Lower range value output	In the **Current span** parameter (→ 🖹 104), one of the following options is selected: ▪ 4...20 mA NAMUR (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 4 mA value.	Signed floating-point number	Country-specific: ▪ m^3/h ▪ ft^3/h
Upper range value output	In the **Current span** parameter (→ 🖹 104), one of the following options is selected: ▪ 4...20 mA NAMUR (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 20 mA value.	Signed floating-point number	Depends on country and nominal diameter
Fixed current	The **Fixed current** option is selected in the **Current span** parameter (→ 🖹 104).	Defines the fixed output current.	0 to 22.5 mA	22.5 mA

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Damping current output	A process variable is selected in the **Assign current output** parameter (→ 🖹 104) and one of the following options is selected in the **Current span** parameter (→ 🖹 104): ▪ 4...20 mA NAMUR (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)	Set reaction time for output signal to fluctuations in the measured value.	0.0 to 999.9 s	–
Failure behavior current output	A process variable is selected in the **Assign current output** parameter (→ 🖹 104) and one of the following options is selected in the **Current span** parameter (→ 🖹 104): ▪ 4...20 mA NAMUR (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)	Define output behavior in alarm condition.	▪ 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	22.5 mA

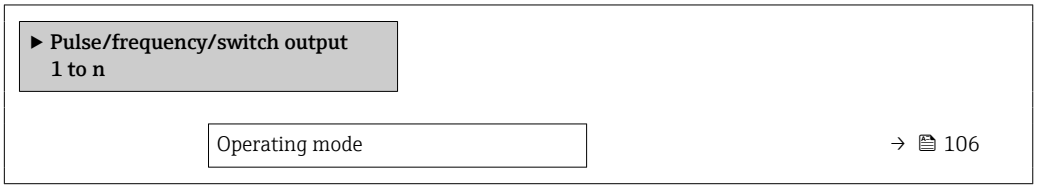
* Visibility depends on order options or device settings

10.4.10 Configuring the pulse/frequency/switch output

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

Navigation

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



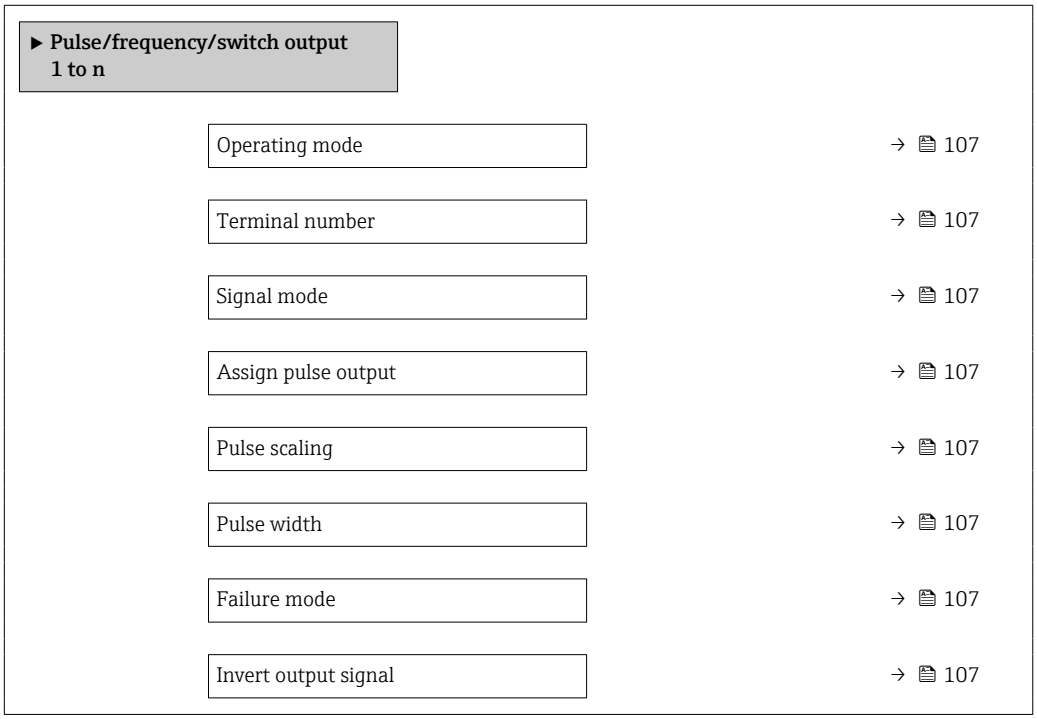
Parameter overview with brief description

Parameter	Description	Selection
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

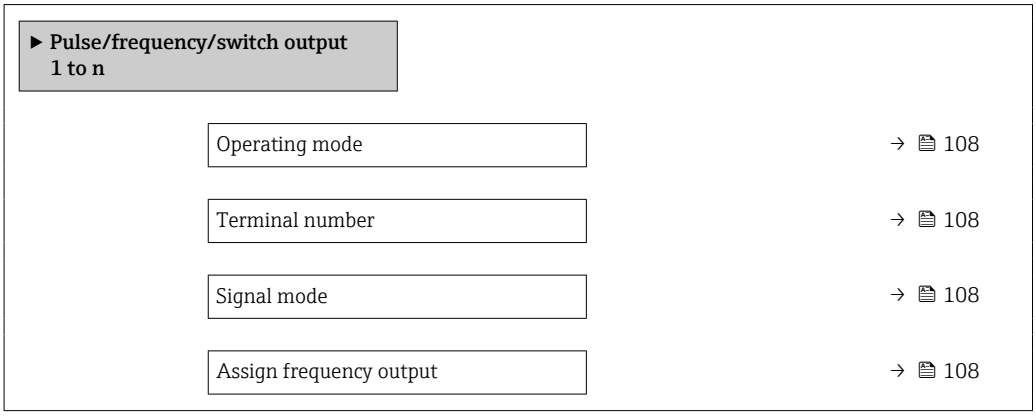
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	–
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active * ▪ Passive NAMUR	–
Assign pulse output 1 to n	The **Pulse** option is selected in the **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 (→ 🖹 106) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 107).	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 (→ 🖹 106) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 107).	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 (→ 🖹 106) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 107).	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	–
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	–

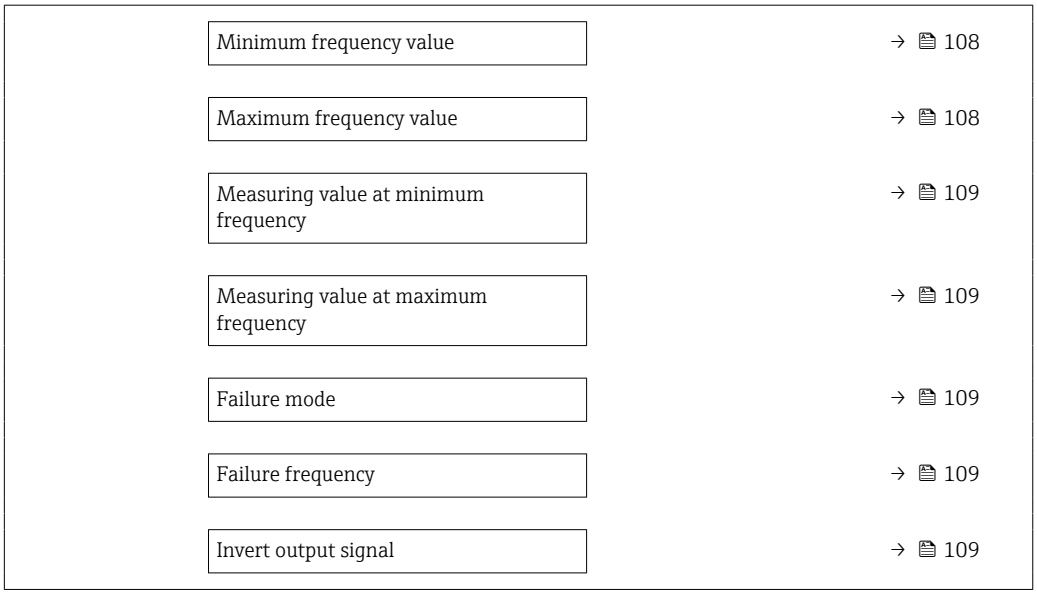
* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output





Parameter overview with brief description

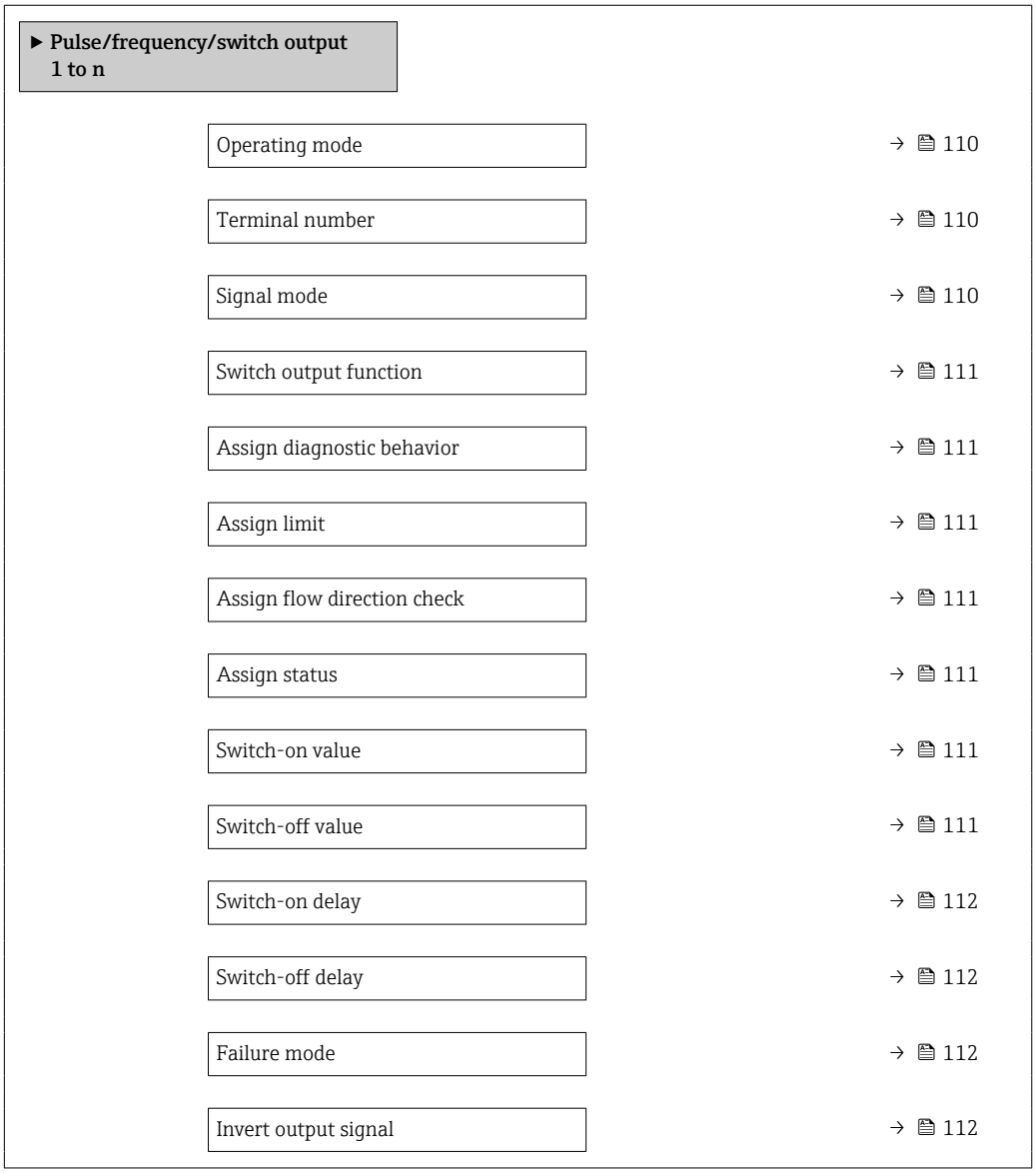
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	–
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active * ▪ Passive NAMUR	–
Assign frequency output	The **Frequency** option is selected in the **Operating mode** parameter (→ 106).	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Temperature * ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Acceptance rate * ▪ Electronics temperature ▪ Density *	–
Minimum frequency value	The **Frequency** option is selected in the **Operating mode** parameter (→ 106) and a process variable is selected in the **Assign frequency output** parameter (→ 108).	Enter minimum frequency.	0.0 to 10 000.0 Hz	–
Maximum frequency value	The **Frequency** option is selected in the **Operating mode** parameter (→ 106) and a process variable is selected in the **Assign frequency output** parameter (→ 108).	Enter maximum frequency.	0.0 to 10 000.0 Hz	–

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Measuring value at minimum frequency	The **Frequency** option is selected in the **Operating mode** parameter (→ 106) and a process variable is selected in the **Assign frequency output** parameter (→ 108).	Enter measured value for minmum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum frequency	The **Frequency** option is selected in the **Operating mode** parameter (→ 106) and a process variable is selected in the **Assign frequency output** parameter (→ 108).	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 (→ 106) and a process variable is selected in the **Assign frequency output** parameter (→ 108).	Define output behavior in alarm condition.	▪ Actual value ▪ Defined value ▪ 0 Hz	–
Failure frequency	The **Frequency** option is selected in the **Operating mode** parameter (→ 106) and a process variable is selected in the **Assign frequency output** parameter (→ 108).	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



Parameter overview with brief description

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

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch output function	The **Switch** option is selected in the **Operating mode** parameter 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.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	–
Assign limit	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Temperature * ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Electronics temperature ▪ Acceptance rate * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Density *	–
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.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity	–
Assign status	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Status** option is selected in the **Switch output function** parameter.	Select device status for switch output.	▪ Off ▪ Low flow cut off	–
Switch-on value	▪ The **Switch** option is selected in the **Operating mode** parameter parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter parameter.	Enter measured value for the switch-on point.	Signed floating-point number	Country-dependent
Switch-off value	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Enter measured value for the switch-off point.	Signed floating-point number	Country-dependent

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

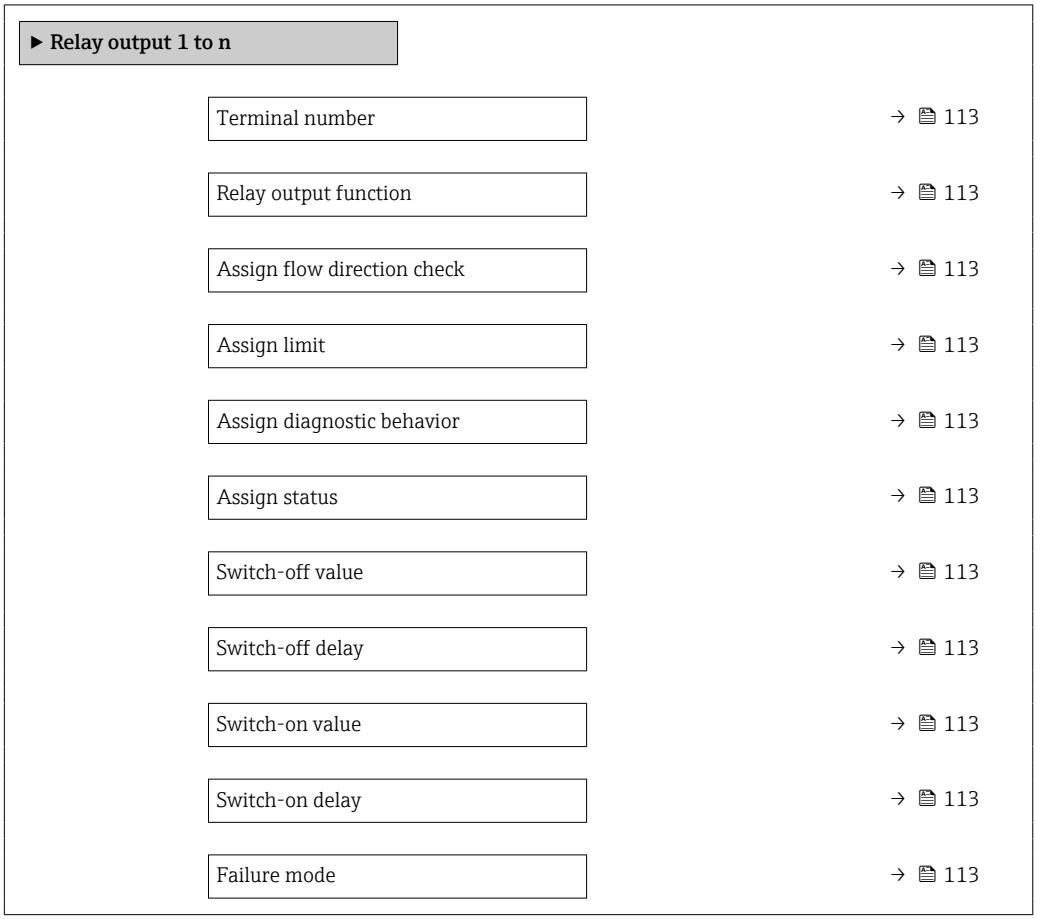
* Visibility depends on order options or device settings

10.4.11 Configuring the relay output

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

Navigation

"Setup" menu → Relay output 1 to n



Parameter overview with brief description

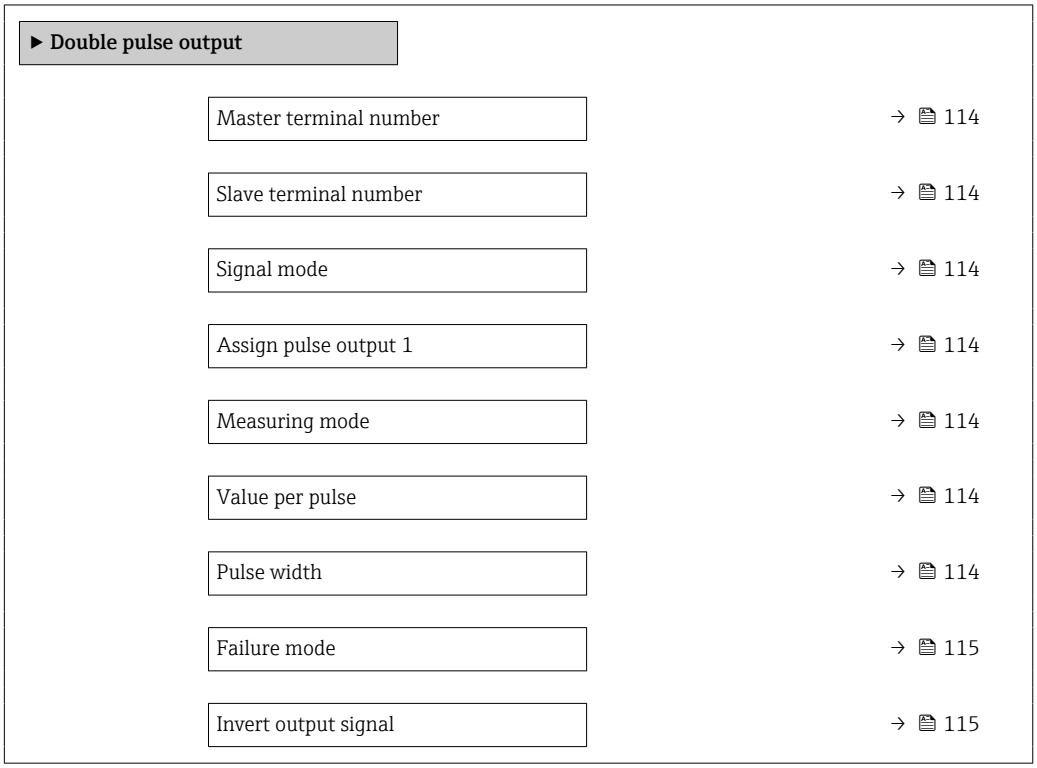
Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Relay output function	–	Select the function for the relay output.	▪ Closed ▪ Open ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Digital Output	–
Assign flow direction check	The **Flow direction check** option is selected in the **Relay output function** parameter.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Flow velocity	–
Assign limit	The **Limit** option is selected in the **Relay output function** parameter.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Temperature * ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Electronics temperature ▪ Acceptance rate * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Density *	–
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.	▪ Off ▪ Low flow cut off	–
Switch-off value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	–
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	0 m^3/h
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	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	–

* Visibility depends on order options or device settings

10.4.12 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	User interface / Selection / User entry	Factory setting
Master terminal number	Shows the terminal numbers used by the master of the double pulse output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Slave terminal number	Shows the terminal numbers used by the slave of the double pulse output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	Select the signal mode for the double pulse output.	▪ Passive ▪ Active * ▪ Passive NAMUR	–
Assign pulse output 1	Select process variable for pulse output.	▪ Off ▪ Volume flow ▪ 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	–

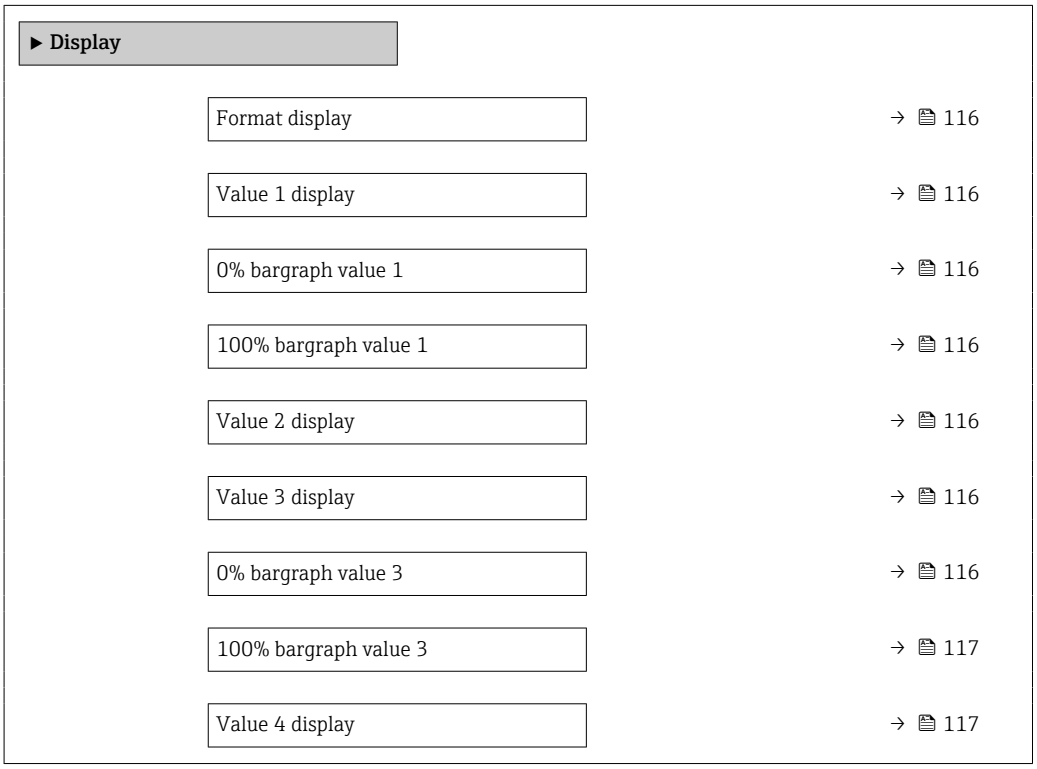
Parameter	Description	User interface / Selection / User entry	Factory setting
Failure mode	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	–
Invert output signal	Invert the output signal.	▪ No ▪ Yes	–

* Visibility depends on order options or device settings

10.4.13 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 ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Electronics temperature ▪ Acceptance rate * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-dependent
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.	▪ None ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Turbulence * ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Electronics temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	–
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 116)	–
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-dependent

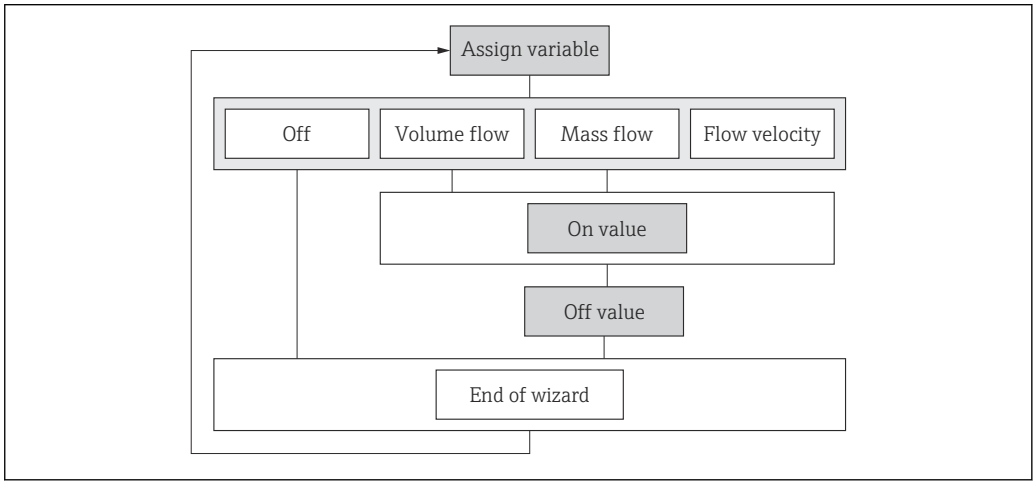
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	–
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 116)	–

* Visibility depends on order options or device settings

10.4.14 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.

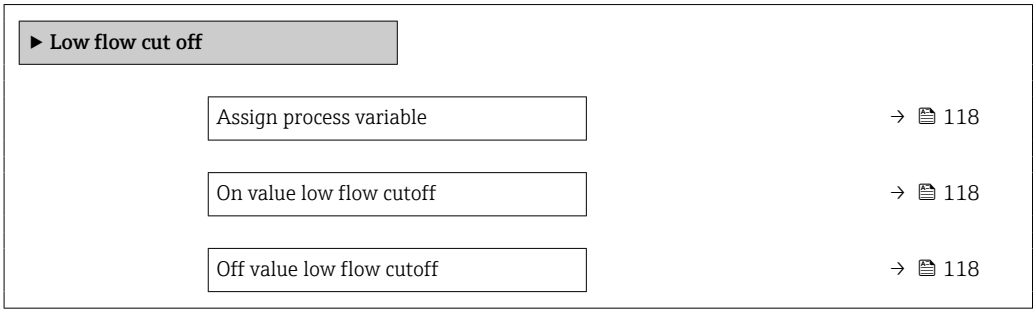
Structure of the wizard



58 *"Low flow cutoff" wizard in the "Setup" menu*

Navigation

"Setup" menu → Low flow cut off



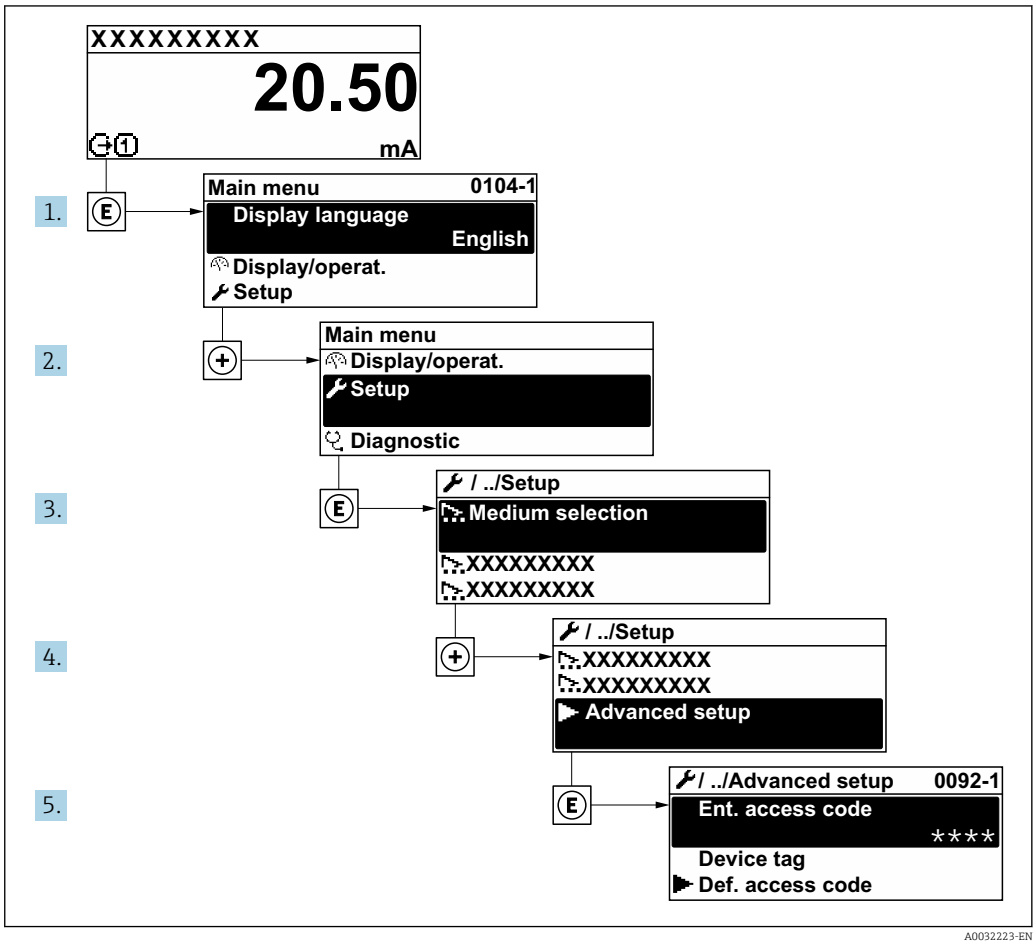
Parameter overview with brief description

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	–
On value low flow cutoff	A process variable is selected in the **Assign process variable** parameter (→ 🖹 118).	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	A process variable is selected in the **Assign process variable** parameter (→ 🖹 118).	Enter off value for low flow cut off.	0 to 100.0 %	–

10.5 Advanced settings

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

Navigation to the "Advanced setup" submenu



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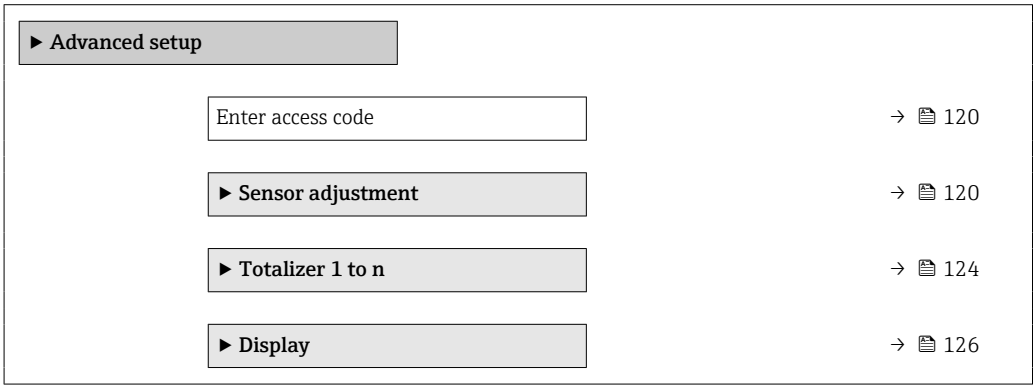
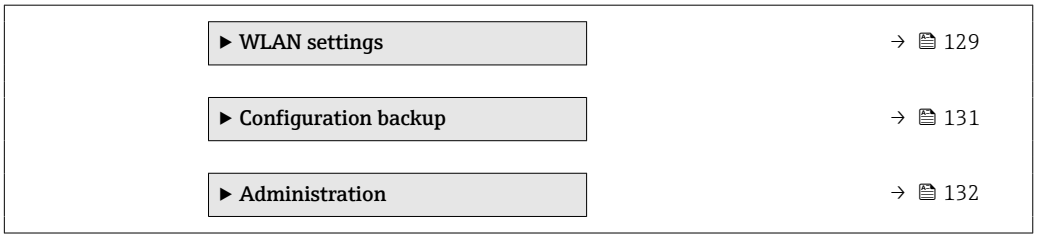
The number of submenus and parameters can vary depending on the device version. Certain submenus and parameters in these submenus are not described in the Operation Instructions. Instead a description is provided in the Special Documentation for the device (→ "Supplementary documentation" section).

Navigation

"Setup" menu → Advanced setup





10.5.1 Using the parameter to enter the access code

Navigation
"Setup" menu → Advanced setup

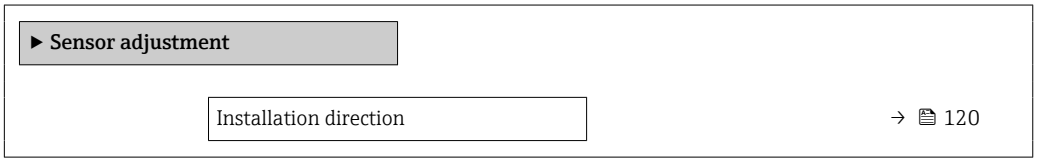
Parameter overview with brief description

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



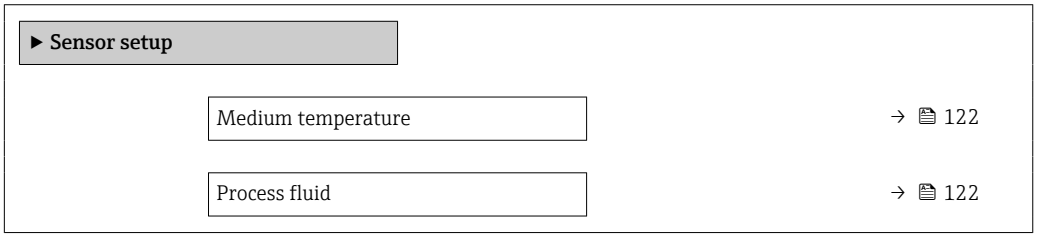
Parameter overview with brief description

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

10.5.3 Performing the sensor setup

The **Sensor setup** submenu contains parameters that concern the sensor setup.

Navigation
"Setup" menu → Advanced setup → Sensor setup



Sound velocity	→ 122
Viscosity	→ 122
Minimum sound velocity	→ 122
Maximum sound velocity	→ 122
Pipe material	→ 122
Pipe sound velocity	→ 122
Pipe dimensions	→ 122
Pipe circumference	→ 122
Pipe outer diameter	→ 123
Pipe wall thickness	→ 123
Liner material	→ 123
Liner sound velocity	→ 123
Liner thickness	→ 123
Sensor type	→ 123
Mounting type	→ 123
Cable length	→ 123
Wire length	→ 123
Sensor distance	→ 123
Signal path length	→ 123
Arc length	→ 123
Sensor distance deviation	→ 123
Arc length deviation	→ 124
Sensor setup result 1	→ 124
Sensor setup result 2	→ 124

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Medium temperature	–	Enter a fixed value for process temperature.	−200 to 550 °C	–
Process fluid	–	Select process fluid.	▪ Water ▪ Sea water ▪ Distilled water ▪ Ammonia NH3 ▪ Benzene ▪ Ethanol ▪ Glycol ▪ Kerosene ▪ Milk ▪ Methanol ▪ User-specific liquid	Water
Sound velocity	The **User-specific liquid** option is selected in the **Process fluid** parameter.	Enter sound velocity of fluid.	200 to 3 000 m/s	–
Viscosity	The **User-specific liquid** option is selected in the **Process fluid** parameter.	Enter medium viscosity at installation temperature.	1E-10 to 0.01 m²/s	–
Minimum sound velocity	–	Enter the minimum deviation of sound velocity.	0.0 to 1 000.0 m/s	–
Maximum sound velocity	–	Enter the maximum deviation of sound velocity.	0.0 to 1 000.0 m/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	User entry / Selection / User interface	Factory setting
Pipe outer diameter	The **Diameter** option is selected in the **Pipe dimensions** parameter.	Define the outer diameter of the pipe.	10 to 5 000 mm	100 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	One of the following options is selected in the **Liner material** parameter: ▪ Cement ▪ Rubber ▪ Epoxy resin ▪ Unknown liner material	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 *	As per order
Mounting type	–	Select how the sensors are arranged to each other. ▪ **(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) direct ▪ (2) V-mounting ▪ (3) Z-Mounting ▪ (4) W-mounting ▪ Automatic	Automatic
Cable length	–	Enter length of sensor cables.	0 to 200 000 mm	As per order
Wire length	–	Shows wire length of installation kit.	Signed floating-point number	–
Sensor distance	–	Shows the distance between the sensors.	Signed floating-point number	–
Signal path length	–	Shows signal path length.	Signed floating-point number	–
Arc length	–	Shows the given radial distance for the mounting position of the sensor.	Signed floating-point number	–
Sensor distance deviation	–	Enter deviation between nominal signal path length and welded position.	Signed floating-point number	–

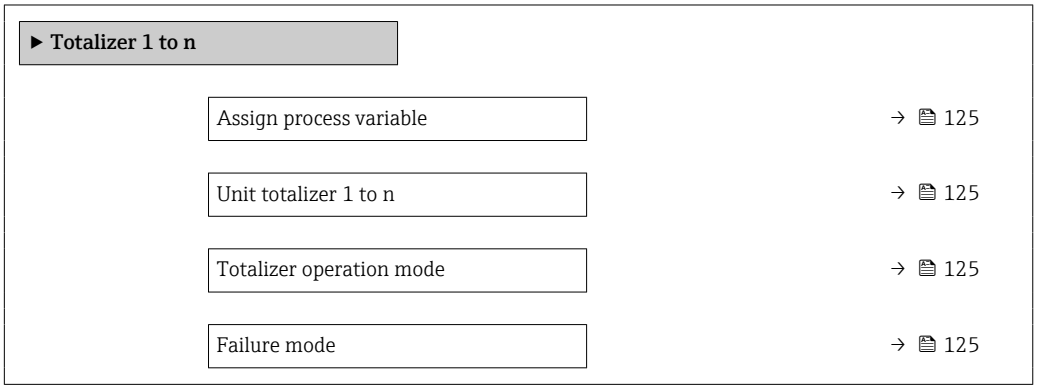
Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Arc length deviation	–	Enter the radial deviation between given radial distance and the real mounting position of the sensor.	Signed floating-point number	–
Result sensor type / mounting type	–	Shows the selected 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	–

* Visibility depends on order options or device settings

10.5.4 Configuring the totalizer

In the **"Totalizer 1 to n" submenu** the individual totalizer can be configured.

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



Parameter overview with brief description

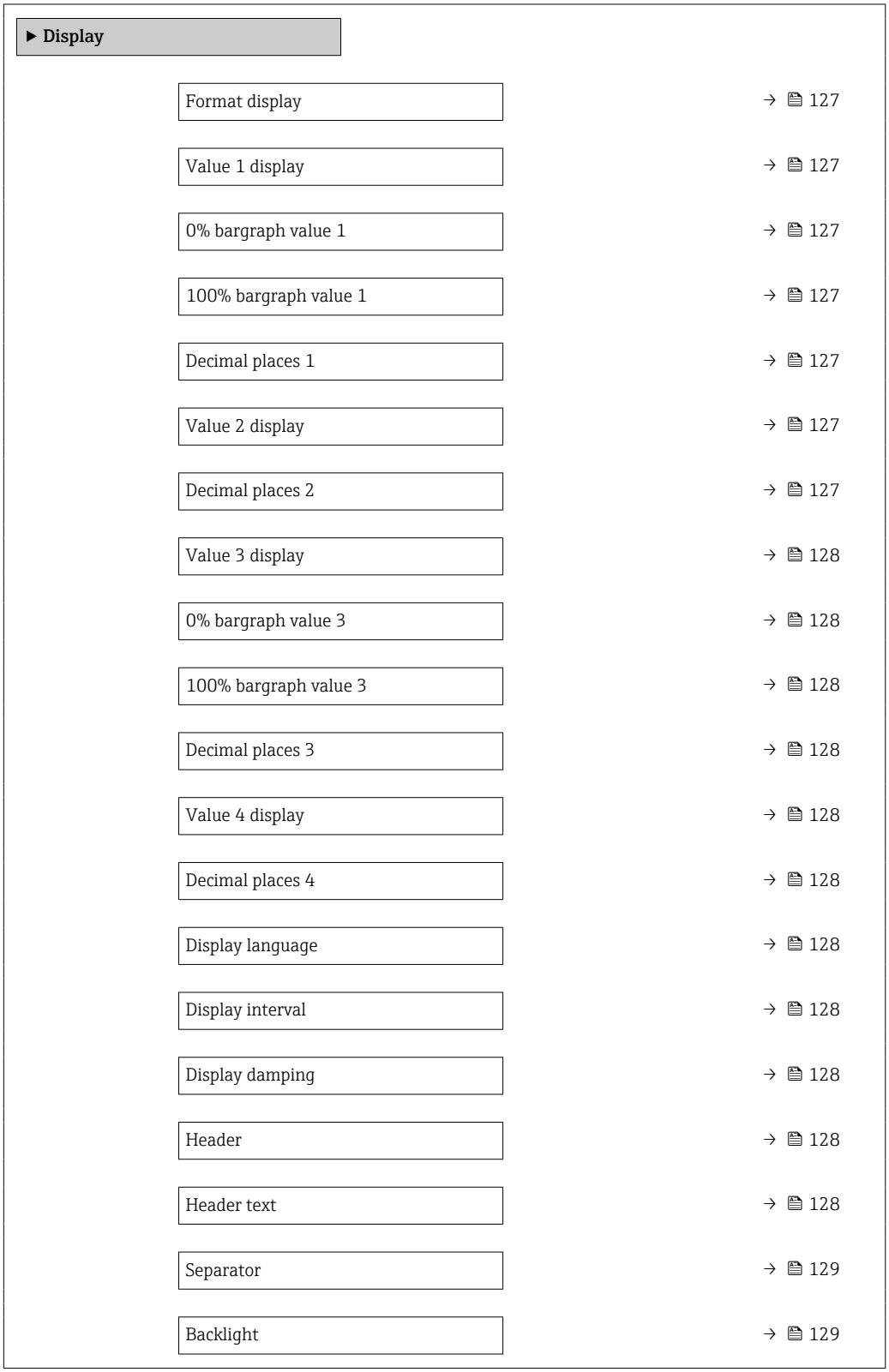
Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable	–	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow	Volume flow
Unit totalizer 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 🖹 125) of the **Totalizer 1 to n** submenu.	Select process variable totalizer unit.	▪ g * ▪ kg * ▪ t * ▪ oz * ▪ lb * ▪ STon * ▪ cm³ * ▪ dm³ * ▪ m³ * ▪ ml * ▪ l * ▪ hl * ▪ Ml Mega * ▪ af * ▪ ft³ * ▪ 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 *	Country-specific: ▪ m³ ▪ ft³
Totalizer operation mode	A process variable is selected in the **Assign process variable** parameter (→ 🖹 125) of the **Totalizer 1 to n** submenu.	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total
Failure mode	A process variable is selected in the **Assign process variable** parameter (→ 🖹 125) of the **Totalizer 1 to n** submenu.	Define totalizer behavior in alarm condition.	▪ Stop ▪ Actual value ▪ Last valid value	Stop

* Visibility depends on order options or device settings

10.5.5 Carrying out additional display configurations

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

Navigation
"Setup" menu → 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 ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Electronics temperature ▪ Acceptance rate * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-dependent
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is defined in the **Value 1 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ 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.	▪ None ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Sound velocity ▪ Turbulence * ▪ Signal strength * ▪ Signal to noise ratio * ▪ Acceptance rate * ▪ Electronics temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	–
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	–

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 the **Value 2 display** parameter (→ 🖹 116)	–
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-dependent
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	–
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 116)	–
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) ▪ Bahasa Indonesia ▪ tiếng Việt (Vietnamese) ▪ čeština (Czech)	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	–
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	In the **Header** parameter, the **Free text** option is selected.	Enter display header text.	Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /)	–

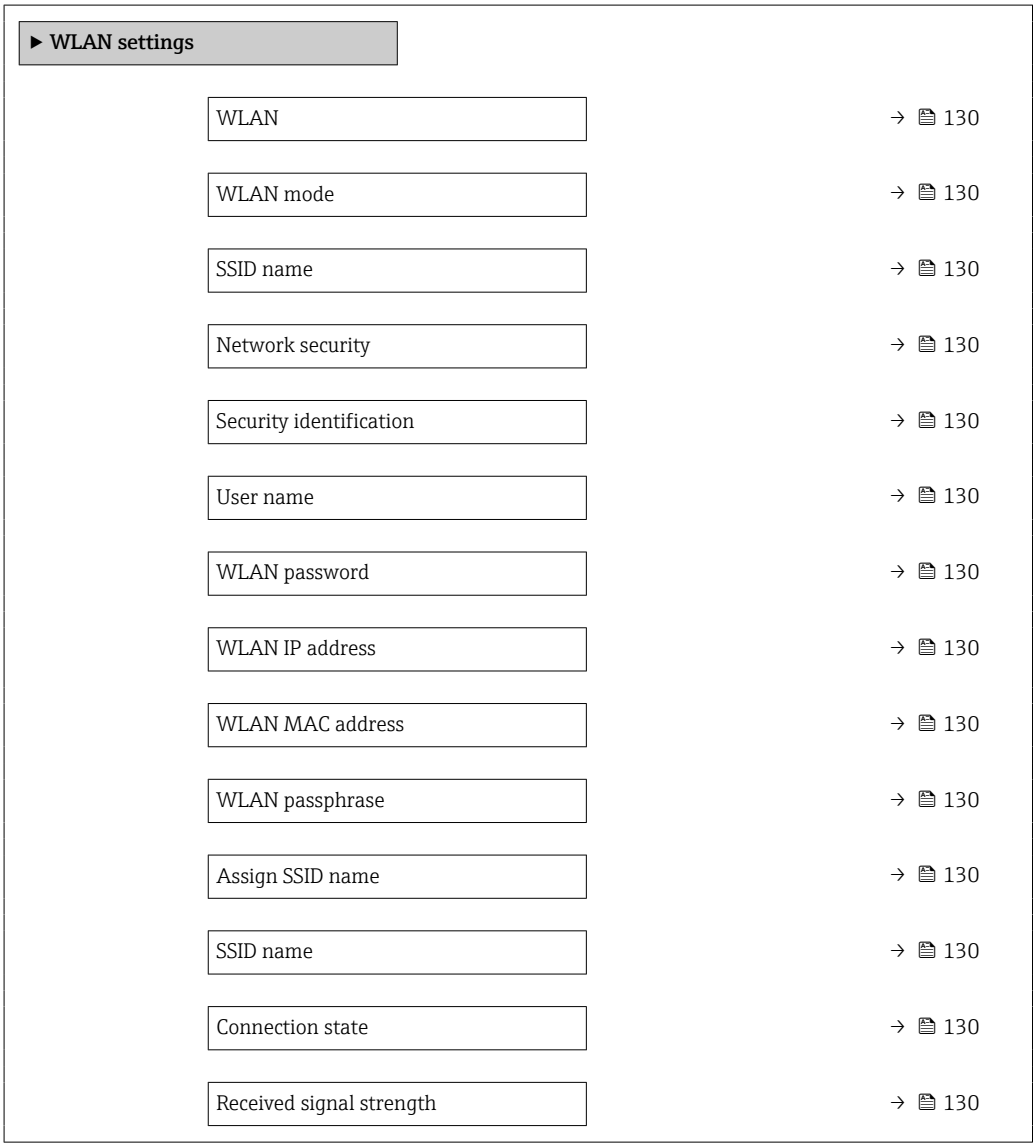
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	▪ . (point) ▪ , (comma)	. (point)
Backlight	One of the following conditions is met: ▪ Order code for "Display; operation", option **F** "4-line, illum.; touch control" ▪ Order code for "Display; operation", option **G** "4-line, illum.; touch control +WLAN"	Switch the local display backlight on and off.	▪ Disable ▪ Enable	–

* Visibility depends on order options or device settings

10.5.6 WLAN configuration

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

Navigation
"Setup" menu → Advanced setup → WLAN settings



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
WLAN	–	Switch WLAN on and off.	▪ Disable ▪ Enable	–
WLAN mode	–	Select WLAN mode.	▪ WLAN access point ▪ WLAN Client	–
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)	–
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_500_A802000)
Connection state	–	Displays the connection status.	▪ Connected ▪ Not connected	–
Received signal strength	–	Shows the received signal strength.	▪ Low ▪ Medium ▪ High	–

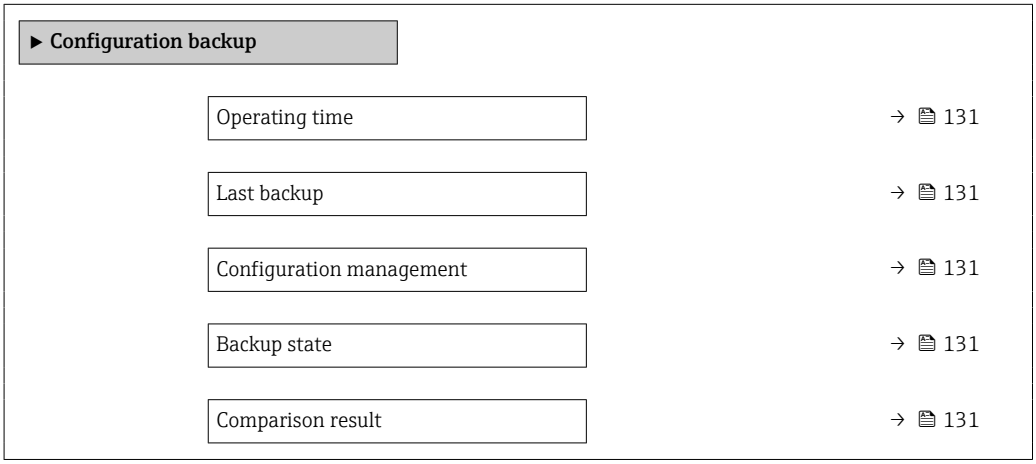
* Visibility depends on order options or device settings

10.5.7 Configuration management

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

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

Navigation
"Setup" menu → Advanced setup → Configuration backup



Parameter overview with brief description

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

* Visibility depends on order options or device settings

Function scope of the "Configuration management" parameter

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

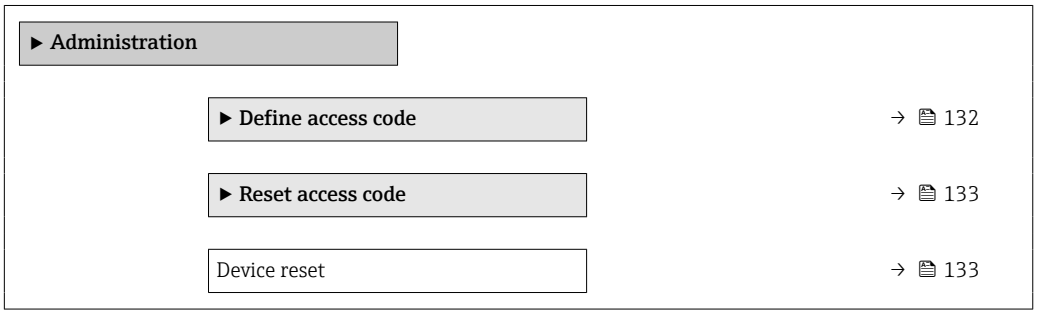
HistoROM backup
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

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

10.5.8 Using parameters for device administration

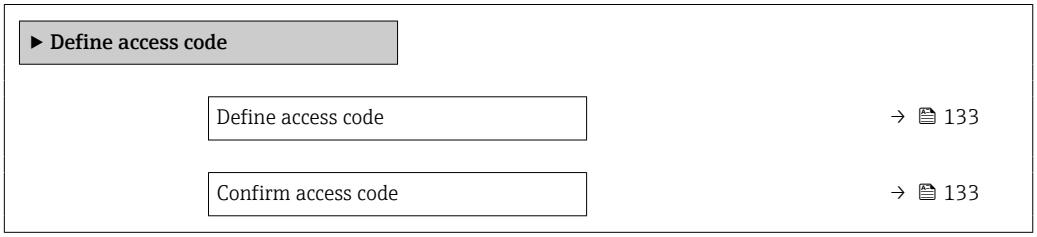
The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation
"Setup" menu → Advanced setup → Administration



Using the parameter to define the access code

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

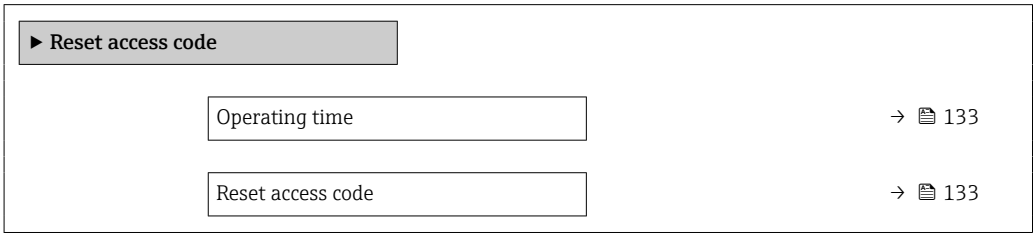


Parameter overview with brief description

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

Using the parameter to reset the access code

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



Parameter overview with brief description

Parameter	Description	User interface / User entry
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)
Reset access code	Reset access code to factory settings. For a reset code, contact your Endress+Hauser service organization. The reset code can only be entered via: ▪ Web browser ▪ DeviceCare, FieldCare (via service interface CDI-RJ45) ▪ 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

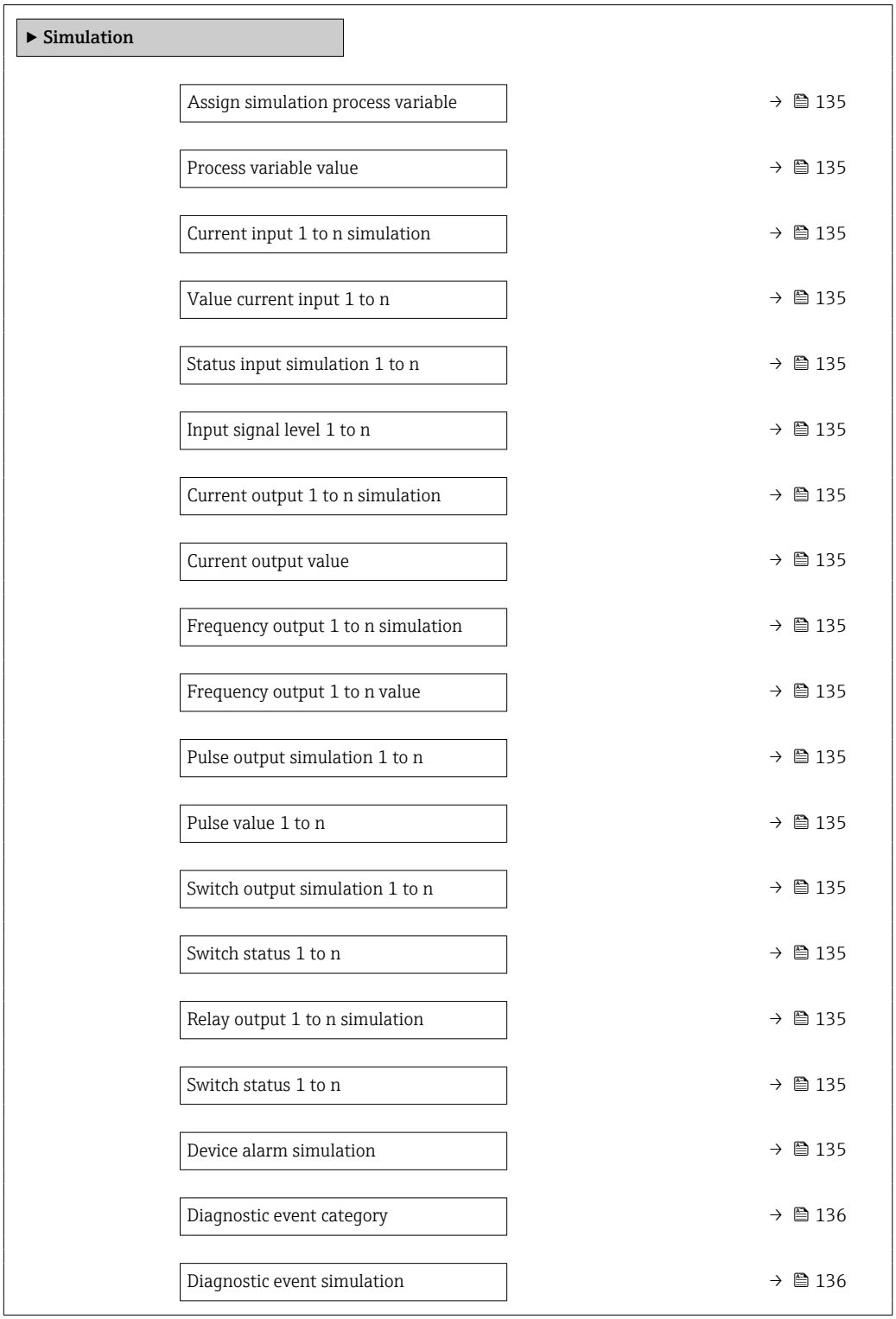
Parameter	Description	Selection
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	▪ Cancel ▪ To delivery settings ▪ Restart device ▪ Restore S-DAT backup *

* Visibility depends on order options or device settings

10.6 Simulation

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

Navigation
"Diagnostics" menu → Simulation



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Temperature * ▪ Density *
Process variable value	A process variable is selected in the **Assign simulation process variable** parameter (→ 135).	Enter the simulation value for the selected process variable.	Depends on the process variable selected
Current input 1 to n simulation	–	Switch simulation of the current input on and off.	▪ Off ▪ On
Value current input 1 to n	In the **Current input 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	0 to 22.5 mA
Status input simulation 1 to n	–	Switch simulation of the status input on and off.	▪ Off ▪ On
Input signal level 1 to n	In the **Status input simulation** parameter, the **On** option is selected.	Select the signal level for the simulation of the status input.	▪ High ▪ Low
Current output 1 to n simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On
Current output value	In the **Current output 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA
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 output 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 (→ 107) 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 status 1 to n	–	Select the status of the status output for the simulation.	▪ Open ▪ Closed
Relay output 1 to n simulation	–	Switch simulation of the relay output on and off.	▪ Off ▪ On
Switch status 1 to n	The **On** option is selected in the **Switch output simulation 1 to n** parameter parameter.	Select status of the relay output for the simulation.	▪ Open ▪ Closed
Device alarm simulation	–	Switch the device alarm on and off.	▪ Off ▪ On

Parameter	Prerequisite	Description	Selection / User entry
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)

* Visibility depends on order options or device settings

10.7 Protecting settings from unauthorized access

The following write protection options exist in order to protect the configuration of the measuring device from unintentional modification:
- Protect access to parameters via access code → 136
- Protect access to local operation via key locking → 73
- Protect access to measuring device via write protection switch → 137

10.7.1 Write protection via access code

The effects of the user-specific access code are as follows:
- Via local operation, the parameters for the measuring device configuration are write-protected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.
- Device access is protected via FieldCare or DeviceCare (via CDI-RJ45 service interface), as are the parameters for the measuring device configuration.

Defining the access code via local display

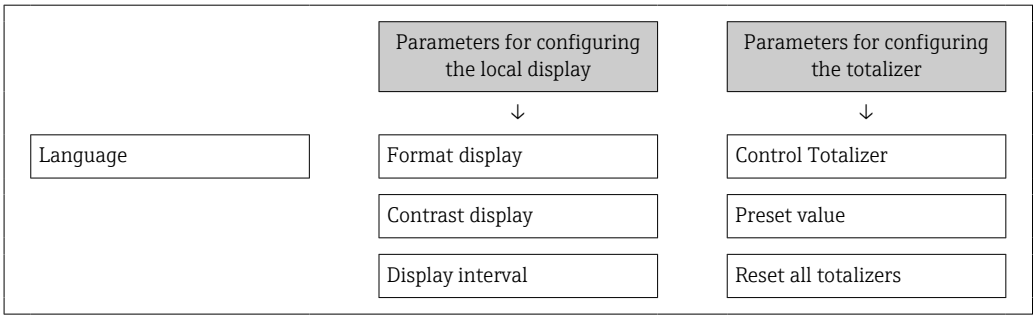
1. Navigate to the **Define access code** parameter (→ 133).
2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 133) to confirm the code.
   ↳ The 🔒-symbol appears in front of all write-protected parameters.

The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 72.
- The user role with which the user is currently logged on via the local display → 72 is indicated by the **Access status** parameter. Navigation path: Operation → Access status

Parameters which can always be modified via the local display

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



Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 133).
2. Define a max. 16-digit numeric code as an access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 133) to confirm the code.
   ↳ The Web browser switches to the login page.

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

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 72.
- The user role with which the user is currently logged on via Web browser is indicated by the **Access status** parameter. Navigation path: Operation → Access status

Resetting the access code

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

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

For a reset code, contact your Endress+Hauser service organization.

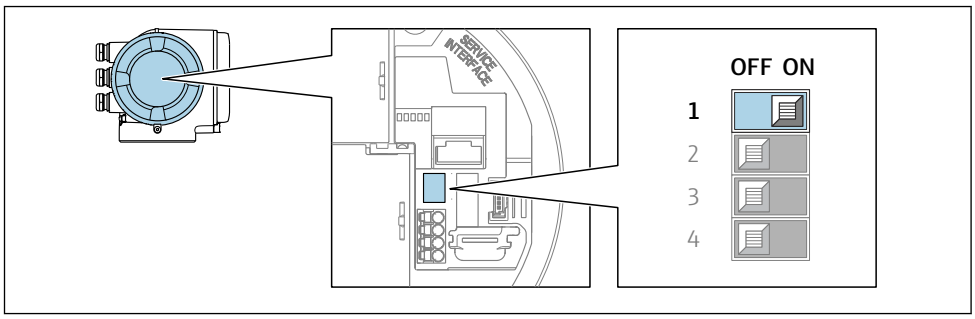
1. Navigate to the **Reset access code** parameter (→ 133).
2. Enter the reset code.
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 136.

10.7.2 Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for the **"Contrast display" parameter** - to be locked.

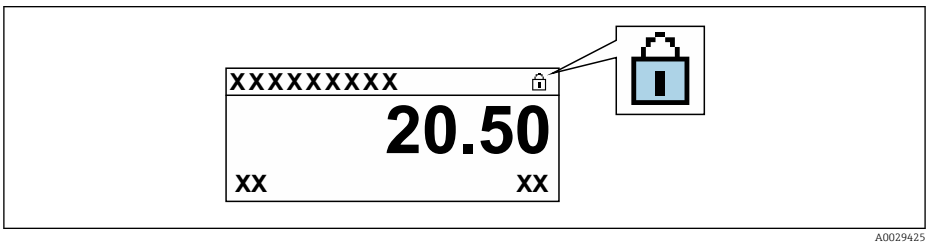
The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via MODBUS RS485 protocol

Proline 500

1. 

Setting the write protection (WP) switch on the main electronics module to the **ON** position enables hardware write protection.

↳ In the **Locking status** parameter the **Hardware locked** option is displayed → 139. In addition, on the local display the -symbol appears in front of the parameters in the header of the operational display and in the navigation view.



2. Setting the write protection (WP) switch on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.

↳ No option is displayed in the **Locking status** parameter → 139. On the local display, the -symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

11 Operation

11.1 Reading the device locking status

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

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access status displayed in the **Access status** parameter applies → 🖹 72. Only appears on local display.
Hardware locked	The DIP switch for hardware locking is activated on the PCB board. This locks write access to the parameters (e.g. via local display or operating tool) → 🖹 137.
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 → 🖹 91
- For information on the operating languages supported by the measuring device → 🖹 192

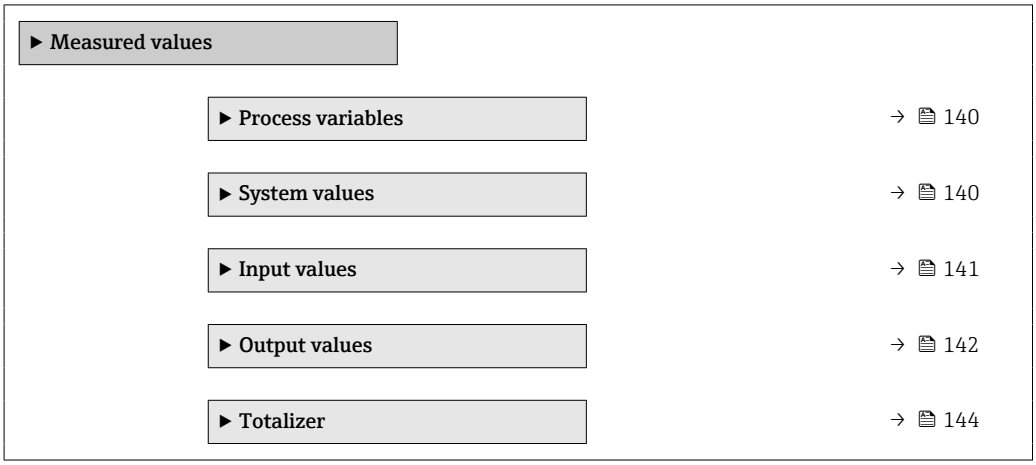
11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 🖹 115
- On the advanced settings for the local display → 🖹 126

11.4 Reading measured values

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

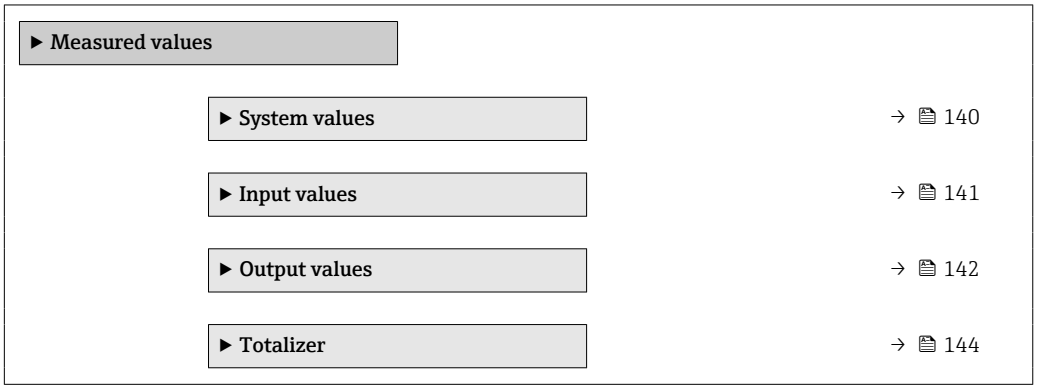
Navigation
"Diagnostics" menu → Measured values



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



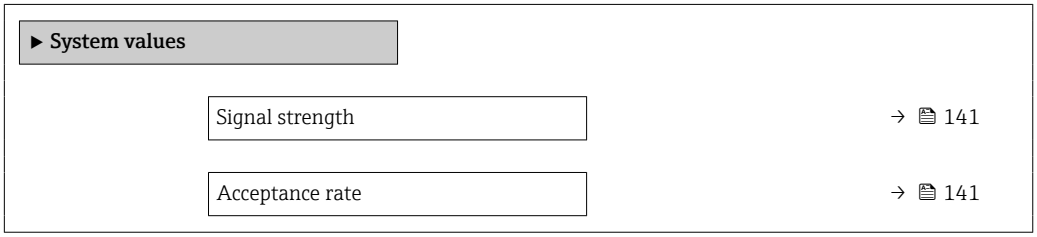
Parameter overview with brief description

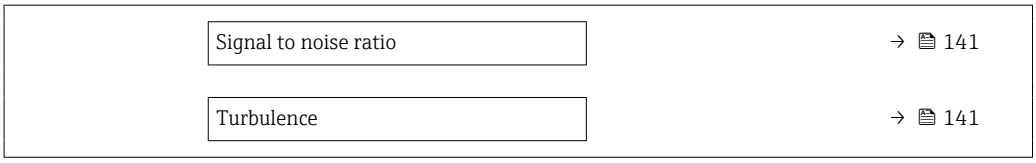
Parameter	Description	User interface
Volume flow	Displays the volume flow that is currently measured. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 94).	Signed floating-point number
Mass flow	Displays the mass flow that is currently calculated. *Dependency* The unit is taken from the **Mass flow unit** parameter (→ 94).	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
Flow velocity	Displays the average flow velocity that is currently calculated. *Dependency* The unit is taken from the **Velocity 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

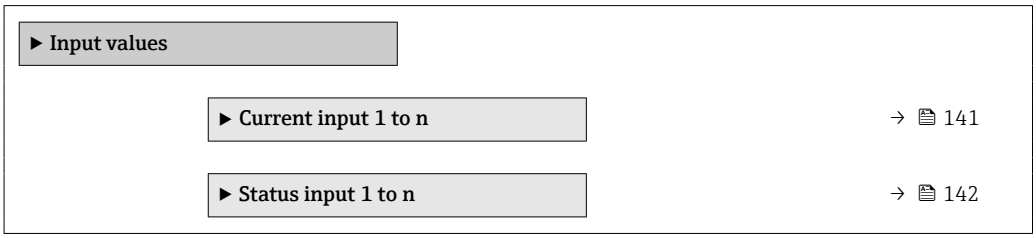
Parameter	Description	User interface
Signal strength	Displays the current signal strength (0 to 100 dB). Assessment of the signal strength: ▪ < 10 dB: bad ▪ > 90 dB: very good	Signed floating-point number
Acceptance rate	Displays the ratio of the number of ultrasonic signals accepted for flow calculation 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" submenu

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

Navigation

"Diagnostics" menu → Measured values → Input values

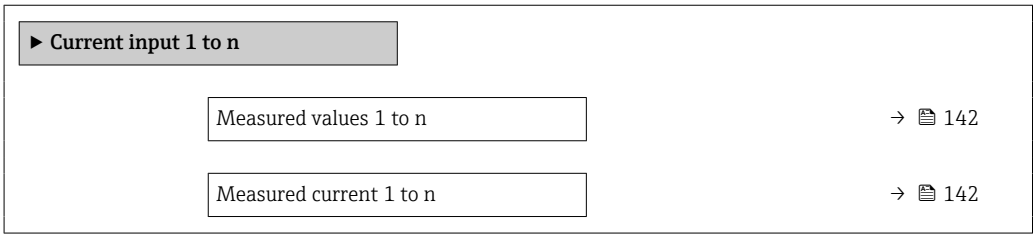


Input values of current input

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

Navigation

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



Parameter overview with brief description

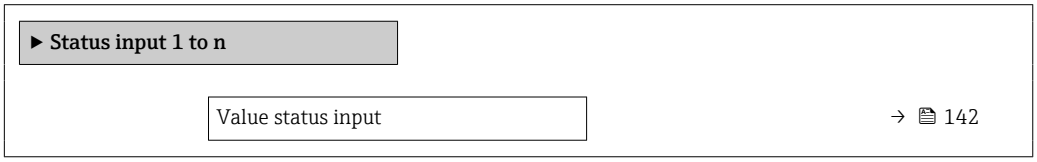
Parameter	Description	User interface
Measured values 1 to n	Displays the current input value. *Dependency* The unit is taken from the **Pressure unit** parameter	Signed floating-point number
Measured current 1 to n	Displays the current value of the current input.	0 to 22.5 mA

Input values of status input

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

Navigation

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



Parameter overview with brief description

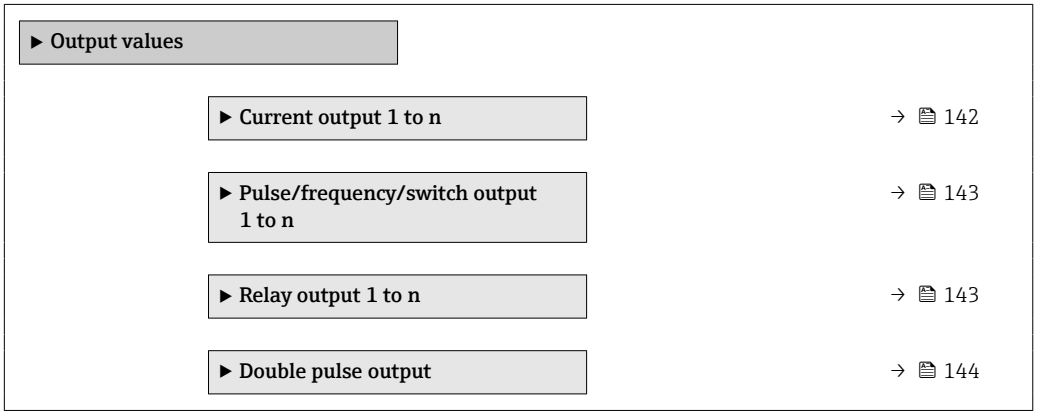
Parameter	Description	User interface
Value status input	Shows the current input signal level.	▪ High ▪ Low

11.4.4 Output values

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

Navigation

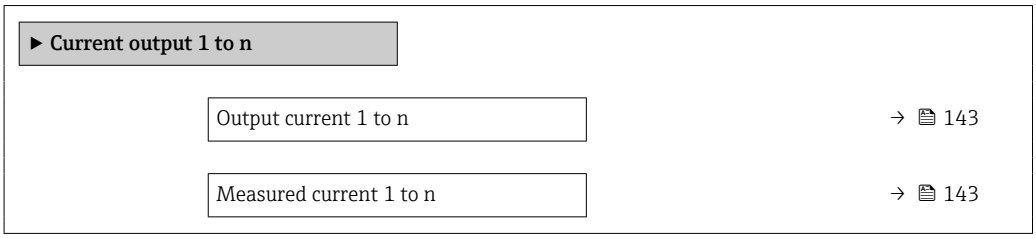
"Diagnostics" menu → Measured values → Output values



Output values of current output

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

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



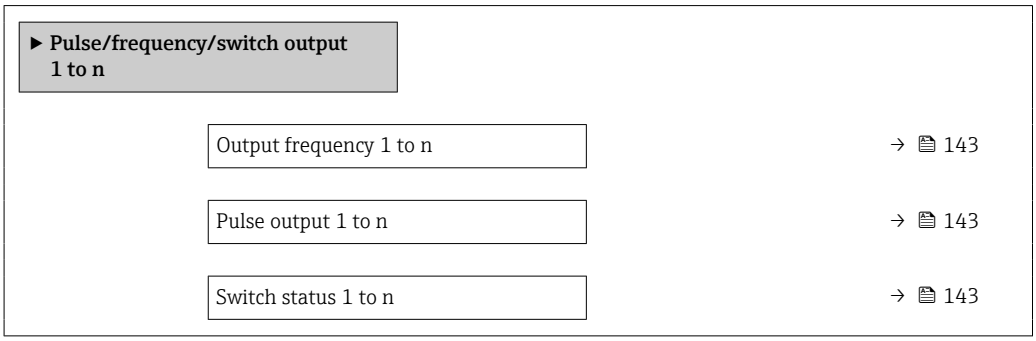
Parameter overview with brief description

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

Output values for pulse/frequency/switch output

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

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



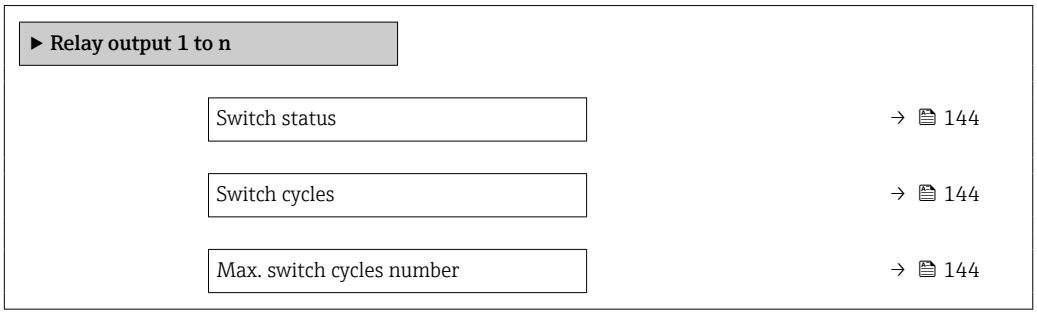
Parameter overview with brief description

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

Output values for relay output

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

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



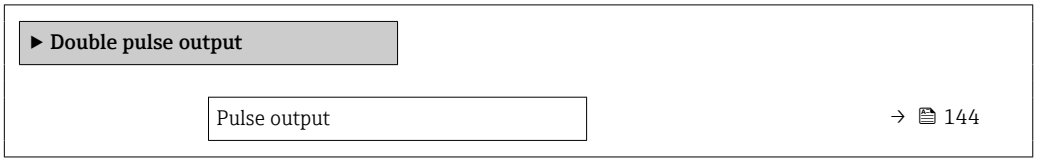
Parameter overview with brief description

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

Output values for double pulse output

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

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



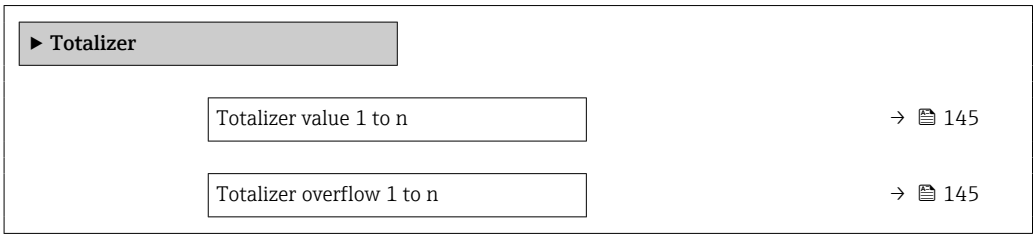
Parameter overview with brief description

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

11.4.5 "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 value 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 125) of the **Totalizer 1 to n** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 125) of the **Totalizer 1 to n** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer overflow.	Integer with sign

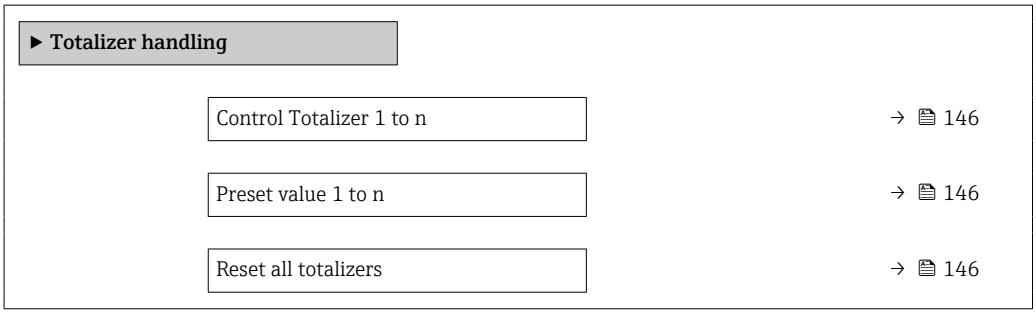
11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 91)
- Advanced settings using the**Advanced setup** submenu (→ 119)

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	Factory setting
Control Totalizer 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 125) 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 (→ 125) of the **Totalizer 1 to n** submenu.	Specify start value for totalizer. *Dependency* The unit of the selected process variable is specified for the totalizer in the **Unit totalizer** parameter (→ 125).	Signed floating-point number	Country-specific: ▪ 0 m³ ▪ 0 ft³
Reset all totalizers	–	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	–

11.6.1 Function scope of the "Control Totalizer" parameter

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

11.6.2 Function scope of the "Reset all totalizers" parameter

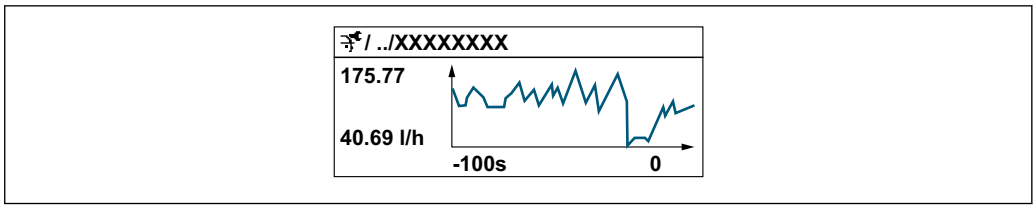
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

11.7 Showing data logging

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

Data logging is also available via:
- Plant Asset Management Tool FieldCare → 83.
- Web browser

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



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

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

Navigation
"Diagnostics" menu → Data logging

▶ Data logging	
Assign channel 1	→ 148
Assign channel 2	→ 148
Assign channel 3	→ 148
Assign channel 4	→ 148
Logging interval	→ 148
Clear logging data	→ 148
Data logging	→ 148
Logging delay	→ 148
Data logging control	→ 148
Data logging status	→ 148
Entire logging duration	→ 148

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 ▪ Signal strength * ▪ Signal to noise ratio * ▪ Turbulence * ▪ Acceptance rate * ▪ Electronics temperature ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 * ▪ 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 process variable to logging channel.	For the picklist, see the **Assign channel 1** parameter (→ 148)
Assign channel 3	The **Extended HistoROM** application package is available. The software options currently enabled are displayed in the **Software option overview** parameter.	Assign process variable to logging channel.	For the picklist, see the **Assign channel 1** parameter (→ 148)
Assign channel 4	The **Extended HistoROM** application package is available. The software options currently enabled are displayed in the **Software option overview** parameter.	Assign process variable to logging channel.	For the picklist, see the **Assign channel 1** parameter (→ 148)
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 data logging method.	▪ 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 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Error	Possible causes	Remedy
Local display dark and no output signals	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage → 📄 50.
Local display dark and no output signals	The polarity of the supply voltage is wrong.	Correct the polarity.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
Local display dark and no output signals	Terminals are not plugged into the I/O electronics module correctly. Terminals are not plugged into the main electronics module correctly.	Check terminals.
Local display dark and no output signals	I/O electronics module is defective. Main electronics module is defective.	Order spare part → 📄 171.
Local display dark and no output signals	The connector between the main electronics module and display module is not plugged in correctly.	Check the connection and correct if necessary.
Local display dark and no output signals	The connecting cable is not plugged in correctly.	1. Check the connection of the electrode cable and correct if necessary. 2. Check the connection of the coil current cable and correct if necessary.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 📄 171.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures → 📄 159
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured.	1. Press 2 s ⊟ + ⊞ ("home position"). 2. Press Ⓔ. 3. Set the desired language in the **Display language** parameter (→ 📄 128).
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 → 📄 171.

For output signals

Error	Possible causes	Solution
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 🖹 171.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error	Check and correct the parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

Error	Possible causes	Solution
No write access to parameters	Hardware write protection enabled	Set the write protection switch on main electronics module to the **OFF** position → 🖹 137.
No write access to parameters	Current user role has limited access authorization	1. Check user role → 🖹 72. 2. Enter correct customer-specific access code → 🖹 72.
No connection via Modbus RS485	Modbus RS485 bus cable connected incorrectly	Check the terminal assignment → 🖹 46.
No connection via Modbus RS485	Modbus RS485 cable incorrectly terminated	Check the terminating resistor → 🖹 58.
No connection via Modbus RS485	Incorrect settings for the communication interface	Check the Modbus RS485 configuration → 🖹 94.
Not connecting to Web server	Web server disabled	Using the "FieldCare" or "DeviceCare" operating tool, check whether the web server of the measuring device is enabled, and enable it if necessary→ 🖹 79.
	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) → 🖹 75→ 🖹 75. 2. Check the network settings with the IT manager.
Not connecting to Web server	Incorrect IP address	Check the IP address: 192.168.1.212 → 🖹 75→ 🖹 75
Not connecting to Web server	Incorrect WLAN access data	▪ Check WLAN network status. ▪ Log on to the device again using WLAN access data. ▪ Verify that WLAN is enabled on the measuring device and operating device → 🖹 75.
	WLAN communication disabled	–
Not connecting to Web server, FieldCare or DeviceCare	No WLAN network available	▪ Check if WLAN reception is present: LED on display module is lit blue ▪ Check if WLAN connection is enabled: LED on display module flashes blue ▪ Switch on instrument function.
Network connection not present or unstable	WLAN network is weak.	▪ Operating device is outside of reception range: Check network status on operating device. ▪ To improve network performance, use an external WLAN antenna.

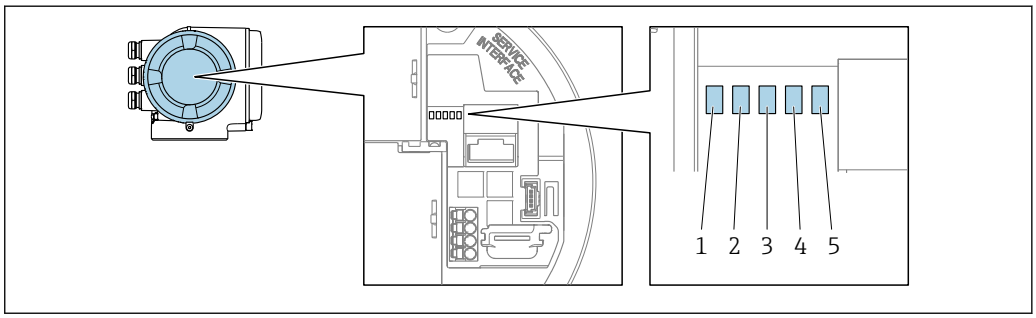
Error	Possible causes	Solution
	Parallel WLAN and Ethernet communication	▪ Check network settings. ▪ Temporarily enable only the WLAN as an interface.
Web browser frozen and operation no longer possible	Data transfer active	Wait until data transfer or current action is finished.
	Connection lost	1. Check cable connection and power supply. 2. Refresh the Web browser and restart if necessary.
Content of Web browser incomplete or difficult to read	Not using optimum version of Web server.	1. Use the correct web browser version → 🖹 74. 2. Clear the Web browser cache and restart the Web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No or incomplete display of contents in the Web browser	▪ JavaScript not enabled ▪ JavaScript cannot be enabled	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.
Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

Proline 500

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



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

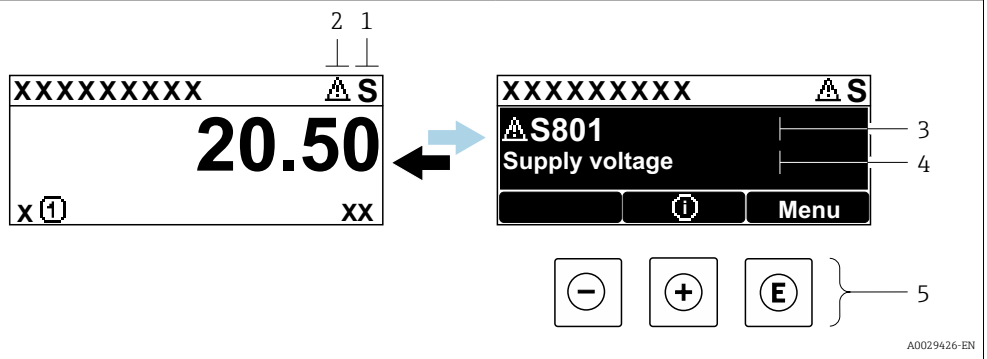
LED		Color	Meaning
1	Supply voltage	Off	Supply voltage is off or too low.
		Green	Supply voltage is ok.
2	Device status (normal operation)	Off	Firmware error
		Green	Device status is ok.
		Flashing green	Device is not configured.
		Red	A diagnostic event with "Alarm" diagnostic behavior has occurred.
		Flashing red	A diagnostic event with "Warning" diagnostic behavior has occurred.
		Flashing red/green	The device restarts.
2	Device status (during start-up)	Flashes red slowly	If > 30 seconds: problem with the boot loader.
		Flashes red quickly	If > 30 seconds: compatibility problem when reading the firmware.
3	Not used	–	–
4	Communication	Off	Communication not active.
		White	Communication active.
5	Service interface (CDI)	Off	Not connected or no connection established.
		Yellow	Connected and connection established.
		Flashing yellow	Service interface active.

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

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

Operational display in alarm condition	Diagnostic message



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

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

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter → 164
- Via submenus → 164

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

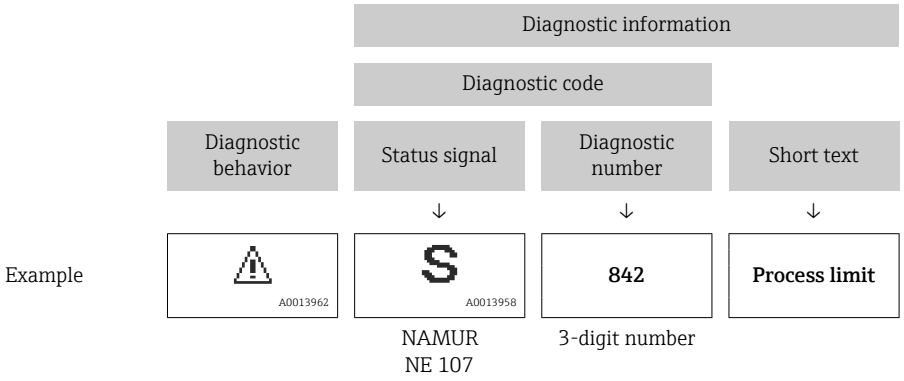
Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device is operated: Outside its technical specification limits (e.g. outside the process temperature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

Diagnostic information

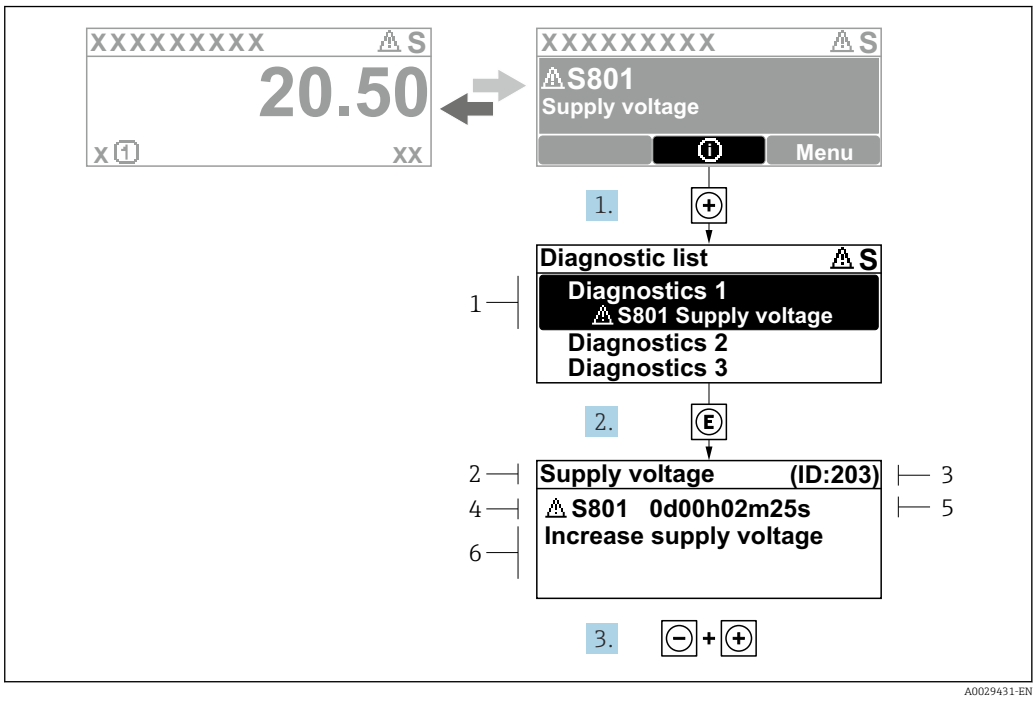
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Key	Meaning
	**Plus key** *In a menu, submenu* Opens the message about remedy information.
	**Enter key** *In a menu, submenu* Opens the operating menu.

12.3.2 Calling up remedial measures



59 *Message about remedial measures*

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

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

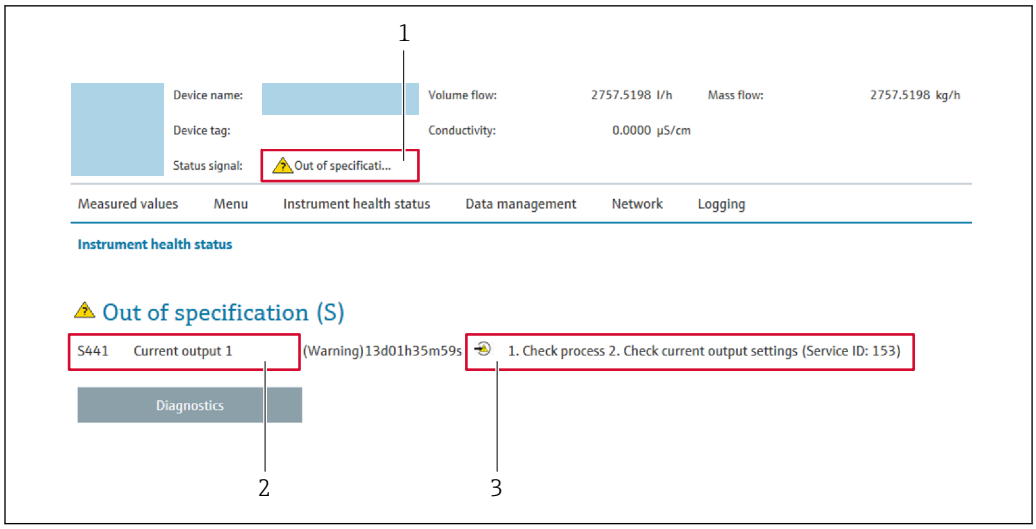
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

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

12.4 Diagnostic information in the Web browser

12.4.1 Diagnostic options

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



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

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 164
- Via submenu → 164

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 operated: Outside its technical specification limits (e.g. outside the process temperature range)
	Maintenance required Maintenance is required. The measured value is still valid.

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

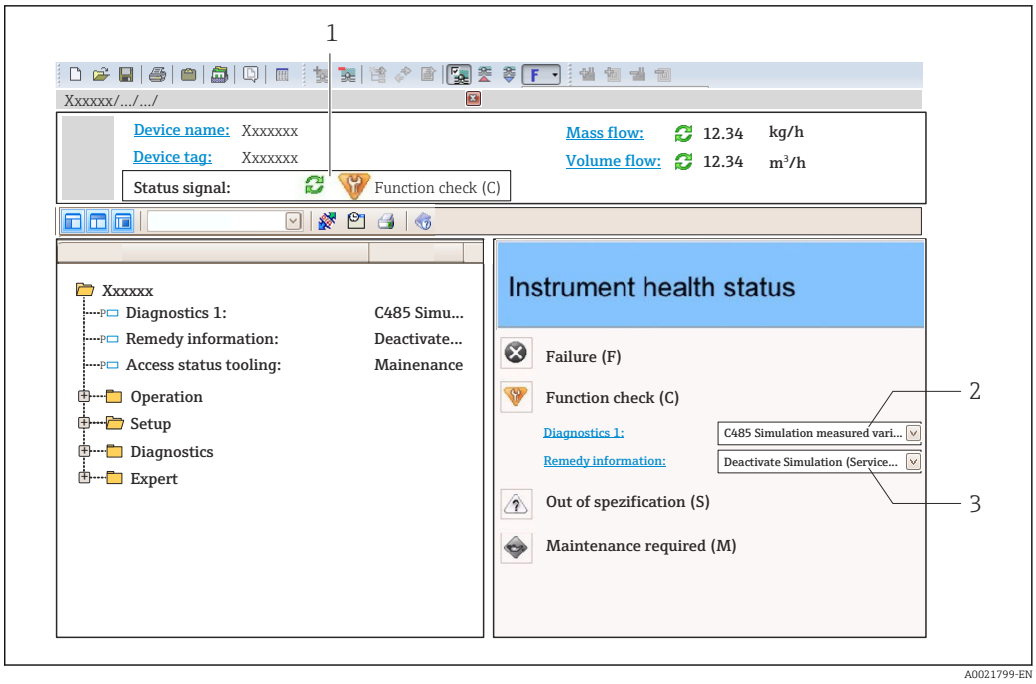
12.4.2 Calling up remedy information

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

12.5 Diagnostic information in FieldCare or DeviceCare

12.5.1 Diagnostic options

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

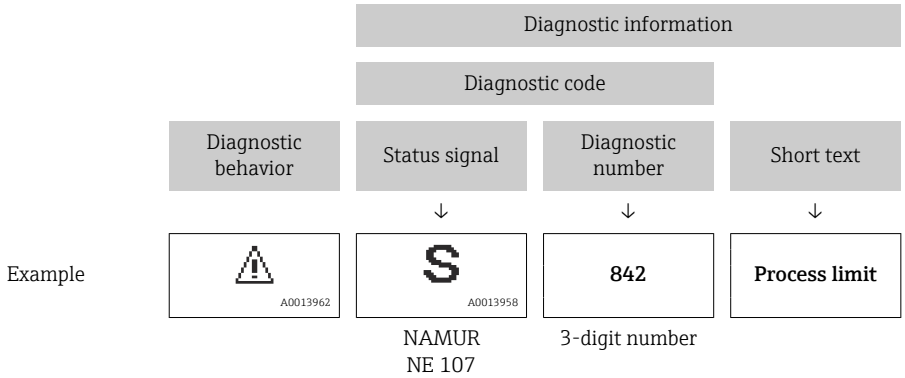


1 *Status area with status signal*→ 🖹 *153*
2 *Diagnostic information*→ 🖹 *154*
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 🖹 164
- Via submenu → 🖹 164

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 **6801** (data type = string): diagnosis code, e.g. F270
- Via register address **6821** (data type = string): diagnosis code, e.g. F270

For an overview of diagnostic events with diagnosis number and diagnosis code → 159

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

Parameters	Description	Selection	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.

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

12.8 Overview of diagnostic information

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

In the case of some items of diagnostic information, the diagnostic behavior can be changed. Adapting the diagnostic information → 158

Not all the diagnostics information is available for the device.

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
022	Temperature sensor defective	Check connection to the temperature sensor	F	Alarm
082	Data storage	1. Check module connections 2. Change electronic modules	F	Alarm
083	Memory content	1. Restart device 2. Restore HistoROM S-DAT backup ('Device reset' parameter) 3. Replace HistoROM S-DAT	F	Alarm
104	Sensor signal path 1 to n	1. Check process conditions 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) 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 to n defective	1. Check connection to the upstream transducer 2. Replace upstream transducer	F	Alarm
124	Relative signal strength	1. Check process conditions 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) 3. Replace sensor electronic module (ISEM)	M	Warning [1)]
125	Relative sound velocity	1. Check process conditions 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) 3. Replace sensor electronic module (ISEM)	M	Warning [1)]
160	Signal path switched off	Contact service	M	Warning [1)]
170	Pressure cell connection defective	1. Check connection to pressure cell 2. Replace pressure cell	F	Alarm
171	Ambient temperature too low	Increase ambient temperature	S	Warning
172	Ambient temperature too high	Reduce ambient temperature	S	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
173	Pressure cell range exceeded	1. Check process conditions 2. Adapt process pressure	S	Warning
174	Pressure cell electronics defective	Replace pressure cell	F	Alarm
175	Pressure cell deactivated	Enable pressure cell	M	Warning
Diagnostic of electronic				
201	Device failure	Restart device	F	Alarm
242	Software incompatible	1. Check software 2. Flash or change main electronic module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Check if correct modules are available (e.g. NEx, Ex) 3. Replace electronic modules	F	Alarm
252	Modules incompatible	1. Check if correct electronic modul is plugged 2. Replace electronic module	F	Alarm
262	Sensor electronics connection faulty	1. Check/replace connection cable between sensor electronic module (ISEM) and main electr. 2. Check/replace module cartridge, ISEM, main electr.	F	Alarm
270	Main electronics failure	Change main electronic module	F	Alarm
271	Main electronics failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronics failure	Restart device	F	Alarm
273	Main electronics failure	Change electronics	F	Alarm
275	I/O module 1 to n defective	Change I/O module	F	Alarm
276	I/O module 1 to n faulty	1. Restart device 2. Change I/O module	F	Alarm
281	Electronic initialization	Firmware update active, please wait!	F	Alarm
283	Memory content	Reset device	F	Alarm
283	Memory content	Restart device	F	Alarm
302	Device verification in progress	Device verification active, please wait.	C	Warning
303	I/O 1 to n configuration changed	1. Apply I/O module configuration (parameter 'Apply I/O configuration') 2. Afterwards reload device description and check wiring	M	Warning
311	Electronic failure	1. Do not reset device 2. Contact service	M	Warning
332	Writing in HistoROM backup failed	Replace user interface board Ex d/XP: replace transmitter	F	Alarm
361	I/O module 1 to n faulty	1. Restart device 2. Check electronic modules 3. Change I/O module or main electronics	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
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- 1 to n communication failed	1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules	F	Alarm
378	Supply voltage ISEM faulty	Check supply voltage to the ISEM	F	Alarm
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	1. Restart device 2. Delete T-DAT via 'Reset device' parameter 3. Replace T-DAT	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				
330	Flash file invalid	1. Update firmware of device 2. Restart device	M	Warning
331	Firmware update failed	1. Update firmware of device 2. Restart device	F	Warning
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 to n	Carry out trim	C	Warning
437	Configuration incompatible	Restart device	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1 to n	1. Check process 2. Check current output settings	S	Warning [1)]
442	Frequency output 1 to n	1. Check process 2. Check frequency output settings	S	Warning [1)]
442	Frequency output 1 to n		S	Warning
443	Pulse output 1 to n	1. Check process 2. Check pulse output settings	S	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
444	Current input 1 to n	1. Check process 2. Check current input settings	S	Warning [1)]
452	Calculation error	1. Check device configuration 2. Check process conditions	S	Warning [1)]
453	Flow override	Deactivate flow override	C	Warning
484	Failure mode simulation	Deactivate simulation	C	Alarm
485	Measured variable simulation	Deactivate simulation	C	Warning
486	Current input 1 to n simulation	Deactivate simulation	C	Warning
491	Current output 1 to n simulation	Deactivate simulation	C	Warning
492	Simulation frequency output 1 to n	Deactivate simulation frequency output	C	Warning
493	Pulse output 1 to n simulation active	Deactivate pulse output simulation	C	Warning
494	Switch output simulation 1 to n	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation	Deactivate simulation	C	Warning
496	Status input simulation	Deactivate simulation status input	C	Warning
502	CT activation/ deactivation failed	Follow the sequence of the custody transfer activation/deactivation: First authorized user login, then set the DIP switch on the main electonic module	C	Warning
520	I/O 1 to n hardware configuration invalid	1. Check I/O hardware configuration 2. Replace wrong I/O module 3. Plug the module of double pulse output on correct slot	F	Alarm
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
538	Flow computer configuration incorrect	Check input value (pressure, temperature)	S	Warning
539	Flow computer configuration incorrect	1. Check input value (pressure, temperature) 2. Check allowed values of the medium properties	S	Alarm
540	Custody transfer mode failed	1. Power off device and toggle DIP switch 2. Deactivate custody transfer mode 3. Reactivate custody transfer mode 4. Check electronic components	F	Alarm
541	Flow computer configuration incorrect	Check entered reference value using the document Operating Instructions	S	Warning
543	Double pulse output	1. Check process 2. Check pulse output settings	S	Warning
593	Double pulse output simulation	Deactivate simulation pulse output	C	Warning
594	Relay output simulation	Deactivate simulation switch output	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
599	Custody transfer logbook full	1. Deactivate custody transfer mode 2. Clear custody transfer logbook (all 30 entries) 3. Activate custody transfer mode	F	Warning
Diagnostic of process				
803	Current loop	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)]
834	Process temperature too high	Reduce process temperature	S	Warning [1)]
835	Process temperature too low	Increase process temperature	S	Warning [1)]
836	Process pressure	Reduce process pressure	S	Alarm
837	Process pressure	Increase process pressure	S	Warning [1)]
840	Sensor range	Check flow velocity	S	Warning [1)]
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning [1)]
870	Measuring inaccuracy increased	1. Check process conditions 2. Increase flow velocity	S	Warning [1)]
881	Sensor signal path 1 to n	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	1. Check input configuration 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	Alarm [1)]
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	Alarm [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)	F	Alarm
954	Sound velocity deviation too high	1. Check medium configuration 2. Check process conditions 3. Clean or replace transducers	S	Warning [1)]

1) Diagnostic behavior can be changed.

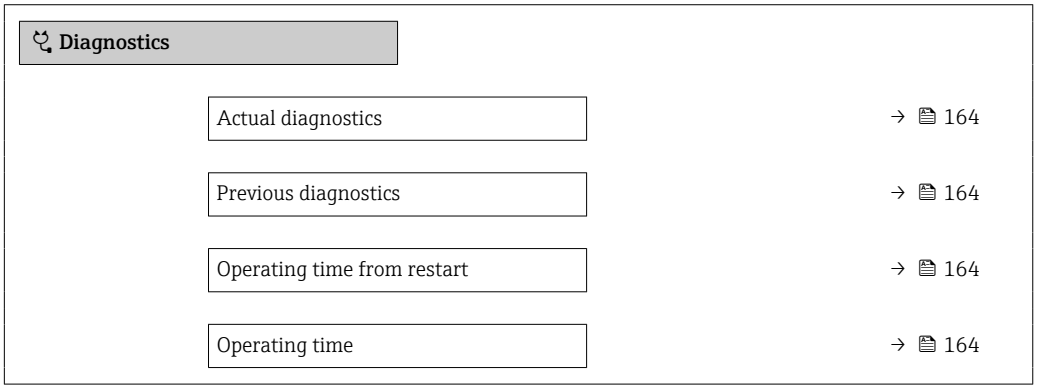
12.9 Pending diagnostic events

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 → 155
- Via web browser → 156
- Via "FieldCare" operating tool → 157
- Via "DeviceCare" operating tool → 157

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 164

Navigation
"Diagnostics" menu



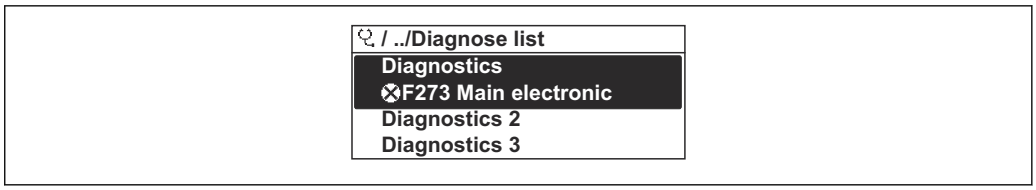
Parameter overview with brief description

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 Diagnostic list

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

Navigation path
Diagnostics → Diagnostic list



60 *Taking the example of the local display*

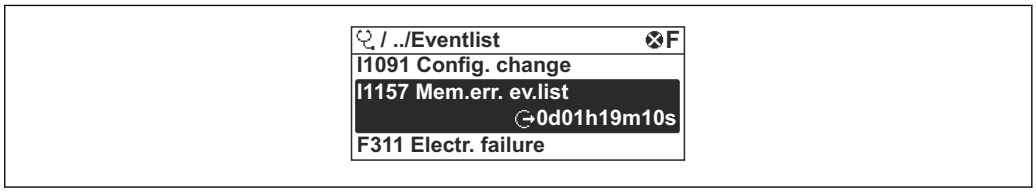
To call up the measures to rectify a diagnostic event:
- Via local display → 155
- Via web browser → 156
- Via "FieldCare" operating tool → 157
- Via "DeviceCare" operating tool → 157

12.11 Event logbook

12.11.1 Reading out the event logbook

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

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



61 *Taking the example of the local display*

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

The event history includes entries for:
- Diagnostic events → 159
- Information events → 166

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostic event
  - : Occurrence of the event
  - : End of the event
- Information event
  : Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 155
- Via web browser → 156
- Via "FieldCare" operating tool → 157
- Via "DeviceCare" operating tool → 157

For filtering the displayed event messages → 166

12.11.2 Filtering the event logbook

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

Navigation path
Diagnostics → Event logbook → Filter options

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

12.11.3 Overview of information events

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

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	HistoROM backup deleted
I1137	Electronics changed
I1151	History reset
I1155	Reset electronics temperature
I1156	Memory error trend
I1157	Memory error event list
I1256	Display: access status changed
I1264	Safety sequence aborted
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

Info number	Info name
I1515	Upload finished
I1517	Custody transfer active
I1518	Custody transfer inactive
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off
I1618	I/O module 2 replaced
I1619	I/O module 3 replaced
I1621	I/O module 4 replaced
I1622	Calibration changed
I1624	Reset all totalizers
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
I1639	Max. switch cycles number reached
I1643	Custody transfer logbook cleared
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1651	Custody transfer parameter changed
I1712	New flash file received
I1725	Sensor electronic module (ISEM) changed
I1726	Configuration backup failed

12.12 Resetting the measuring device

Using the**Device reset** parameter (→ 133) it is possible to reset the entire device configuration or some of the configuration to a defined state.

12.12.1 Function scope of the "Device reset" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.

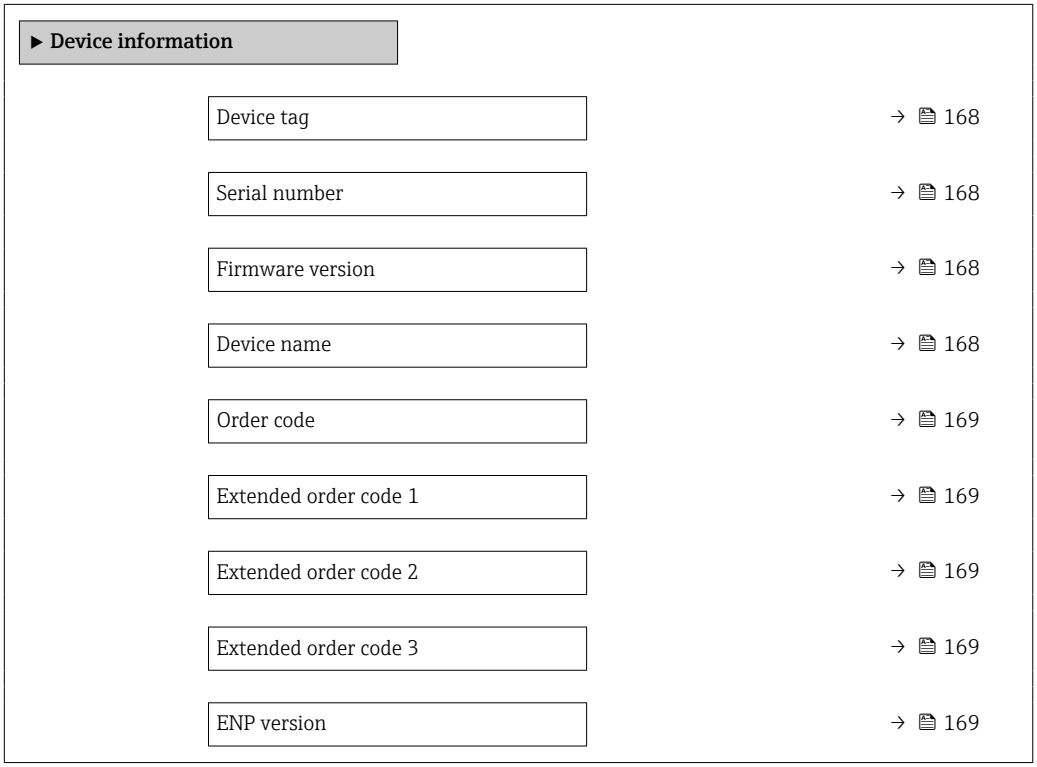
Options	Description
Restart device	The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restore the data that are saved on the S-DAT. The data record is restored from the electronics memory to the S-DAT. This option is displayed only in an alarm condition.

12.13 Device information

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

Navigation

"Diagnostics" menu → Device information



Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	–
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.	Prosonic Flow 500	–

Parameter	Description	User interface	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	–

12.14 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
05.2021	01.01.zz	Option **76**	Original firmware	Operating Instructions	BA02026D/06/EN/01.21

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. 9P5B
    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 wide variety of measuring and test equipment, such as W@M or device tests.

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

List of some of the measuring and testing equipment: → 175→ 173

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

14.2 Spare parts

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

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→ 168) in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

14.4 Return

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

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

14.5 Disposal

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

14.5.1 Removing the measuring device

1. Switch off the device.

⚠ WARNING

Danger to persons from process conditions.

- 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 Proline 500	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software Proline 500 transmitter: Order number: 9X5BXX-*********B Proline 500 transmitter for replacement: It is essential to specify the serial number of the current transmitter when ordering. Based on the serial number, the device-specific data of the replacement device can be used for the new transmitter. Proline 500 transmitter: Installation Instructions EA01152D
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. ▪ Further information on the WLAN interface → 81. Order number: 71351317 Installation Instructions EA01238D
Pipe mounting set	Pipe mounting set for transmitter. Installation Instructions EA01195D Proline 500 transmitter Order number: 71346428

Protective cover Transmitter Proline 500	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Proline 500 transmitter Order number: 71343505 Installation Instructions EA01191D
Sensor cable Proline 500 Sensor – Transmitter	The sensor cable can be ordered directly with the measuring device (order code for "Cable") or as an accessory (order number DK9012). 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) ▪ Temperature: −50 to +170 °C (−58 to +338 °F) ▪ Option BA: 5 m (15 ft) ▪ Option BB: 10 m (30 ft) ▪ Option BC: 15 m (45 ft) ▪ Option BD: 30 m (90 ft) ▪ Armored; temperature: −40 to +80 °C (−40 to +176 °F) ▪ Option CA: 5 m (15 ft) ▪ Option CB: 10 m (30 ft) ▪ Option CC: 15 m (45 ft) ▪ Option CD: 30 m (90 ft) ▪ Armored; temperature: −50 to +170 °C (−58 to +338 °F) ▪ Option DA: 5 m (15 ft) ▪ Option DB: 10 m (30 ft) ▪ Option DC: 15 m (45 ft) ▪ Option DD: 30 m (90 ft) Possible cable length for a Proline 500 sensor cable: max. 30 m (100 ft)

15.1.2 For the sensor

Accessories	Description
Sensor set (DK9013)	▪ Sensor set 0.3 MHz (C-030) ▪ Sensor set 0.5 MHz (C-050) ▪ Sensor set 1 MHz (C-100) ▪ Sensor set 2 MHz (C-200) ▪ Sensor set 5 MHz (C-500)
Sensor holder set (DK9014)	▪ Sensor holder set 0.3 to 2 MHz ▪ Sensor holder set 5 MHz
Installation set (DK9015)	▪ Installation set, DN15-DN32, 1/2-1 1/4" ▪ Installation set, DN32-DN65, 1 1/2-2 1/2" ▪ Installation set, DN50-DN150, 2"-6" ▪ Installation set, DN150-DN200, 6"-8" ▪ Installation set, DN200-DN600, 8"-24" ▪ Installation set, DN600-DN2000, 24"-80" ▪ Installation set, DN2000-DN4000, 80"-160"
Conduit adapter set (DK9003)	▪ Without conduit adapter + sensor cable gland ▪ Conduit adapter M20x1.5 + sensor cable gland ▪ Conduit adapter NPT1/2" + sensor cable gland ▪ Conduit adapter G1/2" + sensor cable gland
Coupling medium (DK9CM)	▪ Permanent coupling pad ▪ Coupling gel

15.2 Communication-specific accessories

Accessories	Description
Fieldgate FXA42	Is used to transmit 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 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.
W@M	W@M Life Cycle Management Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle. W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: www.endress.com/lifecyclemanagement
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

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
iTEMP	The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature. "Fields of Activity" document FA00006T

16 Technical data

16.1 Application

The measuring device is suitable for flow measurement of liquids only.

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 two or one 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. Depending on the application and version, the sensors can be arranged for measurement via 1, 2, 3 or 4 traverses → 📄 21. 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. For information on the structure of the device → 📄 14

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)

Measuring range depending on the sensor version.

Operable flow range

Over 150 : 1

Input signal

External measured values

The measuring device provides optional interfaces that enable the transmission of externally measured variables (temperature, density) to the measuring device:
- Analog inputs 4-20 mA
- Digital inputs (via HART input or Modbus)

Various temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 176

Current input

The measured values are written from the automation system to the measuring device via the current input → 178.

Digital communication

The measured values are written from the automation system to the measuring device via Modbus RS485.

Current input 0/4 to 20 mA

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

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Configurable: 5 to 200 ms

Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

16.4 Output

Output signal

Modbus RS485

Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Integrated, can be activated via DIP switches

Current output 4 to 20 mA

Signal mode	Can be set to: ▪ Active ▪ Passive
Current span	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ 0 to 20 mA (only if the signal mode is active) ▪ Fixed current
Maximum output values	22.5 mA
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	0 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ 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	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: ▪ Active ▪ Passive
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Pulse output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Pulse width	Configurable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow

Frequency output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Output frequency	Adjustable: end value frequency 2 to 10 000 Hz (f_{max} = 12 500 Hz)
Damping	Configurable: 0 to 999.9 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature The range of options increases if the measuring device has one or more application packages.
Switch output	
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s
Number of switching cycles	Unlimited

Assignable functions	▪ Off
	▪ On
	▪ Diagnostic behavior
	▪ Limit value
	  ▪ Volume flow
	  ▪ Mass flow
	  ▪ Flow velocity
	  ▪ Electronics temperature
	  ▪ Sound velocity
	  ▪ Totalizer 1-3
	▪ Flow direction monitoring
	▪ Status
	Low flow cut off
	The range of options increases if the measuring device has one or more application packages.

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ Active ▪ Passive ▪ Passive NAMUR
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Output frequency	Configurable: 0 to 1 000 Hz
Damping	Configurable: 0 to 999 s

Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow The range of options increases if the measuring device has one or more application packages.

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)
Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A

Assignable functions	▪ Off
	▪ On
	▪ Diagnostic behavior
	▪ Limit value
	  ▪ Volume flow
	  ▪ Mass flow
	  ▪ Flow velocity
	  ▪ Electronics temperature
	  ▪ Sound velocity
	  ▪ Totalizer 1-3
	▪ Flow direction monitoring
	▪ Status
	Low flow cut off
	The range of options increases if the measuring device has one or more application packages.

User-configurable input/output

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

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

Signal on alarm

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

Modbus RS485

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

Current output 0/4 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 ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value (f_{max} 2 to 12 500 Hz)
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Local display

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

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
  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 → 151

Low flow cut off

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

Galvanic isolation

The outputs are galvanically isolated from one another and from earth (PE).

The clamp-on sensors can also be mounted on cathodically protected pipes [4].

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

4) Only DN 50 to 4000 (2 to 160") and non-Ex

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 transfer mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information
System integration	Information on system integration → 86. ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

16.5 Power supply

Terminal assignment → 46

Supply voltage

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

Power consumption

Transmitter

Max. 10 W (active power)

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

Current consumption

Transmitter

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

Power supply failure

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

Electrical connection → 48

Potential equalization → 54

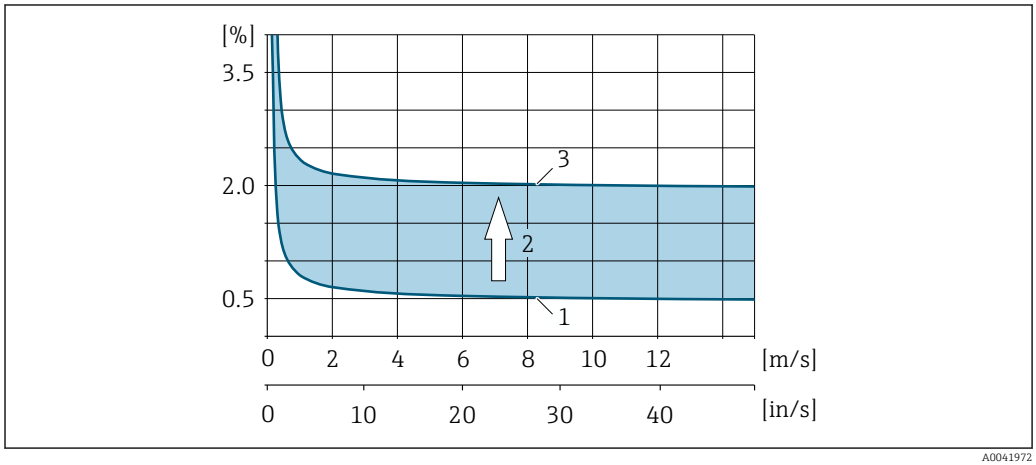
Terminals	Spring-loaded terminals: Suitable for strands and strands with ferrules. Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG).

Cable entries	▪ Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
	▪ Thread for cable entry:
	  ▪ NPT ½"
	  ▪ G ½"
	  ▪ M20
	▪ Device plug for digital communication: M12

Cable specification	→ 🖹 44

16.6 Performance characteristics

Reference operating conditions	▪ Error limits following ISO/DIS 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 → 🖹 175
Maximum measured error	o.r. = of reading The measured error depends on a number of factors. A distinction is made between the measured error of the device (0.5% o.r.) and an additional installation-specific measured error (typically 1.5% o.r.) that is independent of the device. The installation-specific measured error depends on the installation conditions on site, such as the nominal diameter, wall thickness, real pipe geometry or medium. The sum of the two measured errors is the measured error at the measuring point.



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

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

Measured error at the measuring point

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

Nominal diameter	Device error limits	+	Installation-specific error limits (typical)	→	Error limits at the measuring point (typical)	Field calibration [1]
DN 15 (½")	±0.5% o.r. ± 5 mm/s (0.20 in/s)	+	±2.5% o.r.	→	±3% o.r. ± 5 mm/s (0.20 in/s)	±0.5% o.r. ± 5 mm/s (0.20 in/s)
DN 25 to 200 (1 to 8")	±0.5% o.r. ± 7.5 mm/s (0.30 in/s)	+	±1.5% o.r.	→	±2% o.r. ± 7.5 mm/s (0.30 in/s)	±0.5% o.r. ± 7.5 mm/s (0.30 in/s)
> 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 with correction values written back to the transmitter

Measurement report

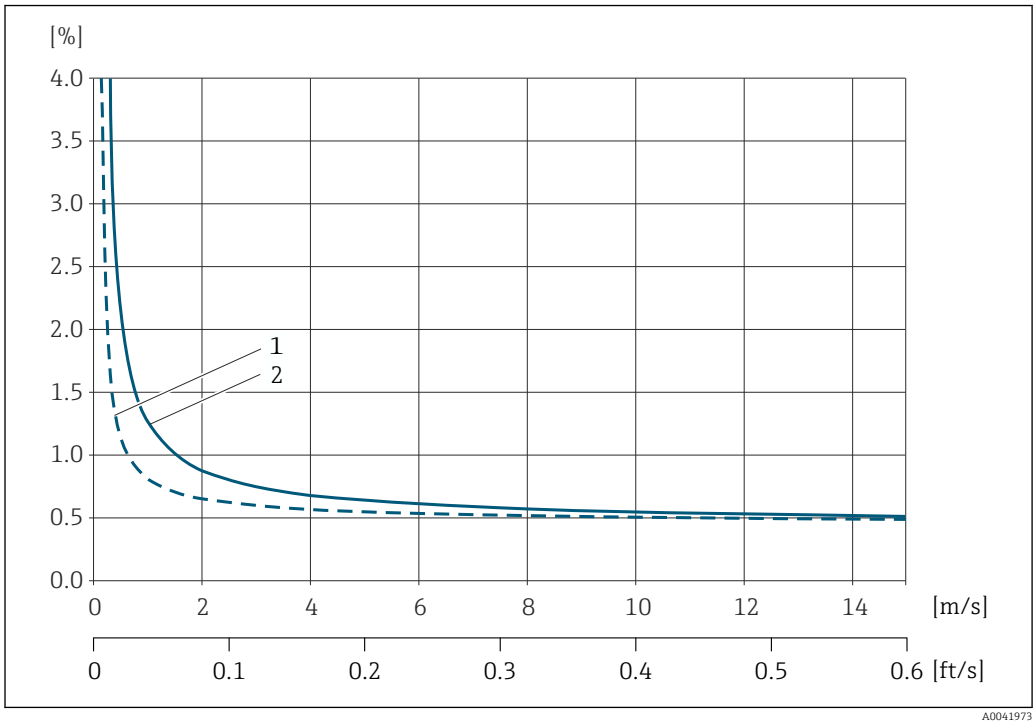
If required, the device can be supplied with a factory measurement report. A measurement is performed under reference conditions to verify the performance of the device. Here, the sensors are mounted on a pipe with a nominal diameter of DN 15 (½"), 25 (1"), 40 (1½"), 50 (2") or 100 (4"), respectively.

The measurement report guarantees the following error limits at a flow velocity of > 0.3 m/s (1 ft/s) and a Reynolds number > 10 000:

Nominal diameter	Device error limits
DN 15 (½"), 25 (1"), 40 (1½"), 50 (2")	±0.5% o.r. ± 5 mm/s (0.20 in/s)
100 (4")	±0.5% o.r. ± 7.5 mm/s (0.30 in/s)

The specification applies for Reynolds numbers Re ≥ 10 000. Larger measured errors can occur for Reynolds numbers Re < 10 000.

Example for max. measured error (volume flow)



63 Example for max. measured error (volume flow) in % o.r.

1 Pipe diameter < DN 100 (4")
2 Pipe diameter = DN 100 (4")

Repeatability

o.r. = of reading

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

Influence of ambient temperature

Current output

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

16.7 Installation

Installation conditions

→ 19

16.8 Environment

Ambient temperature range

→ 24

Temperature tables

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

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

Storage temperature

The storage temperature for all components (except the display modules) corresponds to the ambient temperature range → 24.

Display modules

−40 to +80 °C (−40 to +176 °F)

Degree of protection

Transmitter
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Sensor
IP68, type 6P enclosure

External WLAN antenna
IP67

Vibration- and shock-resistance

Vibration sinusoidal, in accordance with IEC 60068-2-6

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

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

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

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

6 ms 30 g

Rough handling shocks according to IEC 60068-2-31

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) and 43 (NE43)

Details are provided in the Declaration of Conformity.

16.9 Process

Medium temperature range

Sensor version	Frequency	Temperature
C-030-A	0.3 MHz	−40 to +100 °C (−40 to +212 °F)
C-050-A	0.5 MHz	−20 to +80 °C (−4 to +176 °F)
C-100-A	1 MHz	−20 to +80 °C (−4 to +176 °F)
C-200-A	2 MHz	−20 to +80 °C (−4 to +176 °F)
C-500-A	5 MHz	−40 to +150 °C (−40 to +302 °F)
C-100-B	1 MHz	−40 to +80 °C (−40 to +176 °F)

Sensor version	Frequency	Temperature
C-200-B	2 MHz	−40 to +80 °C (−40 to +176 °F)
C-100-C	1 MHz	0 to +170 °C (+32 to +338 °F)
C-200-C	2 MHz	0 to +170 °C (+32 to +338 °F)

Sound velocity range

600 to 2 100 m/s (1 969 to 6 890 ft/s)

Medium pressure range

No pressure limitation. Nevertheless, for correct measurement, the static pressure of the medium must be higher than the vapor pressure.

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 excluding packaging material.

Transmitter
- Proline 500 aluminum: 6.5 kg (14.3 lbs)
- Proline 500 cast, stainless: 15.6 kg (34.4 lbs)

Sensor
Incl. Mounting material
- DN 15 to 65 (½ to 2½"): 1.2 kg (2.65 lb)
- DN 50 to 4000 (2 to 160"): 2.8 kg (6.17 lb)

Materials

Transmitter housing

Housing of Proline 500 transmitter

Order code for "Transmitter housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **L** "Cast, stainless": cast, stainless steel, 1.4409 (CF3M) corresponds to the properties of 316L

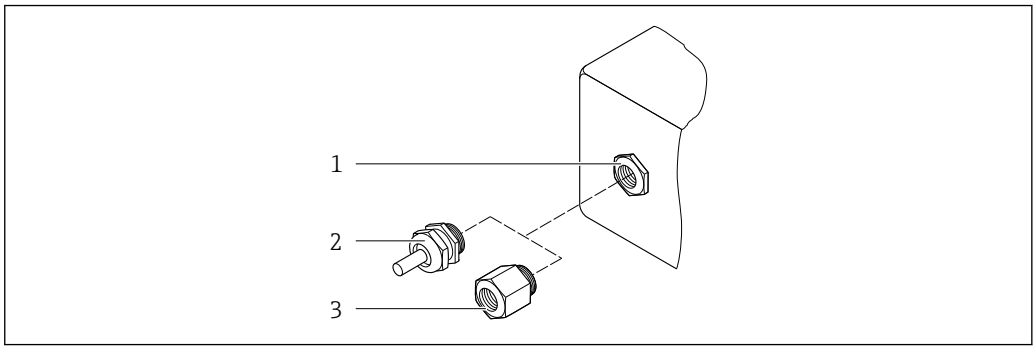
Window material

Order code for "Transmitter housing":
- Option **A** "Aluminum, coated": glass
- Option **L** "Cast, stainless": glass

Fastening components for mounting on a post

- Screws, threaded bolts, washers, nuts: stainless A2 (chrome-nickel steel)
- Metal plates: stainless steel, 1.4301 (304)

Cable entries/cable glands



64 *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"*

Cable entries and adapters	Material
Cable gland of sensor cable	Brass or stainless steel 1.4404
Power cable gland	Plastic
▪ Adapter for cable entry with female thread G ½" ▪ Adapter for cable entry with female thread NPT ½" Only available for certain device versions: Order code for "Transmitter housing": Option A "Aluminum, coated"	Nickel-plated brass
▪ Adapter for cable entry with female thread G ½" ▪ Adapter for cable entry with female thread NPT ½" Only available for certain device versions: Order code for "Transmitter housing": Option L "Cast, stainless"	Stainless steel, 1.4404 (316L)

Sensor cable

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

Sensor cable for sensor - Proline 500 transmitter

DN 15 to 65 (½ to 2½"):
Sensor cable: TPE [5)]
- Cable sheath: TPE
- Cable plug: stainless steel 1.4301 (304), 1.4404 (316L), nickel-plated brass

DN 50 to 4000 (2 to 160"):
- Sensor cable, TPE halogen-free
  - Cable sheath: TPE halogen-free
  - Cable connector: nickel-plated brass
- PTFE sensor cable [5)]
  - Cable sheath: PTFE
  - Cable plug: stainless steel 1.4301 (304), 1.4404 (316L)

5) Also available in optional armored version (316L)

Ultrasonic transducer

- Holder: stainless steel 1.4301 (304), 1.4404 (316L)
- Housing: stainless steel 1.4301 (304), 1.4404 (316L)
- Strapping bands/bracket: stainless steel 1.4301 (304), 1.4404 (316L)
- Contact surfaces: chemically stable plastic

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

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

16.11 Human interface

Languages

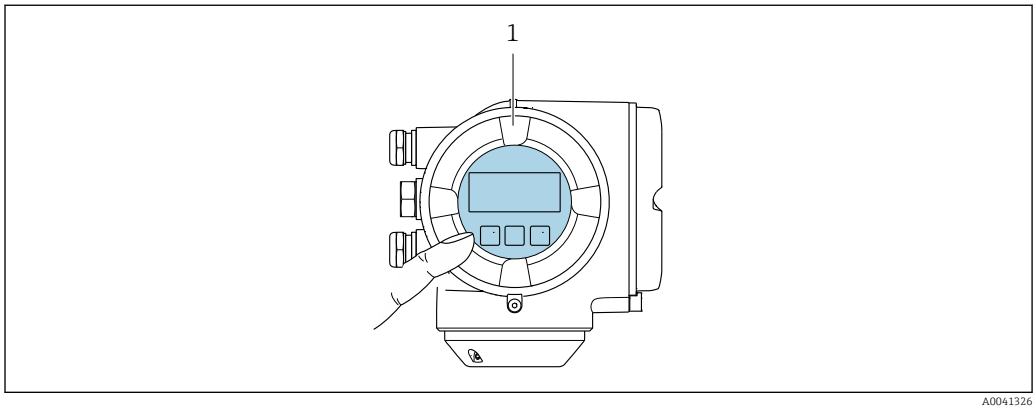
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via Web browser
  English, German, French, Spanish, Italian, Dutch,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

Local operation

Via display module

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

Information about WLAN interface → 81



65 *Operation with touch control*

1 Proline 500

Display elements

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

Operating elements

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

Remote operation

→ 🖹 80

Service interface

→ 🖹 80

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	→ 🖹 175
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 175

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

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

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

Web server

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

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch

control + WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package → 197)

Web server special documentation → 198

HistoROM data management

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

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

Additional information on the data storage concept

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

	HistoROM backup	T-DAT	S-DAT
Available data	▪ Event logbook such as diagnostic events for example ▪ Parameter data record backup ▪ Device firmware package	▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Peakhold indicator (min/max values) ▪ Totalizer values	▪ Sensor data: measuring point configuration etc. ▪ Serial number ▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface board in the connection compartment	Attachable to the user interface board in the connection compartment	In the sensor plug in the transmitter neck part

Data backup

Automatic
- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors
- If exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

Manual
Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:
- Data backup function
  Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
- Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

Data transfer

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

Event list

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

Data logging

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

16.12 Certificates and approvals

Currently available certificates and approvals can be called up via the product configurator.

CE mark	The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
RCM-tick symbol	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.

Radio approval	The measuring device has radio approval. For detailed information regarding radio approval, see the Special Documentation → 198
Additional certification	**Tests and certificates** ▪ EN10204-3.1 material certificate, parts and sensor housing in contact with medium ▪ Ambient temperature −50 °C (−58 °F) (order code for "Test, certificate", option JN) ▪ EN10204-2.1 confirmation of compliance with the order and EN10204-2.2 test report
Other standards and guidelines	▪ EN 60529 Degrees of protection provided by enclosures (IP code) ▪ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements ▪ IEC/EN 61326 Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements). ▪ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment ▪ NAMUR NE 32 Data retention in the event of a power failure in field and control instruments with microprocessors ▪ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal. ▪ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics ▪ NAMUR NE 105 Specifications for integrating fieldbus devices in engineering tools for field devices ▪ NAMUR NE 107 Self-monitoring and diagnosis of field devices ▪ NAMUR NE 131 Requirements for field devices for standard applications

16.13 Application packages

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

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

Detailed information on the application packages:
Special Documentation for the device → 198

Diagnostics functions

Package	Description
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.

Heartbeat Technology

Package	Description
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.

16.14 Accessories

Overview of accessories available for order → 173

16.15 Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Standard documentation

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Prosonic Flow P	KA01474D

Brief Operating Instructions for transmitter

Measuring device	Documentation code
Proline 500	KA01476D

Technical Information

Measuring device	Documentation code
Prosonic Flow P 500	TI01504D

Description of Device Parameters

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow P 500	GP01147D	GP01148D

Device-dependent additional documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEx Ex ia	XA02091D
ATEX/IECEx Ex ec	XA02092D
cCSAus Ex ia	XA02093D
cCSAus Ex ec	XA02094D
cCSAus XP	XA02095D

Special documentation

Contents	Documentation code
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
FlowDC	SD02674D
Heartbeat Technology	SD02594D
Web server	SD02604D

Installation Instructions

Contents	Comment
Installation instructions for spare part sets and accessories	▪ Access the overview of all the available spare part sets via *W@M Device Viewer* → 🖹 171 ▪ Accessories available for order with Installation Instructions → 🖹 173

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