

Operating Instructions

Proline Promass U 500

Coriolis flowmeter
Modbus RS485



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

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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

1.2.2 Electrical symbols

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

1.2.3 Communication-specific symbols

Symbol	Meaning
	Wireless Local Area Network (WLAN) Communication via a wireless, local area network
	LED LED is off.

Symbol	Meaning
	LED LED is on.
	LED LED flashing.

1.2.4 Tool symbols

Symbol	Meaning
	Torx screwdriver
	Phillips screwdriver
	Open-end 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
	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
	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Flow direction

1.3 Documentation

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

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

The following documentation may be available depending on the device version ordered:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Your reference document These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

1.4 Registered trademarks

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

2 Safety instructions

2.1 Requirements for the personnel

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

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

The operating personnel must fulfill the following requirements:

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

2.2 Intended use

Application and media

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

To ensure that the measuring instrument remains in proper condition during the operating time:

- ▶ Only use the measuring instrument in full compliance with the data on the nameplate and the general conditions listed in the manual and supplementary documentation.
- ▶ Use the measuring instrument only for media against which the materials in contact with the process are sufficiently resistant.
- ▶ Keep within the specified pressure and temperature range.
- ▶ Keep within the specified ambient temperature range.
- ▶ Protect the measuring instrument permanently against corrosion from environmental influences.

Incorrect use

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

WARNING

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

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

NOTICE

Verification for borderline cases:

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

2.3 Workplace safety

For work on and with the device:

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

2.4 Operational safety

Damage to the device!

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

Modifications to the device

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

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

Repair

To ensure continued operational safety and reliability:

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

2.5 Product safety

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

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

2.6 IT security

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

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

2.7 Device-specific IT security

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

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

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

2.7.1 Protecting access via hardware write protection

Write access to the parameters of the device 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 main electronics module). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered → 138.

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

Local display, web browser and operating tool (e.g. FieldCare, DeviceCare)

- 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 → 137.
- When delivered, the device does not have an access code; the default value is 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 (→ 68), 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 for security reasons.
- 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 "Write protection via access code" →  137.

2.7.3 Access via web server

The integrated web server can be used to operate and configure the device via a web browser →  59. 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 via the **Web server functionality** parameter (e.g., after commissioning).

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: Description of Device Parameters.

2.7.4 Access via service interface (port 2): CDI-RJ45

The device can be connected to a network via the service interface. 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.



For detailed information on connecting transmitters with an Ex de approval, see separate document "Safety instructions" (XA) for the device.

3 Product description

The measuring system consists of a transmitter, a sensor and a disposable measuring tube.

- The device is available for front panel mounting:
The transmitter and sensor are mounted in physically separate locations and are connected via connecting cables.
- The device is available in a table-top version:
The transmitter and sensor form a mechanical unit.

3.1 Product design

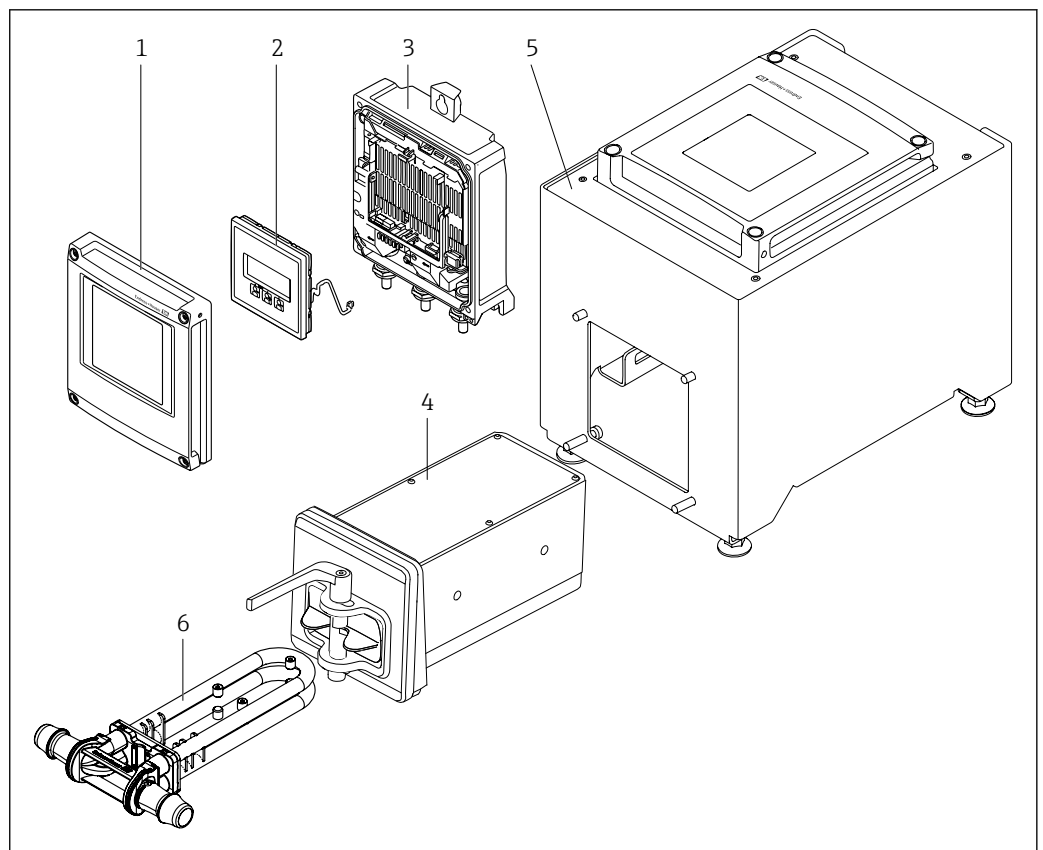
3.1.1 Proline 500 – digital

Signal transmission: digital

For use in clean rooms.

As the electronics are located in the sensor, the device is ideal:
For simple transmitter replacement.

Not sensitive to external EMC interference.



A0053177

 1 Important components of a measuring device

- 1 Electronics compartment cover
- 2 Display module
- 3 Transmitter housing
- 4 Sensor with integrated ISEM electronics
- 5 Table version with integrated transmitter
- 6 Disposable measuring tube

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
 - ↳ Report all damage immediately to the manufacturer.
Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.



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

4.2 Product identification

The device can be identified in the following ways:

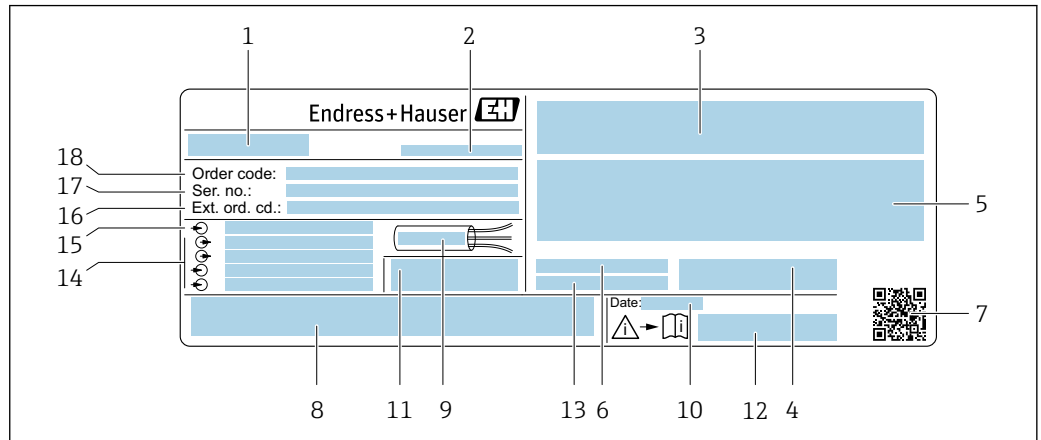
- Nameplate
- Order code with details of the device features on the delivery note
- Enter the serial numbers from the nameplates in the *Device Viewer* (www.endress.com/deviceviewer): all the information about the device is displayed.
- Enter the serial numbers from the nameplates into the *Endress+Hauser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

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

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

4.2.1 Transmitter nameplate

Proline 500 – digital

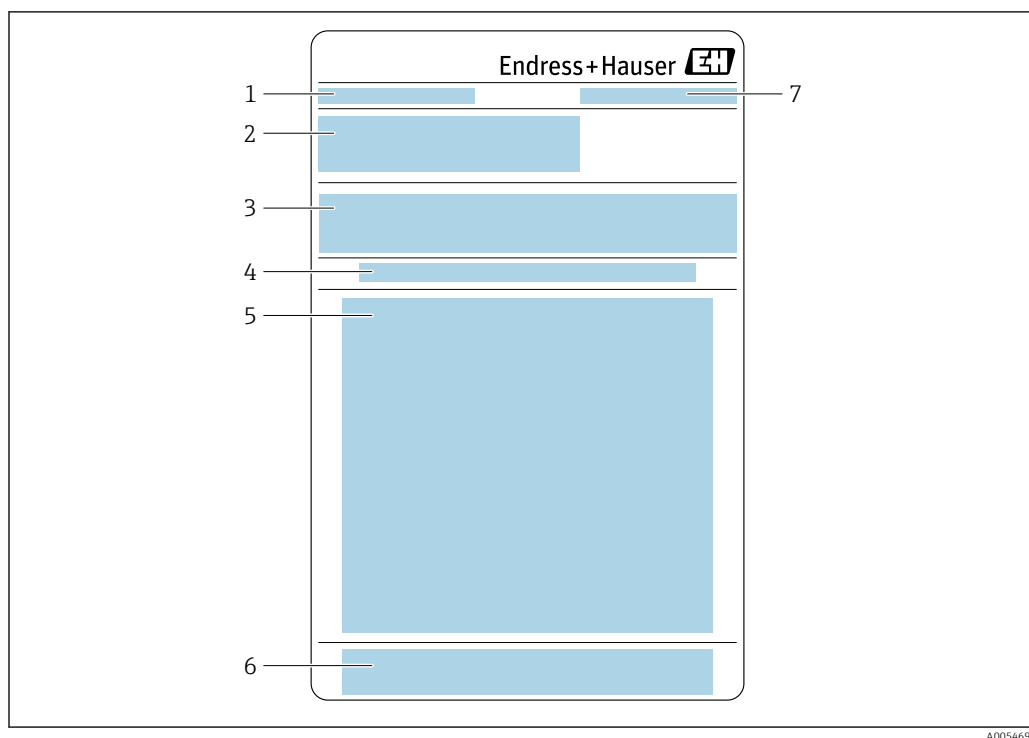


A0058873

 2 Example of a transmitter nameplate

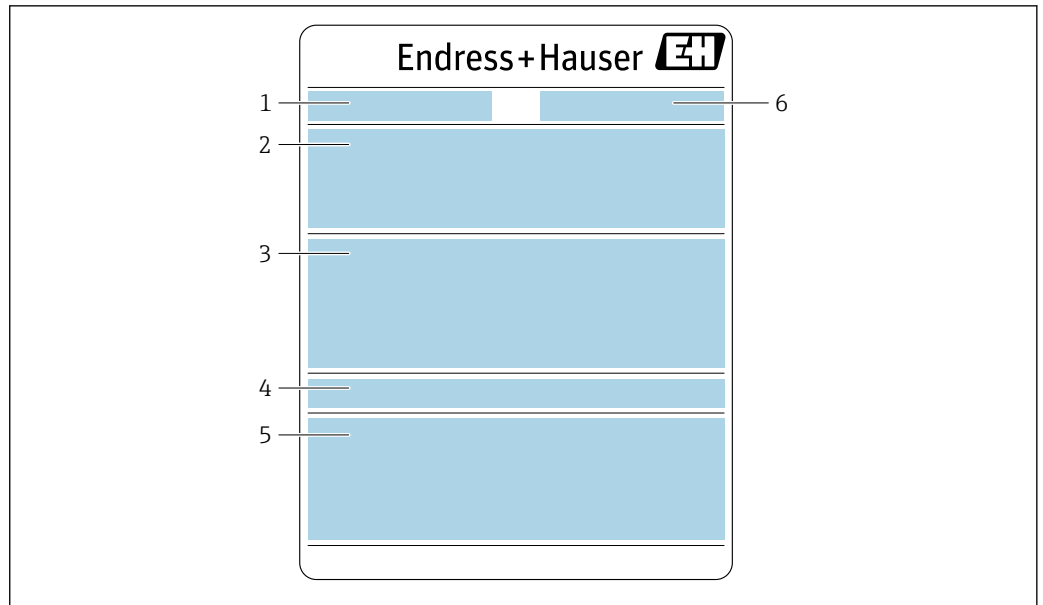
- 1 Name of the transmitter
- 2 Manufacturer/certificate holder
- 3 Space for approvals
- 4 Degree of protection
- 5 Electrical connection data: available inputs and outputs
- 6 Permitted ambient temperature (T_a)
- 7 2-D matrix code
- 8 Space for approvals and certificates: e.g. CE mark, RCM symbol
- 9 Permitted temperature range for cable
- 10 Manufacturing date: year-month
- 11 Firmware version (FW) and device revision (Dev. Rev.) from the factory
- 12 Document number of safety-related supplementary documentation
- 13 Space for additional information in the case of special products
- 14 Available inputs and outputs, supply voltage
- 15 Electrical connection data: supply voltage
- 16 Extended order code (Ext. ord. cd.)
- 17 Serial number (Ser. no.)
- 18 Order code

4.2.2 Sensor nameplate



A0054698

- 1 Designation
- 2 Order code, serial number, extended order code (Ext. ord. cd.)
- 3 Material list, product information
- 4 Installing/removing disposable measuring tube
- 5 Instructions on installing/removing disposable measuring tube
- 6 CE mark + approvals
- 7 Manufacturer address/certificate holder



A0054699

- 1 Designation
- 2 Order code, serial number, extended order code (Ext. ord. cd.)
- 3 Material list, product information
- 4 Degree of protection
- 5 CE mark + approvals
- 6 Manufacturer address/certificate holder



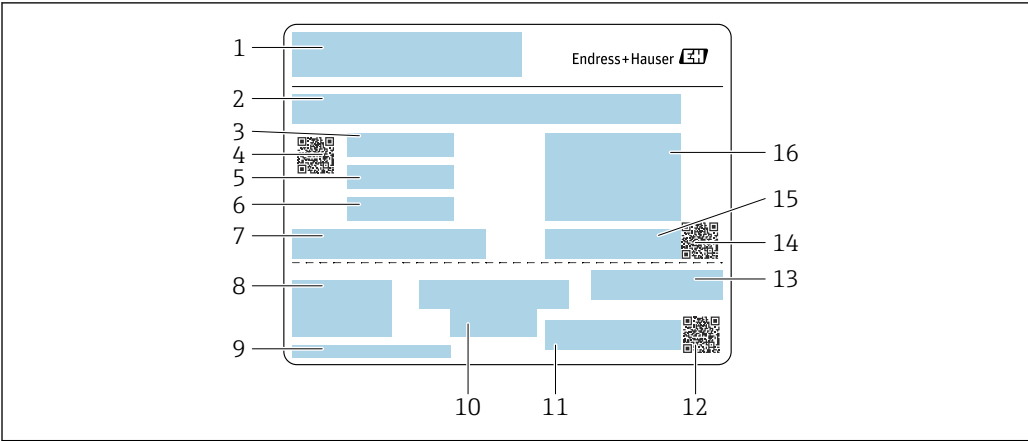
Order code

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 Disposable measuring tube nameplate



A0054484

- 1 Designation
- 2 Material list
- 3 LOT number
- 4 Matrix code with LOT/material number
- 5 Date 1
- 6 Date 2 + 2 years
- 7 Manufacture details
- 8 References to Operating Instructions
- 9 Manufacturer address/certificate holder
- 10 Storage information
- 11 Order code + material number
- 12 Matrix code with DK8014-xx/material number
- 13 CE mark + approvals
- 14 Matrix code with serial number
- 15 Serial number
- 16 Product image

4.2.4 Symbols on the device

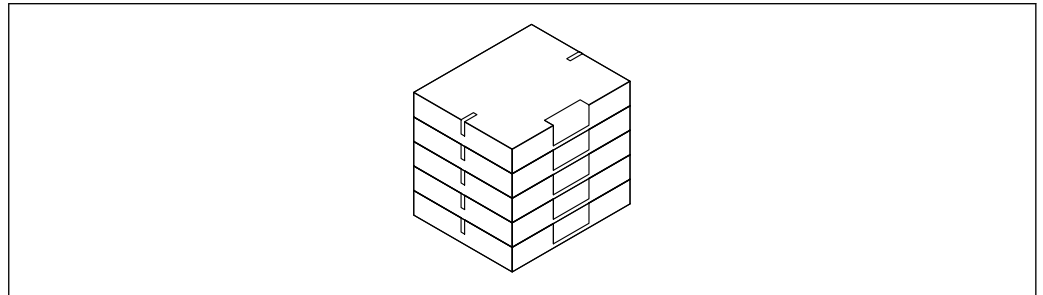
Symbol	Meaning
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. Please consult the documentation for the measuring instrument to discover the type of potential danger and measures to avoid it.
	Reference to documentation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

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:

- ▶ Store in the original packaging to ensure protection from shock.
- ▶ Protect from direct sunlight. Avoid unacceptably high surface temperatures.
- ▶ Store in a dry and dust-free place.
- ▶ Do not store outdoors.
- ▶ Stack a maximum of 6 disposable measuring tubes in the cardboard packaging.
- ▶ Store disposable measuring tubes for a maximum of 2 years.



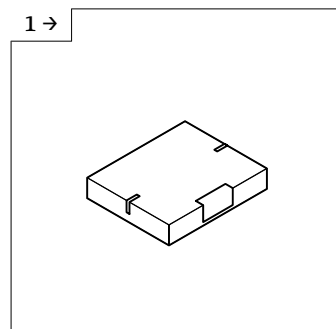
A0054168

Storage temperature → 235

5.2 Transporting the product

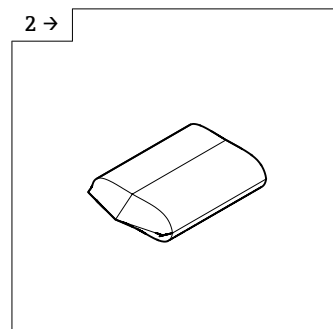
Transport the measuring device to the measuring point in the original packaging.

5.2.1 Transporting the disposable measuring tube



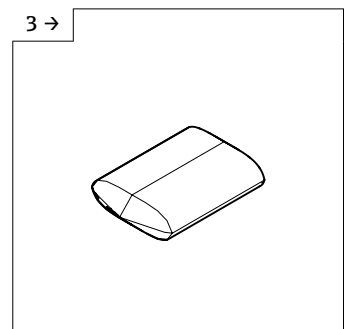
A0054212

- ▶ Transport from the warehouse to the airlock in the box.



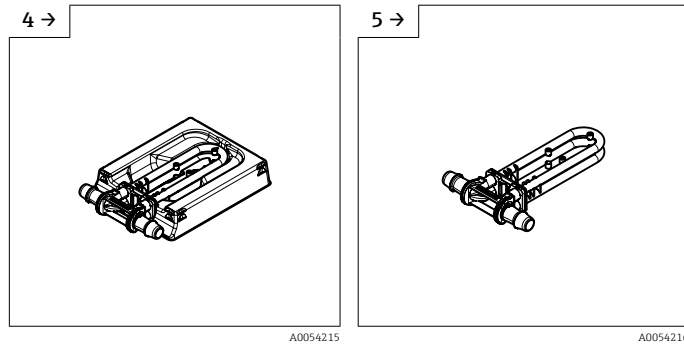
A0054213

- ▶ Remove the box before the first airlock.

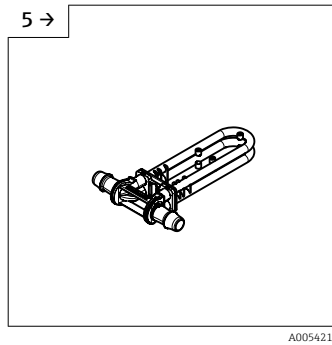


A0054214

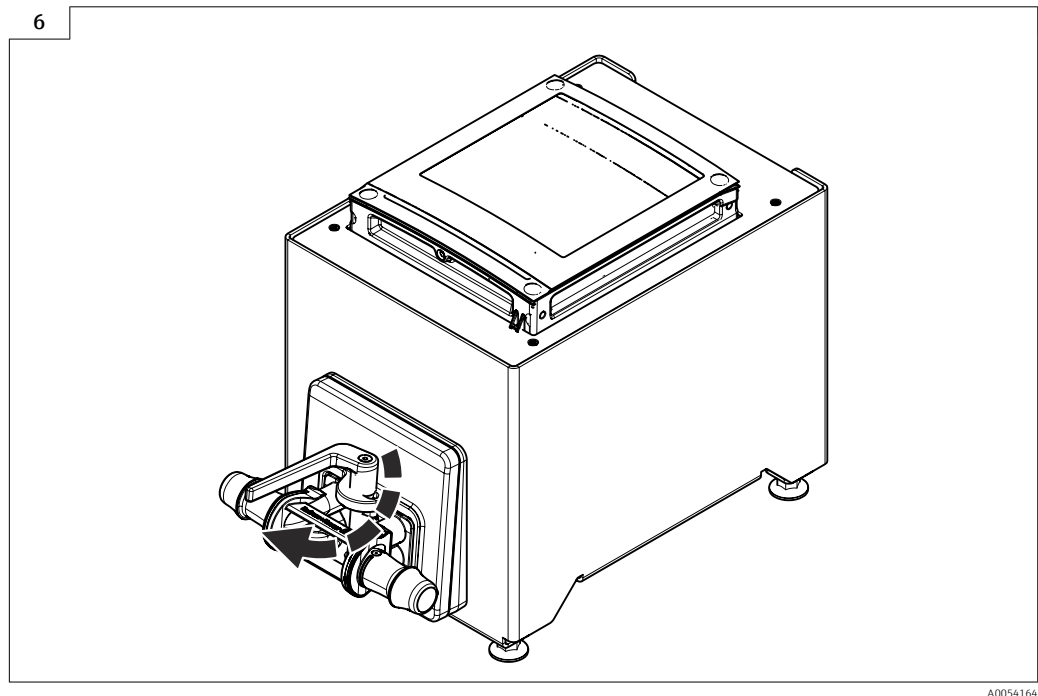
- ▶ Remove the first plastic packaging inside the airlock.



- ▶ Remove the last plastic packaging in the clean room.
- ▶ If the disposable measuring tube is integrated into an assembly prior to commissioning, the stability packaging must remain in place to protect the measuring tube.



- ▶ Remove the disposable measuring tube from the stability packaging and secure it in the sensor immediately.



- ▶ Replacing the disposable measuring tube → 25

5.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

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

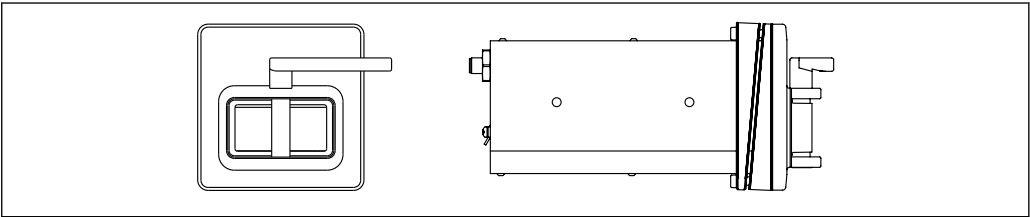
6 Installation

6.1 Installation requirements

6.1.1 Installation position

Installation point

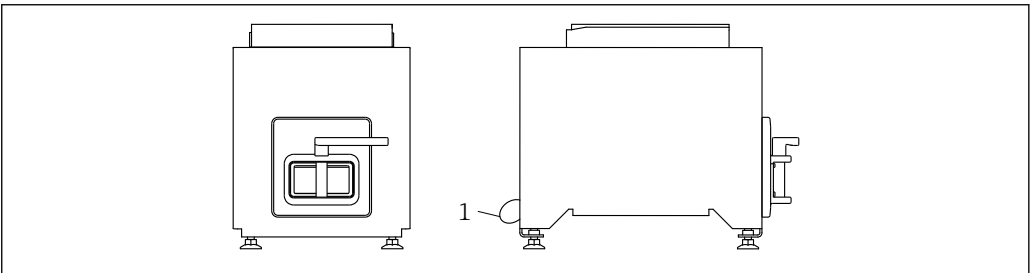
Front panel mounting



A0053021

 3 Order code for "Device version", option NA "Front panel mounting"

Table version

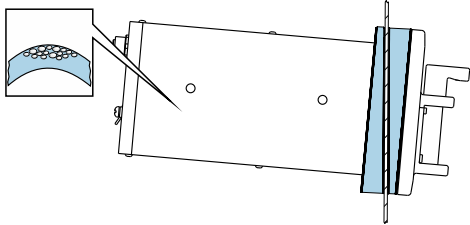
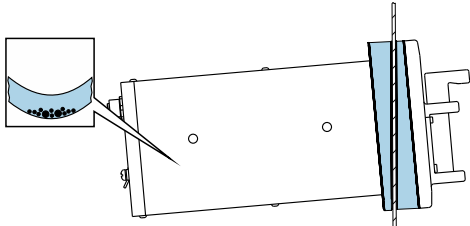


A0053020

 4 Order code for "Device version", option NE "Table version"

1 Secure the device to the table with the supplied cable through the hole on the back.

Orientation

Orientation	
Wedge pointing upwards  Gas accumulation in the measuring tube possible. Self-draining.	 A0053028
Wedge pointing downwards Recommended orientation  Solids accumulation in the measuring tube possible.	 A0053029

6.1.2 Environmental and process requirements

Ambient temperature range

Measuring instrument	+5 to +40 °C (+41 to +104 °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.

 Dependency of ambient temperature on medium temperature →  236

Vibrations

The operational reliability of the measuring system is not affected by plant vibrations.

6.1.3 Special installation instructions

Drainability

When installed with the wedge pointing upwards, the measuring tubes can be drained completely and protected against buildup.

Sterility

 When installing in sterile applications, please refer to the information in the "Certificates and approvals/sterility" section →  241

Biotech

 When installing in biotech applications, please refer to the information in the "Certificates and approvals/biotech" section →  241

Zero point verification and zero adjustment

All measuring instruments are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions →  232.

Important parameters such as the calibration factor of the disposable measuring tube and other device information determined during factory calibration must remain unchanged. A zero adjustment of the mounted measuring instrument filled with liquid is required for commissioning to offset the sensor's manufacturing tolerances.

This results in an updated zero point that deviates from the original zero point indicated on the factory calibration certificate and is then documented on the Heartbeat Technology verification report.

 To achieve the highest possible measurement accuracy at low flow rates, the installation must protect the sensor from mechanical stress during operation.

To get a representative zero point, ensure that

- any flow in the device is prevented during the adjustment
- the process conditions (e.g. pressure, temperature) are stable and representative

Verification and adjustment cannot be performed if the following process conditions are present:

- Gas pockets
Ensure that the system has been sufficiently flushed with the medium. Repeat flushing can help to eliminate gas pockets
- Thermal circulation
In the event of temperature differences (e.g. between the measuring tube inlet and outlet section), induced flow can occur even if the valves are closed due to thermal circulation in the device
- Leaks at the valves
If the valves are not leak-tight, flow is not sufficiently prevented when determining the zero point

If these conditions cannot be avoided, it is advisable to keep the factory setting for the zero point.

6.2 Installing the device

6.2.1 Required tools

For sensor

For process connections: Use a suitable mounting tool.

6.2.2 Preparing the measuring instrument

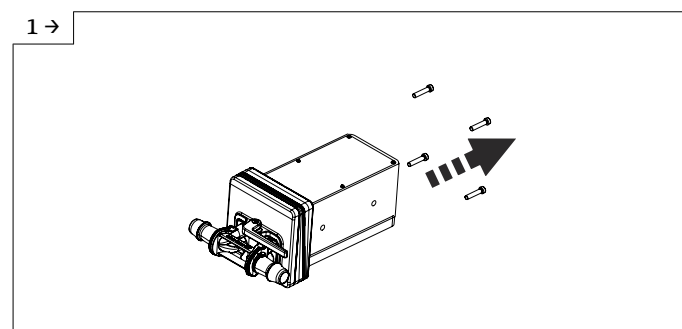
- Remove all remaining transport packaging.

6.2.3 Installing the measuring instrument

- Order code for "Device version", option NE "Table version"
This version is fully installed.
- Order code for "Device version", option NA "Front panel mounting"
This version is installed in a front panel.

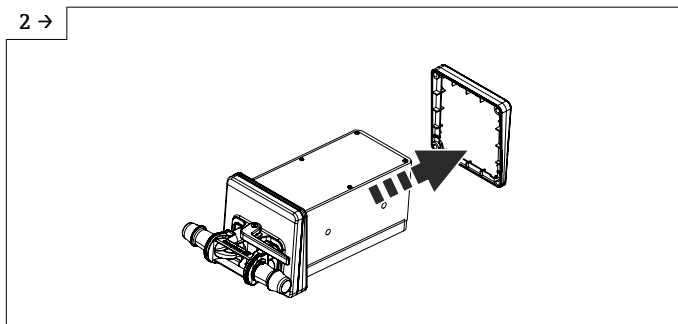
-  The sensor is designed for the following sheet thicknesses:
- 3mm
 - 5mm
 - 7mm

Installing the sensor in a front panel.



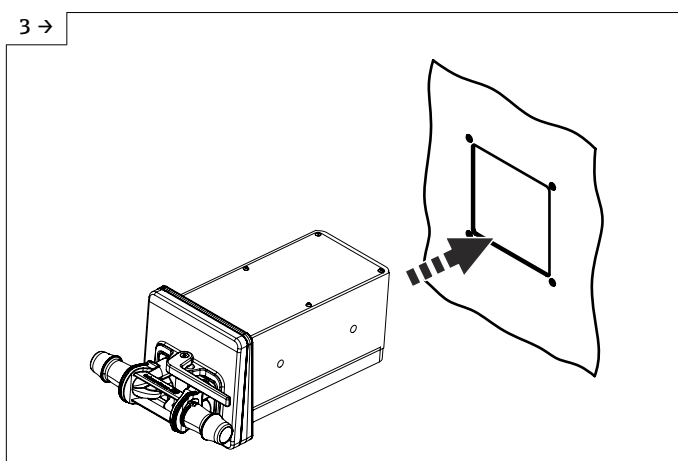
A0054237

- Remove the screws.



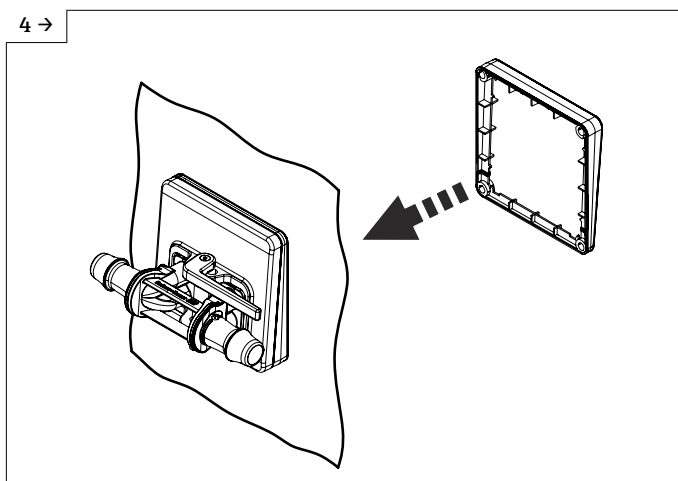
A0054238

- Remove the inner wedge. Depending on the orientation, turn the outside wedge. Orientation → 21



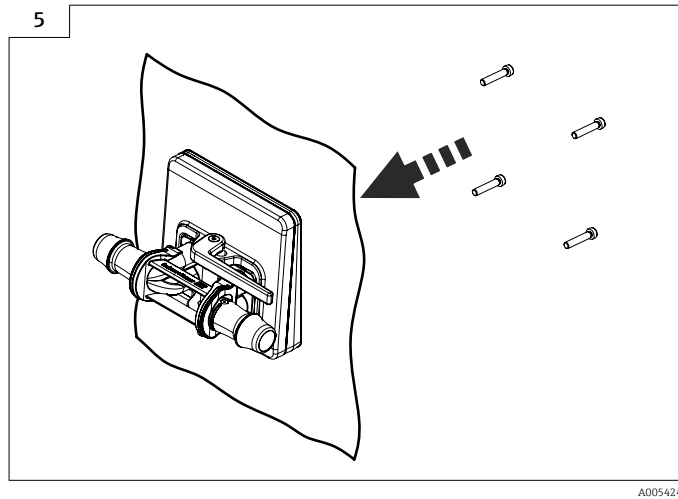
A0054239

- Push the sensor with wedge (towards the outside) into the prepared opening in the front panel.



A0054240

- Push the wedge from the inside over the sensor.

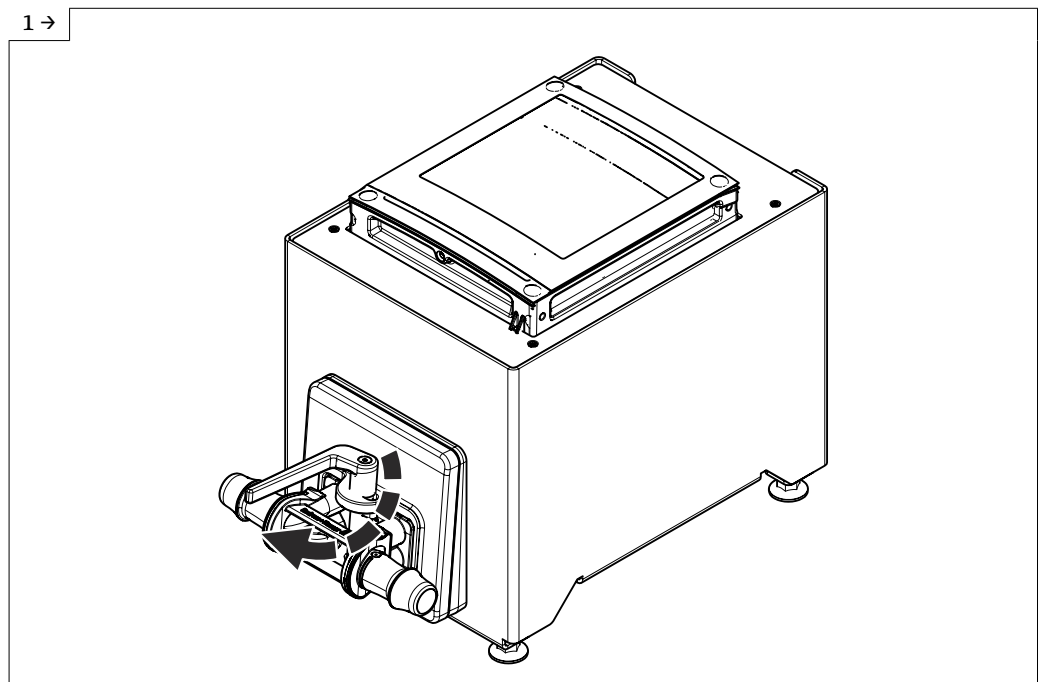


- Bolt the sensor and wedges together.

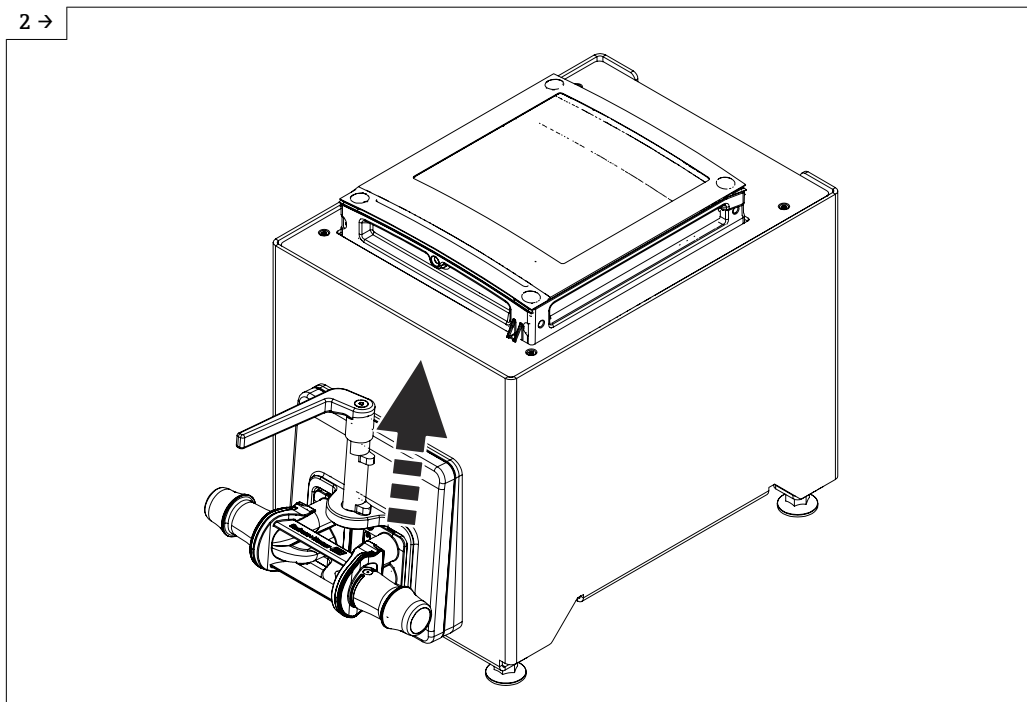
6.2.4 Replacing the disposable measuring tube



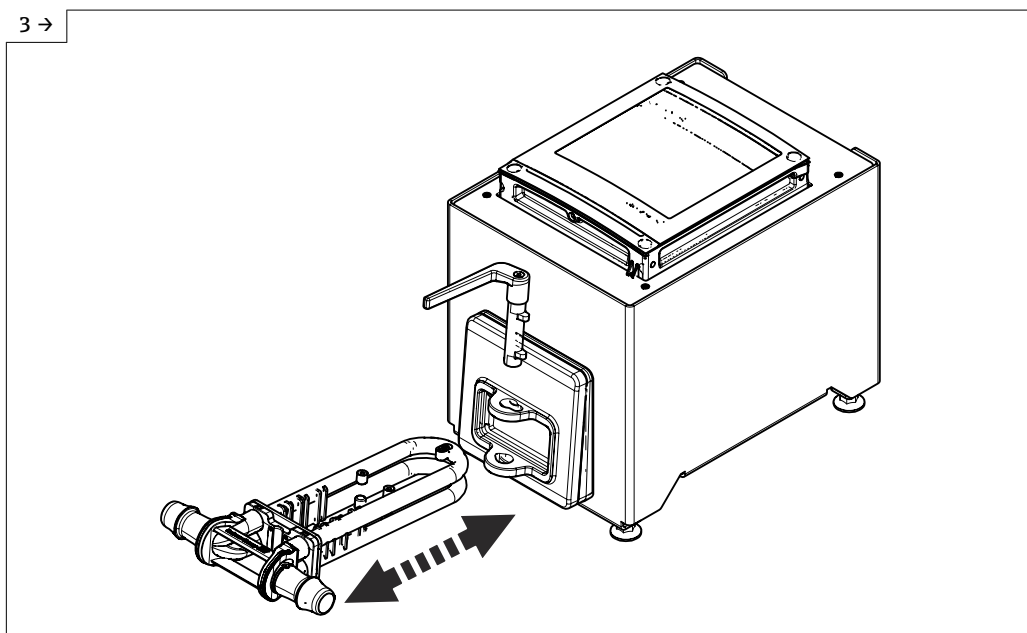
The device version, option NE table version must be attached to the table with the stand.



- Open the lever.

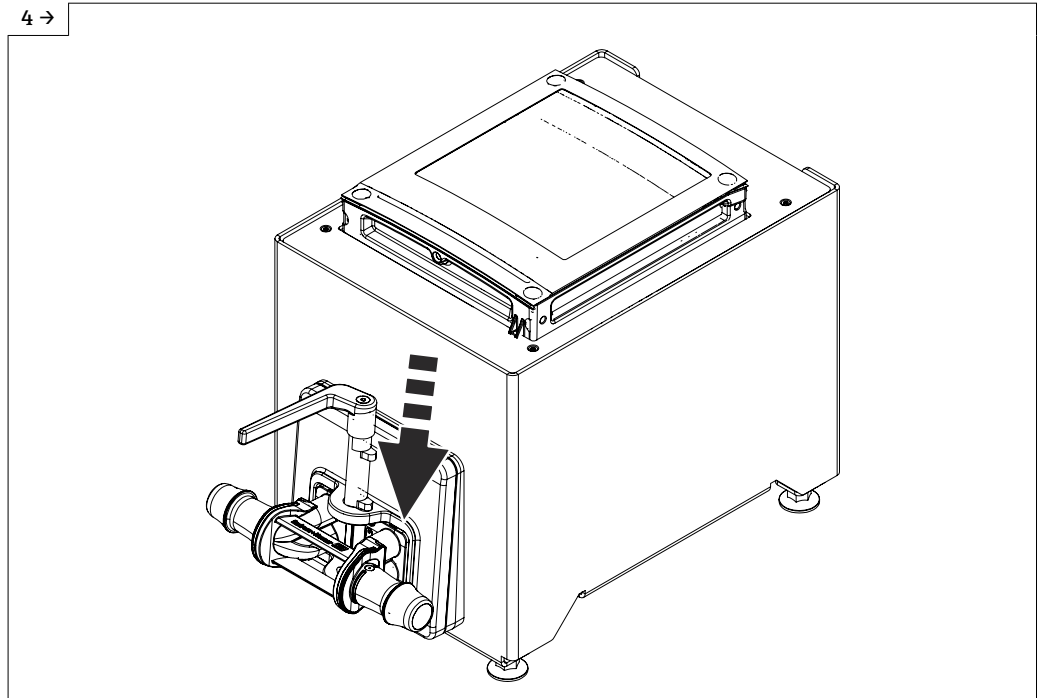


- Pull up the lever.



- Remove the disposable measuring tube.
- Wait until this diagnostic message appears: Sensor unknown.
- Insert the disposable measuring tube.

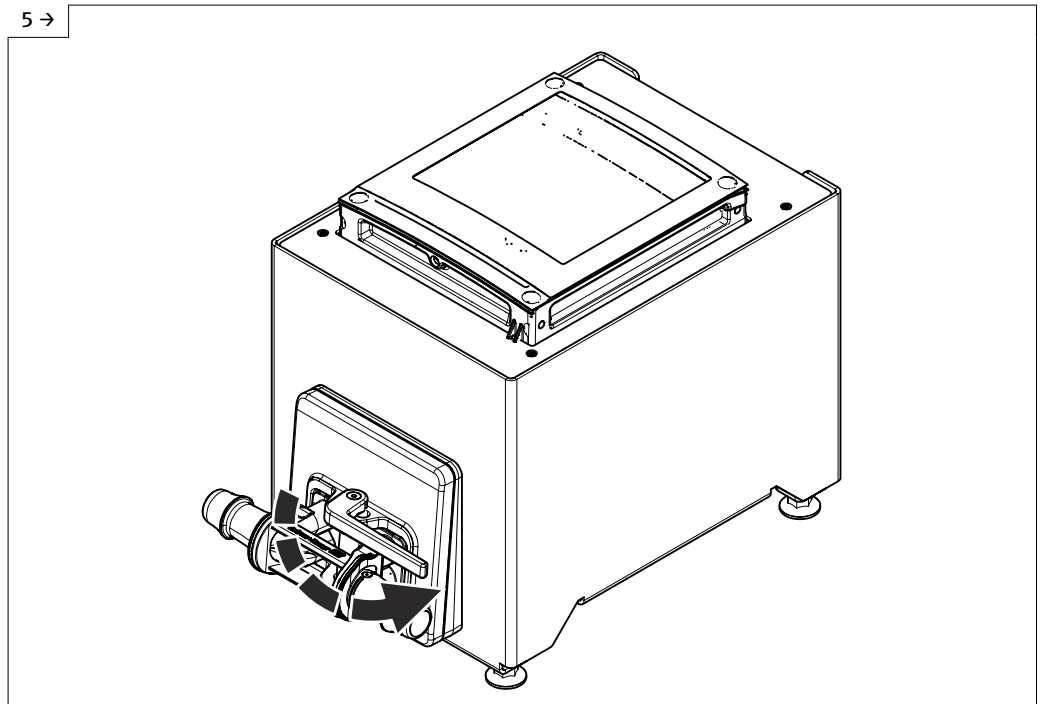
4 →



A0054685

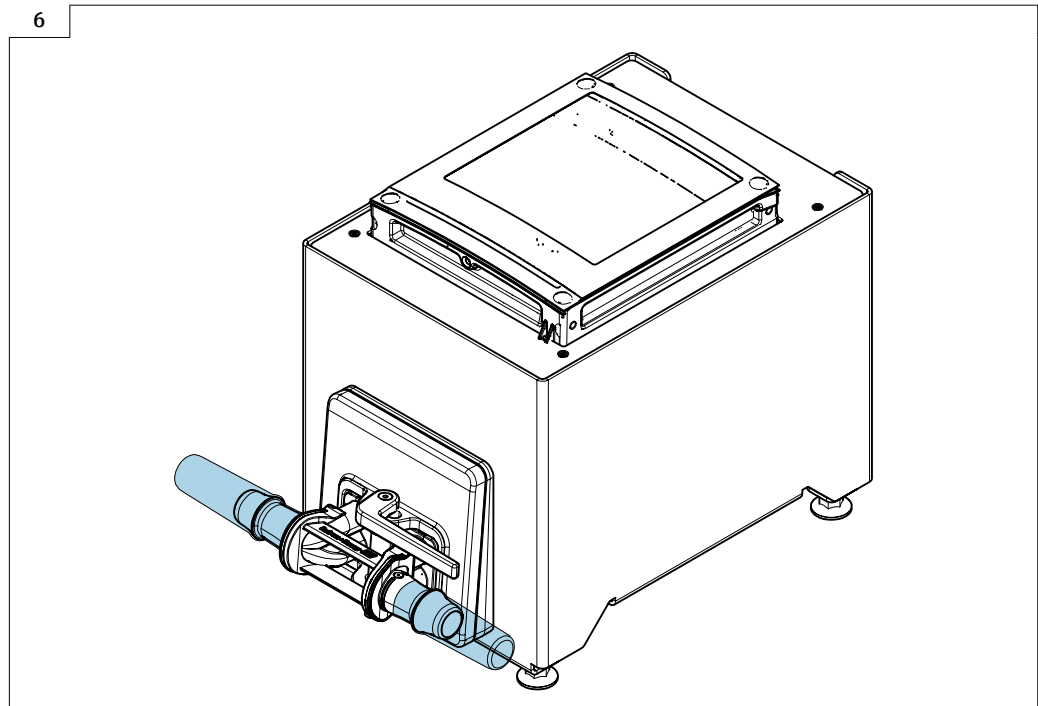
- ▶ Lower the lever.

5 →



A0054163

- ▶ Turn the lever to the limit stop.
- ▶ After inserting the disposable measuring tube, this diagnostic message appears on the display after 30 seconds at the latest: Device initialization active.
- ▶ Heartbeat Verification and zero point adjustment are performed automatically. This diagnostic message is displayed during this time: Device initialization active.
- ▶ Heartbeat Verification and zero point adjustment have been performed: No diagnostic message is displayed.



A0056826

- ▶ Fill the system with liquid (density: 800 to 1 500 kg/m³ (1 764 to 3 307 lb/cf)).
- ▶ Prevent any flow.
- ▶ Repeated flushing can help to eliminate gas pockets.
- ▶ Re-initialize the device: On the display Expert → Sensor → Disposable component → Commissioning, using Modbus Register 26321-1 or Profinet.
- ▶ Heartbeat Verification and zero point adjustment are performed. This diagnostic message is displayed during this time: Device initialization active.
- ▶ Heartbeat Verification and zero point adjustment have been performed: No diagnostic message is displayed.
- ▶ Download the Heartbeat Technology verification report: for detailed information on data management, see the Operating Instructions for the device
- ▶ The device is now operational.

6.2.5 Installing the transmitter housing: Proline 500 – digital

NOTICE

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature.

NOTICE

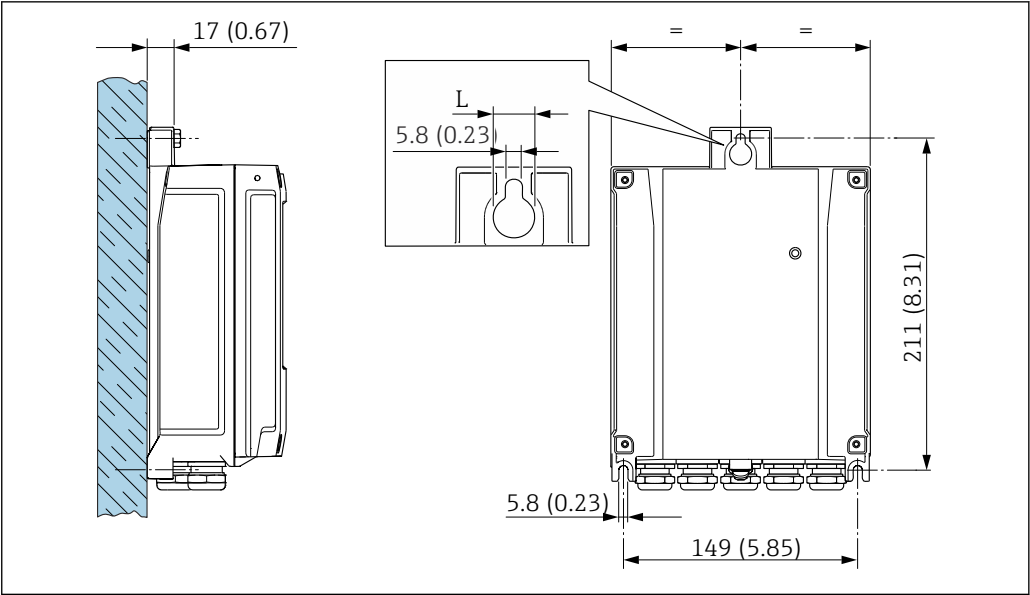
Excessive force can damage the housing!

- ▶ Avoid excessive mechanical stress.

Wall mounting

Required tools:

Drill with drill bit Ø 6.0 mm



5 Unit mm (in)

L Depends on order code for "Transmitter housing"

Order code for "Transmitter housing"
Option **A**, aluminum, coated: L =14 mm (0.55 in)

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

6.3 Post-installation check

Is the device undamaged (visual inspection)?	☐
Does the measuring instrument correspond to the measuring point specifications? For example: ■ Process temperature → 236 ■ Pressure (refer to the "Pressure-temperature ratings" section of the "Technical Information" document). ■ Ambient temperature ■ Measuring range	☐
Has the correct orientation for the sensor been selected ? ■ According to sensor type ■ According to medium temperature ■ According to medium properties (outgassing, with entrained solids)	☐
Does the arrow on the process connection match the direction of flow of the medium?	☐
Is the tag name and labeling correct (visual inspection)?	☐
	☐
Is the securing screw firmly tightened?	☐

7 Electrical connection

WARNING

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

- ▶ Set up a disconnecting device (switch or power-circuit breaker) to easily disconnect the device from the supply voltage.
- ▶ In addition to the device fuse, include an overcurrent protection unit with max. 10 A in the plant installation.

7.1 Electrical safety

In accordance with applicable national regulations.

7.2 Connecting requirements

7.2.1 Required tools

- For cable entries: use appropriate tool
- Wire stripper
- When using stranded cables: crimper for wire end ferrule
- For removing cables from terminal: flat blade screwdriver $\leq 3 \text{ mm}$ (0.12 in)

7.2.2 Requirements for connection cable

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

Protective grounding cable for the outer ground terminal

Conductor cross-section $< 6 \text{ mm}^2$ (10 AWG)

Larger cross-sections can be connected using a cable lug.

The grounding impedance must be less than 2Ω .

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

4 to 20 mA current input

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Relay output

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

Modbus RS485

Shielded twisted-pair cable.



See <https://modbus.org> "MODBUS over Serial Line Specification and Implementation Guide".

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)

Choice of connecting cable between the transmitter and sensor

A: Connecting cable between sensor and transmitter: Proline 500 – digital

Standard cable

A standard cable with the following specifications can be used as the connecting cable.

Design	2x2 cores (twisted pairs); stranded CU wires with common shield
Shield	Tin-plated copper braid, optical cover ≥ 85 %
Loop resistance	Power supply line (+, -): maximum 10 Ω
Cable length	Maximum 300 m (900 ft), see the following table.
Device plug, side 1	M12 socket, 5-pin, A-coded.
Device plug, side 2	M12 plug, 5-pin, A-coded.
Pins 1+2	Connected cores as twisted pair.
Pins 3+4	Connected cores as twisted pair.

Cross-section	Cable length [max.]
0.34 mm ² (AWG 22)	80 m (240 ft)
0.50 mm ² (AWG 20)	120 m (360 ft)
0.75 mm ² (AWG 18)	180 m (540 ft)
1.00 mm ² (AWG 17)	240 m (720 ft)
1.50 mm ² (AWG 15)	300 m (900 ft)

connecting cable

Design	2 × 2 × 0.34 mm ² PUR cable with common shield
Flame resistance	According to DIN EN 60332-1-2 (60 seconds)
Oil resistance	According to DIN EN 60811-2-1 (for 168h at 90°C)
Shield	Tin-plated copper braid
Continuous operating temperature	When mounted in a fixed position: -40 to +105 °C (-40 to +221 °F); when cable can move freely: -25 to +105 °C (-13 to +221 °F)
Available cable lengths	Fixed: 2 m (6 ft), 5 m (15 ft), 10 m (30 ft)
Device plug, side 1	M12 socket, 5-pin, A-coded
Device plug, side 2	M12 plug, 5-pin, A-coded

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 (port 1)		Input/output 2		Input/output 3		Input/output 4 ¹⁾		Service interface (Port 2)
1 (+)	2 (-)	26 (B)	27 (A)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)	CDI-RJ45
Device-specific terminal assignment: adhesive label in terminal cover.										

1) Input/output only available for Proline 500 - digital.

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 – digital →  34

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 device

Carry out the steps in the following order:

1. Mount the sensor and transmitter.

2. Sensor connection housing: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect 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 instrument is supplied without cable glands:
Provide suitable cable gland for corresponding connecting cable.
3. If the measuring instrument is supplied with cable glands:
Observe requirements for connecting cables →  30.

7.3 Connecting the device: Proline 500 – digital

NOTICE

An incorrect connection compromises electrical safety!

- ▶ Only properly trained specialist staff may perform electrical connection work.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.
- ▶ Always connect the protective ground cable ⊕ before connecting additional cables.

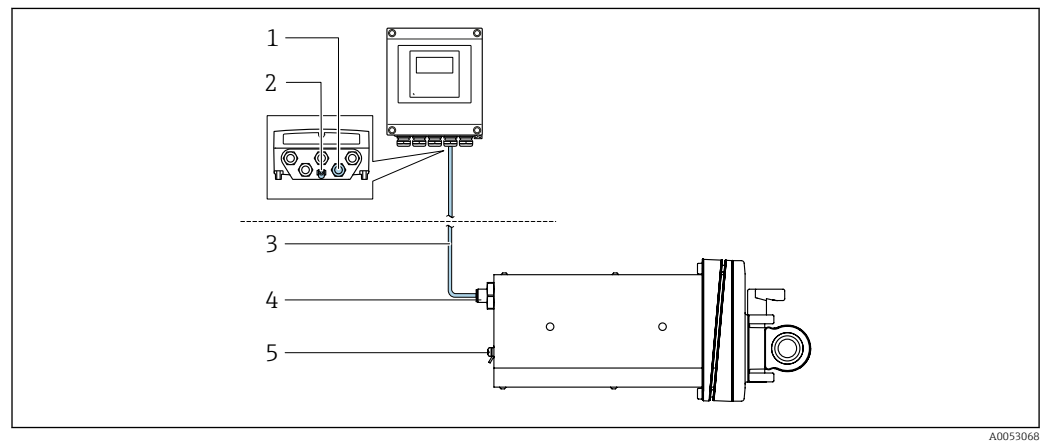
7.3.1 Connecting the connecting cable

NOTICE

Risk of damaging the electronic components!

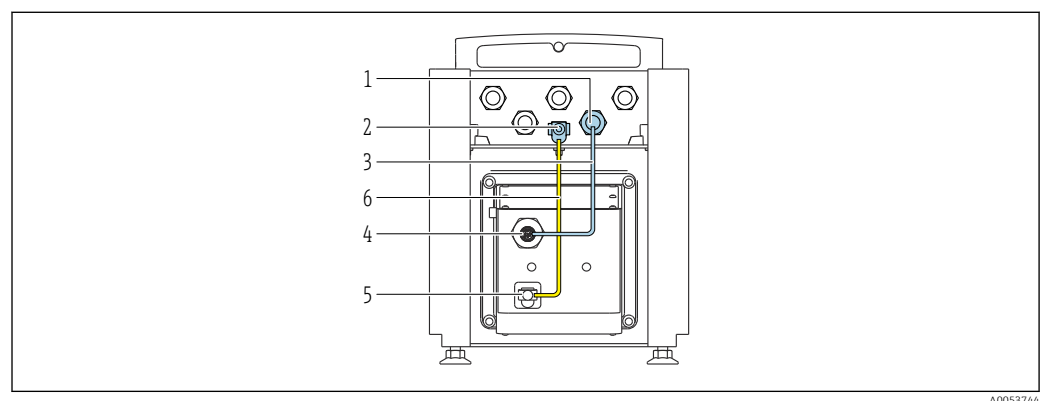
- ▶ Connect the sensor and transmitter to the same potential equalization.
- ▶ Only connect the sensor to a transmitter with the same serial number.

Connection of connecting cable: Proline 500 – digital



 6 Order code for "Device version", option NA "Front panel mounting"

- 1 M12 socket for connecting the connecting cable on the transmitter housing
- 2 Protective ground connection (PE)
- 3 Connecting cable with M12 plug and M12 socket
- 4 M12 plug for connecting the connecting cable on the sensor
- 5 Protective ground connection (PE)

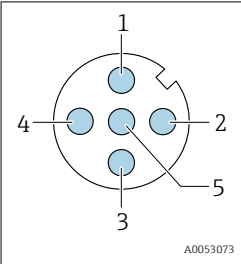


 7 Order code for "Device version", option NE "Table version"

- 1 M12 socket for connecting the connecting cable on the transmitter housing
- 2 Protective ground connection (PE)
- 3 Connecting cable with M12 plug and M12 socket
- 4 M12 plug for connecting the connecting cable on the sensor
- 5 Protective ground connection (PE)
- 6 Fixed connection between the potential equalization (PE)

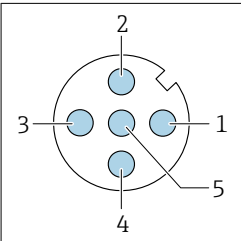
Pin assignment, device plug

Connection to transmitter

 A0053073	Pin	Color ¹⁾	Assignment		Connection to terminal
	1	Brown	+	Supply voltage	61
	2	White	-		62
	3	Blue	A	ISEM communication	64
	4	Black	B		63
	5	-		-	-
	Coding			Plug/socket	
	A			Socket	

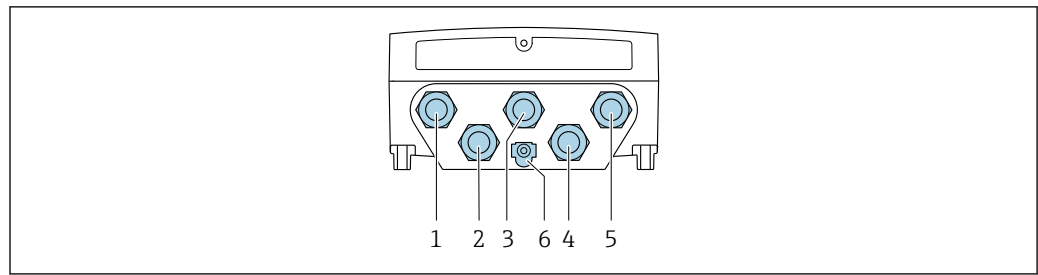
1) Cable colors of connecting cable

Connection on sensor

 A0053073	Pin	Color ¹⁾	Assignment	
	1	Brown	+	Supply voltage
	2	White	-	
	3	Blue	A	ISEM communication
	4	Black	B	
	5	-		-
	Coding			Plug/socket
	A			Plug

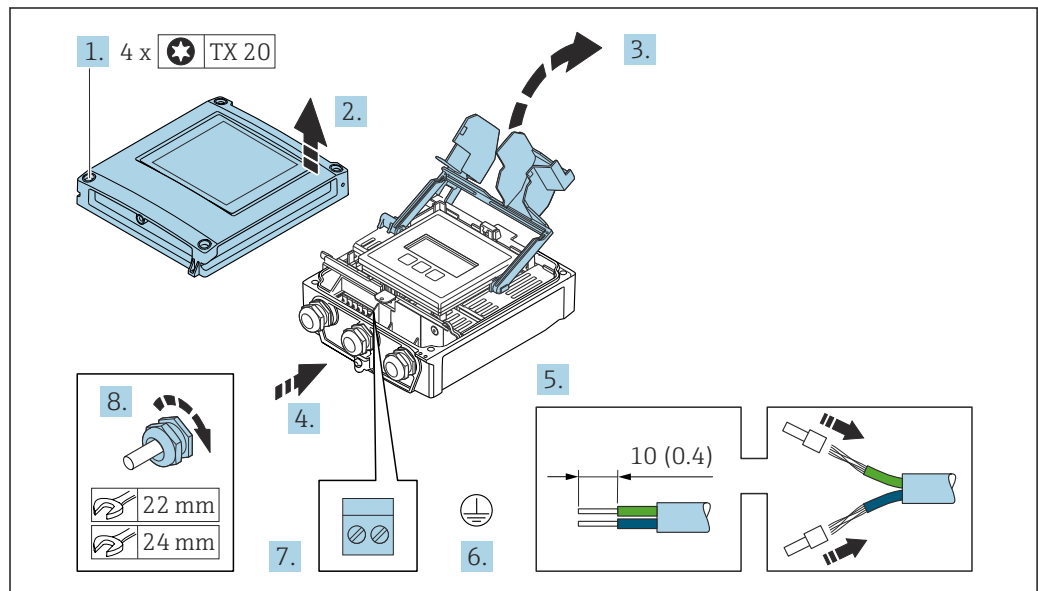
1) Cable colors of connecting cable

7.3.2 Connecting the signal cable and the supply voltage cable



A0028200

- 1 Terminal connection for supply voltage
- 2 Terminal connection for signal transmission, input/output
- 3 Terminal connection for signal transmission, input/output
- 4 Terminal connection for connecting cable between sensor and transmitter
- 5 Terminal connection for signal transmission, input/output; optional: connection for external WLAN antenna
- 6 Protective earth (PE)



A0029597

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Fold open the terminal cover.
4. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
5. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
6. Connect the protective ground.
7. Connect the cable according to 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 → 32.
8. Firmly tighten the cable glands.
 - ↳ This concludes the cable connection process.
9. Close the terminal cover.
10. Close the housing cover.

⚠ WARNING

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

- Screw in the screw without using any lubricant.

NOTICE

Excessive tightening torque applied to the fixing screws!

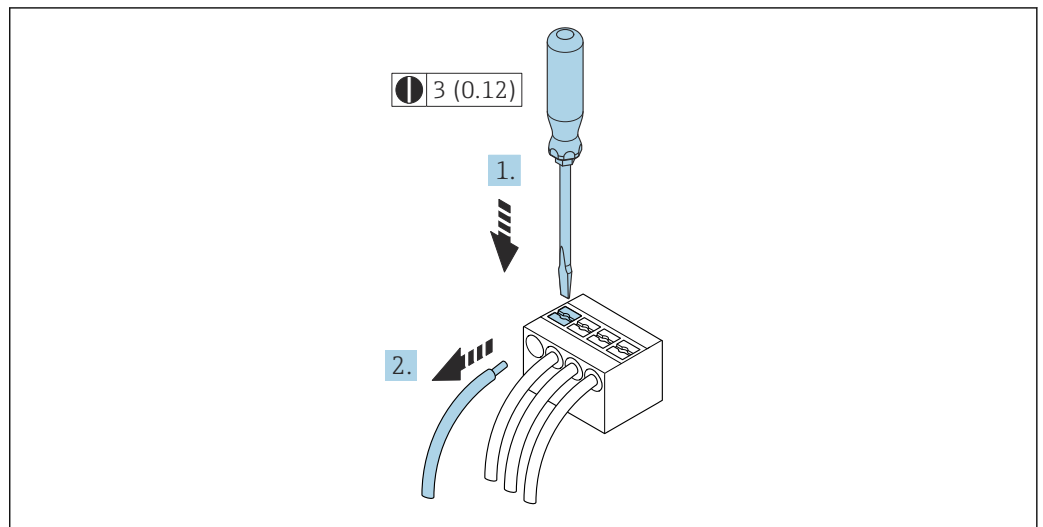
Risk of damaging the plastic transmitter.

- Tighten the fixing screws as per the tightening torque: 2.5 Nm (1.8 lbf ft)

11. Tighten the 4 fixing screws on the housing cover.

Removing a cable

To remove a cable from the terminal:



A0029598

8 Unit mm(in)

1. Use a flat-blade screwdriver to press down on the slot between the two terminal holes.
2. Remove the cable end from the terminal.

7.4 Potential equalization

7.4.1 Requirements

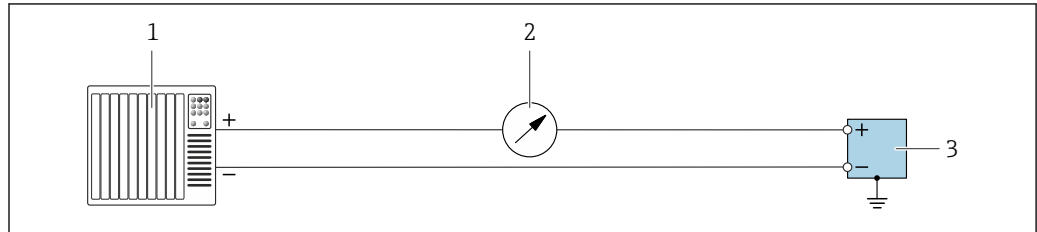
For potential equalization:

- 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 electric potential
- For order code "Device version", option NE "Table version", the sensor and transmitter are internally wired
- Use a ground cable with a minimum cross-section of 6 mm² (10 AWG) and a cable lug for potential equalization connections

7.5 Special connection instructions

7.5.1 Connection examples

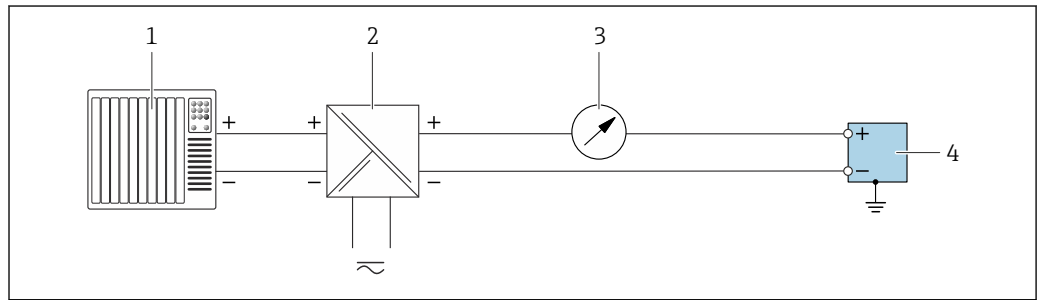
Current output 4 to 20 mA (without HART)



A0055851

9 Connection example for 4 to 20 mA current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Optional additional display unit: Observe maximum load
- 3 Flowmeter with current output (active)

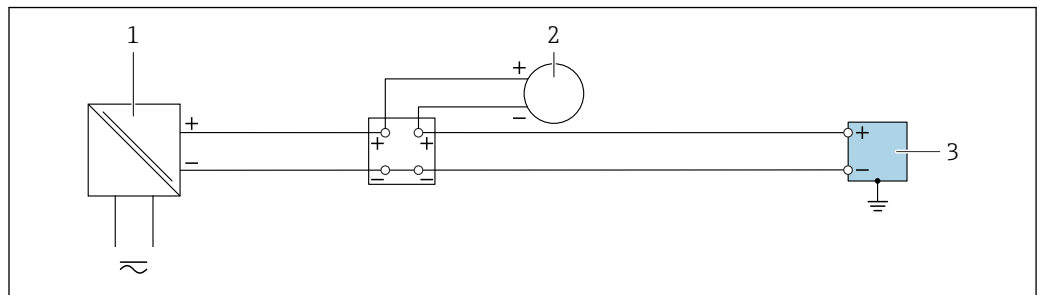


A0055852

10 Connection example for 4 to 20 mA current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Power supply
- 3 Optional additional display unit: Observe maximum load
- 4 Transmitter with current output (passive)

Current input 4 to 20 mA

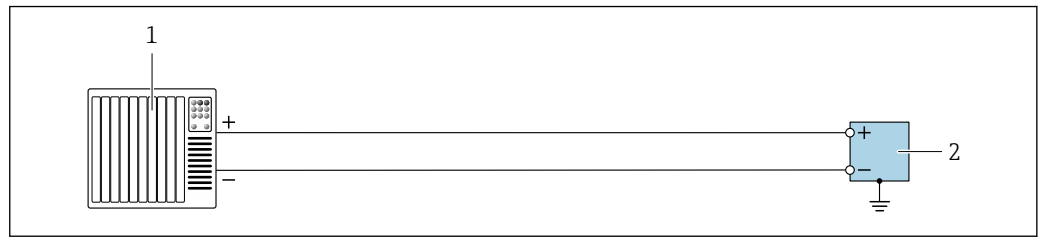


A0055853

11 Connection example for 4 to 20 mA current input

- 1 Power supply
- 2 External measuring instrument with 4 to 20 mA passive current output. e.g. pressure or temperature
- 3 Transmitter with 4 to 20 mA current input

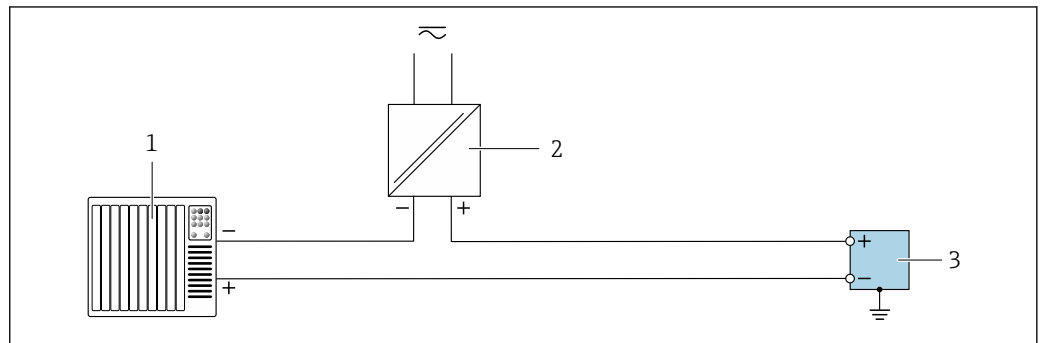
Pulse output/frequency output/switch output



A0055856

12 Connection example for pulse output/frequency output/switch output (active)

- 1 Automation system with pulse input/frequency input/switch input (e.g. PLC)
- 2 Transmitter with pulse output/frequency output/switch output (active)

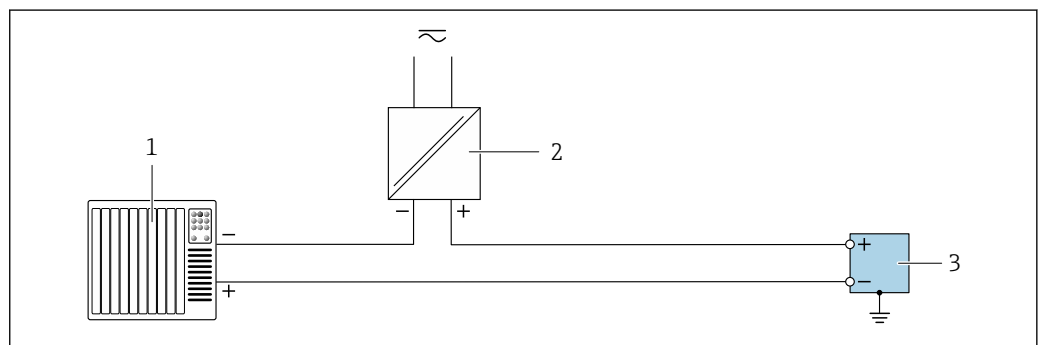


A0055856

13 Connection example for pulse output/frequency output/switch output (passive)

- 1 Automation system with pulse input/frequency input/switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter with pulse output/frequency output/switch output (passive)

Relay output

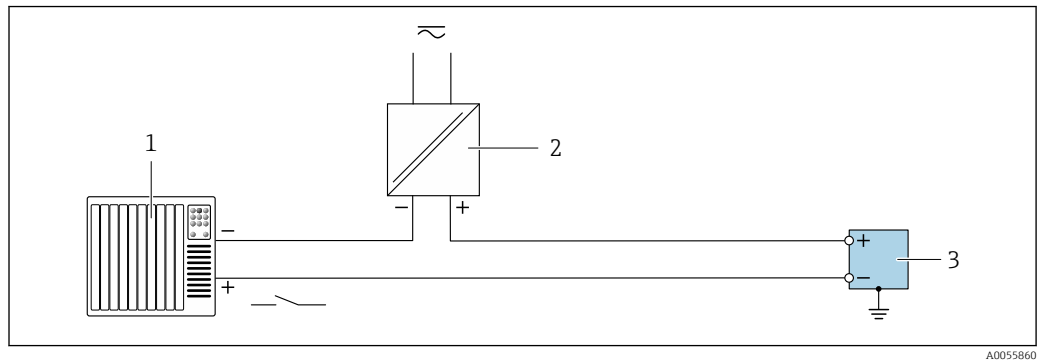


A0055859

14 Connection example for relay output

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter with relay output

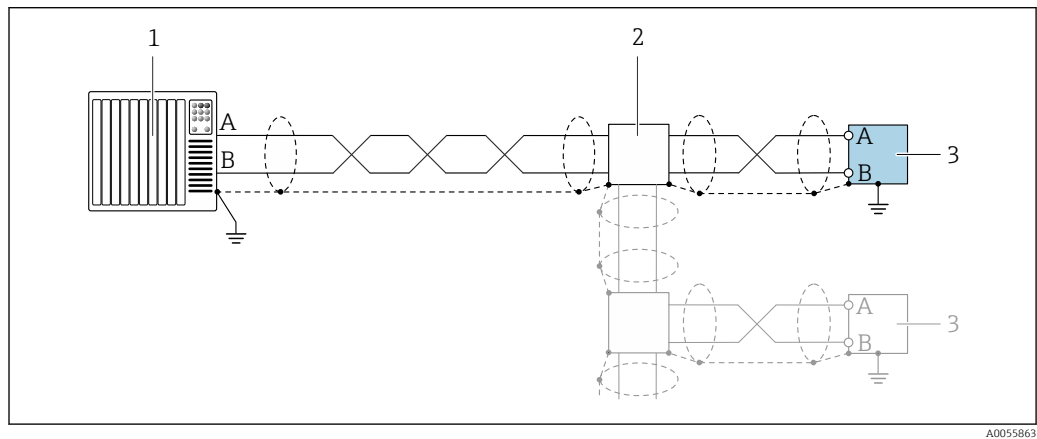
Status input



15 Connection example for status input

- 1 Automation system with switch output passive e.g. PLC)
- 2 Power supply
- 3 Transmitter with status input

Modbus RS485



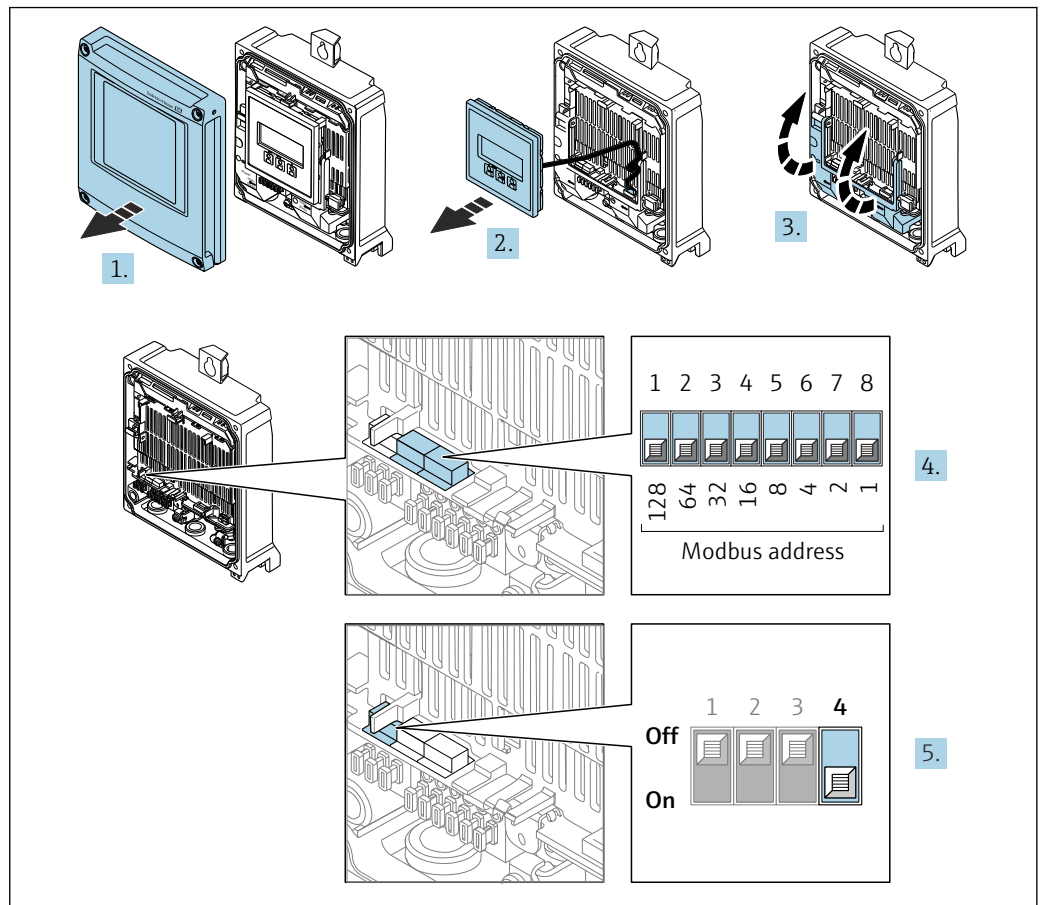
16 Connection example for Modbus RS485

- 1 Automation system with Modbus master (e.g. PLC)
- 2 Optional distribution box
- 3 Transmitter with Modbus RS485

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.

Proline 500 – digital transmitter*Hardware addressing*

A0029677

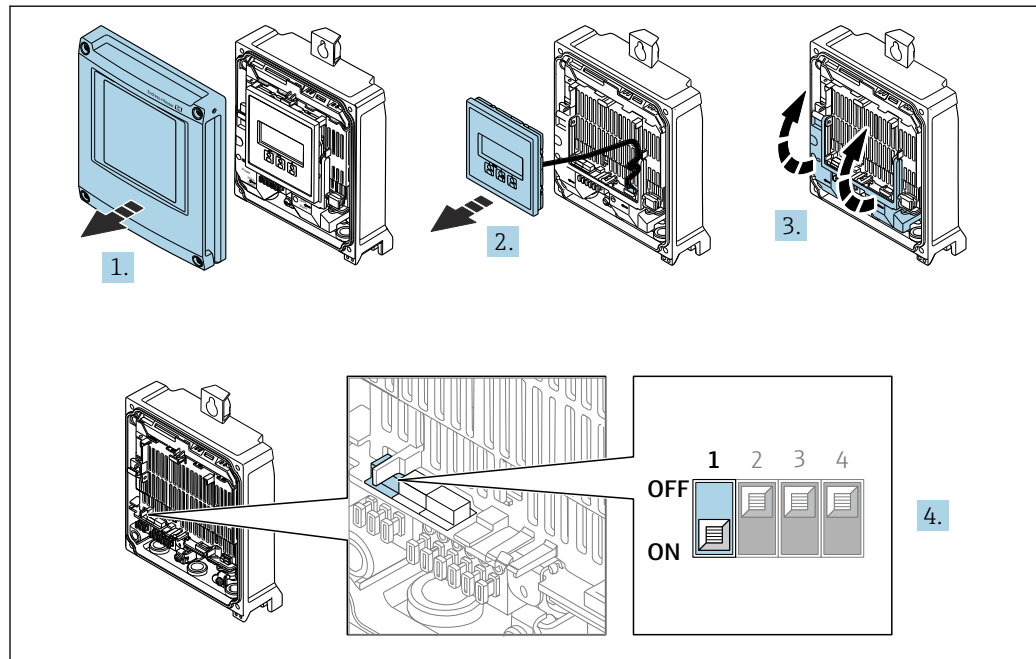
1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.
4. Set the desired device address using the DIP switches.
5. To switch addressing from software addressing to hardware addressing: set the DIP switch to **On**.
 - ↳ The change of device address takes effect after 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.

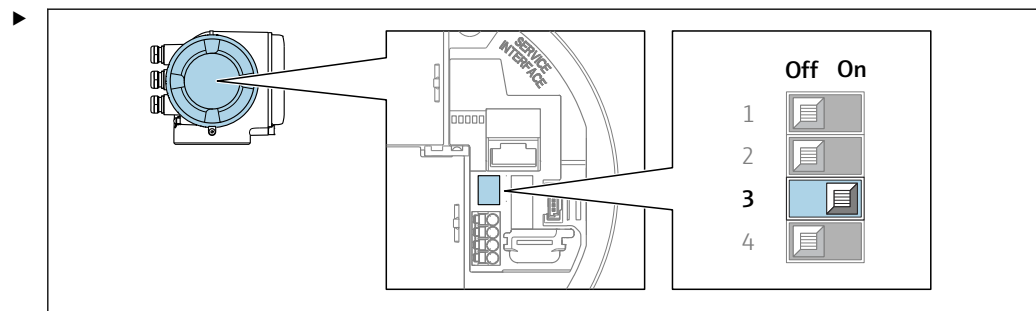
7.6.2 Activating the terminating resistor

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

Proline 500 – digital transmitter

A0029675

1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.
4. Switch DIP switch no. 3 to **On**.

Proline 500 transmitter

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

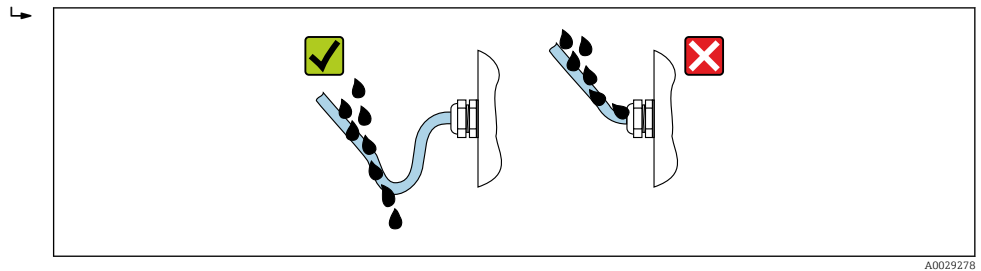
7.7 Ensuring the degree of protection

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

To ensure degree of protection IP66/67, Type 4X enclosure, carry out the following steps after making 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").



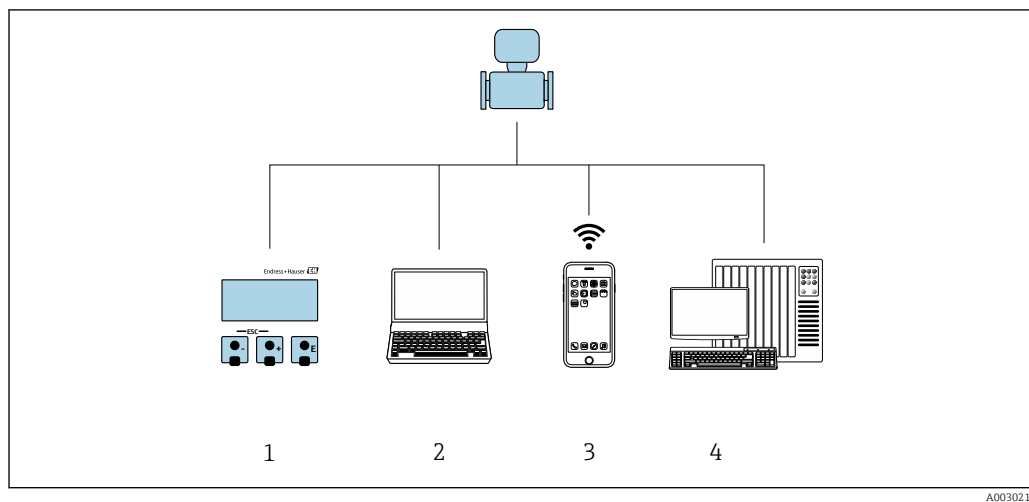
6. The supplied cable glands and plastic dummy plugs used for the threaded cable entries do not ensure degree of protection IP66/67, Type 4X enclosure. To achieve this degree of protection, cable glands and plastic dummy plugs that are not used must be replaced by threaded dummy plugs with the degree of protection IP66/67, Type 4X enclosure.

7.8 Post-connection check

Are the device and cable undamaged (visual inspection)?	☐
Is the protective earthing established correctly?	☐
Do the cables used meet the requirements ?	☐
Are the mounted cables strain-relieved and fixed securely in place?	☐
Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" → 42?	☐
Is the terminal assignment correct ?	☐
Are dummy plugs inserted in unused cable entries and have transportation plugs been replaced with dummy plugs?	☐

8 Operation options

8.1 Overview of operation options

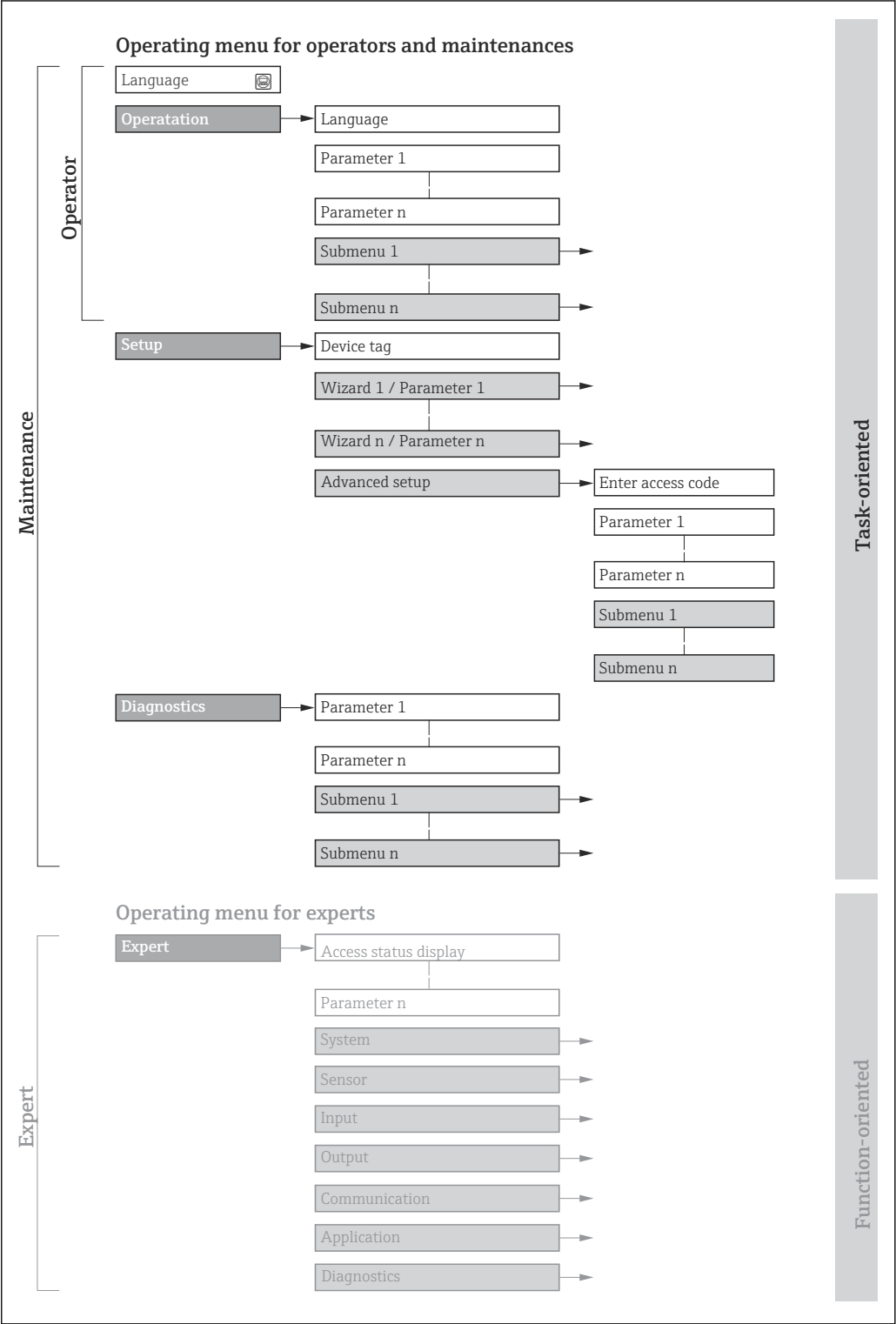


- 1 Local operation via display module
- 2 Computer with web browser or operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)
- 3 Mobile handheld terminal with SmartBlue app
- 4 Automation system (e.g. PLC)

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 →  244



 17 Schematic structure of the operating menu

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8.2.2 Operating philosophy

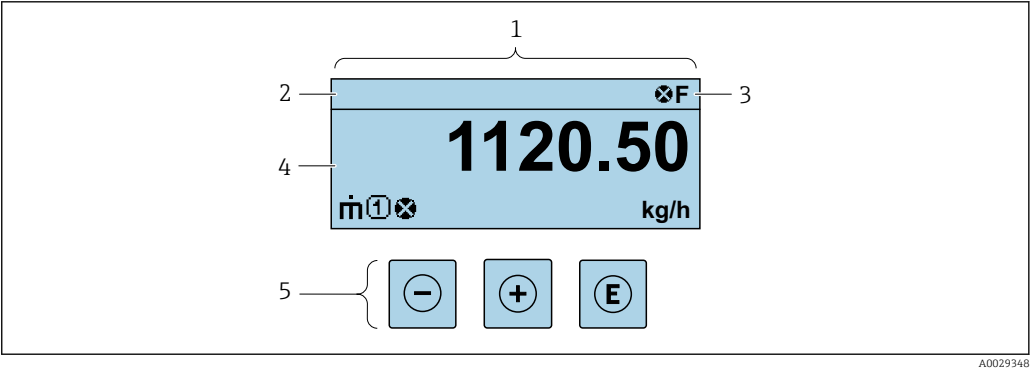
The individual parts of the operating menu are assigned to certain user roles (e.g. operator, maintenance etc.). Each user role contains typical tasks within the device life cycle.

Menu/parameter		User role and tasks	Content/meaning
Language	Task-oriented	Role "Operator", "Maintenance" Tasks during operation: ■ Configuring the operational display ■ Reading measured values	Defining the operating language
Operation			■ Defining the operating language ■ Defining the web server operating language ■ Resetting and controlling totalizers ■ Configuring the operational display (e.g. display format, display contrast) ■ Resetting and controlling totalizers
Setup		"Maintenance" role Commissioning: ■ Configuring the measurement ■ Configuring the inputs and outputs ■ Configuring the communication interface	Wizard for quick commissioning: ■ Configuring the system units ■ Configuring the communication interface ■ Defining the medium ■ Displaying the I/O configuration ■ Configuring the inputs ■ Configuring the outputs ■ Configuring the operational display ■ Configuring the low flow cut off ■ Configuring the detection of partially filled and empty pipes Advanced setup ■ For more customized configuration of the measurement (adaptation to special measuring conditions) ■ Calculated process variables ■ Sensor adjustment ■ Configuring totalizers ■ Configuring the display ■ Configuring the WLAN settings ■ Data backup ■ Administration (define access code, reset measuring instrument)
Diagnostics		"Maintenance" role Troubleshooting: ■ Diagnostics and elimination of process and device errors ■ Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: ■ Diagnostic list Contains up to 5 currently pending diagnostic messages. ■ Event logbook Contains event messages that have occurred. ■ Device information Contains information for identifying the device. ■ Measured values Contains all current measured values. ■ Data logging submenu with the "Extended HistoROM" order option Storage and visualization of measured values ■ Heartbeat Technology The functionality of the device is checked on demand and the verification results are documented. ■ Simulation Used to simulate measured values or output values. ■ Testpoints

Menu/parameter		User role and tasks	Content/meaning
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-level device parameters that do not affect measurement or measured value communication. ■ Sensor Configuring the measurement. ■ Input Configuring the status input. ■ Output Configuring the analog current outputs as well as the pulse/frequency and switch output. ■ Communication Configuring the digital communication interface and the web server. ■ Application Configuring 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 the Heartbeat Technology menu.

8.3 Access to operating menu via local display

8.3.1 Operational display



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

Status area

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

- Status signals → 200
 - **F**: Failure
 - **C**: Function check
 - **S**: Out of specification
 - **M**: Maintenance required
- Diagnostic behavior → 201
 - : 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 variable	Measurement channel number	Diagnostic behavior
	↓	↓	↓
Example			
			Appears only if a diagnostics event is present for this measured variable.

Measured variables

Symbol	Meaning
	Mass flow
	- Volume flow - Corrected volume flow
	- Density - Reference density
	Temperature

The number and display format of the measured variables can be configured via the **Format display** parameter (→ 108).

Totalizer

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

Output

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

Input

Symbol	Meaning
	Status input

Measurement channel numbers

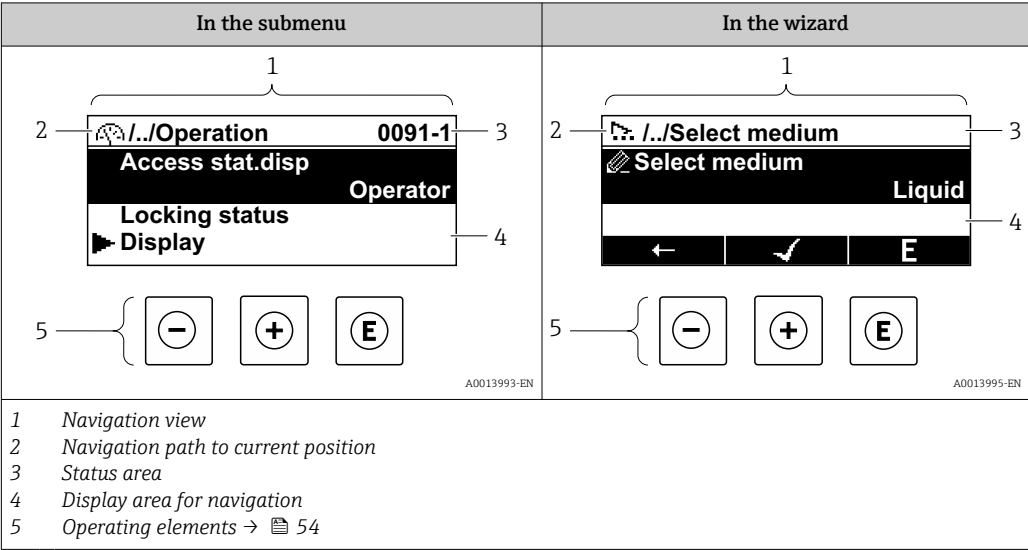
Symbol	Meaning
	Measurement channel 1 to 4 The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).

Diagnostic behavior

Symbol	Meaning
	Alarm ■ Measurement is interrupted. ■ Signal outputs and totalizers assume the defined alarm condition. ■ A diagnostic message is generated.
	Warning ■ Measurement is resumed. ■ The signal outputs and totalizers are not affected. ■ A diagnostic message is generated.

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

8.3.2 Navigation view



Navigation path

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

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

	Display symbol	Omission symbol	Parameter
	↓	↓	↓
Example	▶	/ ../	Indication

For more information about the icons in the menu, refer to the "Display area" section → 50

Status area

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

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

- For information on the diagnostic behavior and status signal → 200
- For information on the function and entry of the direct access code → 56

Display area

Menus

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

	Setup Is displayed: ■ In the menu next to the "Setup" selection ■ At the left in the navigation path in the Setup menu
	Diagnosis Is displayed: ■ In the menu next to the "Diagnostics" selection ■ At the left in the navigation path in the Diagnostics menu
	Expert Is displayed: ■ In the menu next to the "Expert" selection ■ At the left in the navigation path in the Expert menu

Submenus, wizards, parameters

Symbol	Meaning
	Submenu
	Wizards
	Parameters within a wizard
	No display symbol exists for parameters in submenus.

Locking procedure

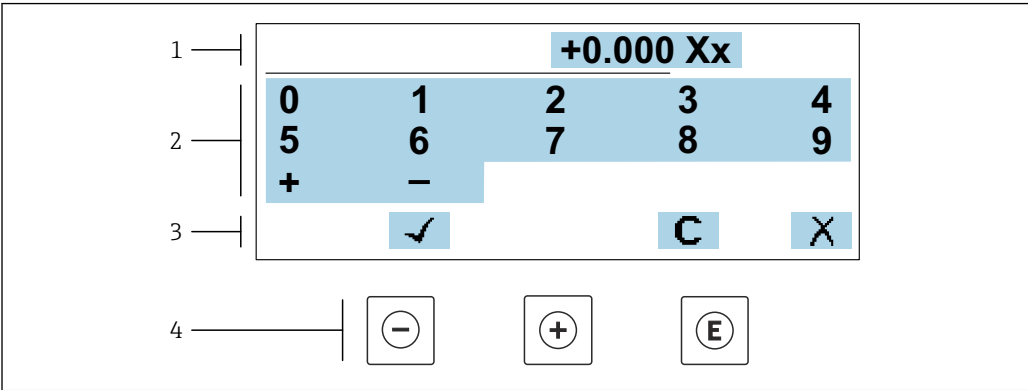
Symbol	Meaning
	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. ■ By a user-specific access code ■ By the hardware write protection switch

Wizards

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

8.3.3 Editing view

Numeric editor

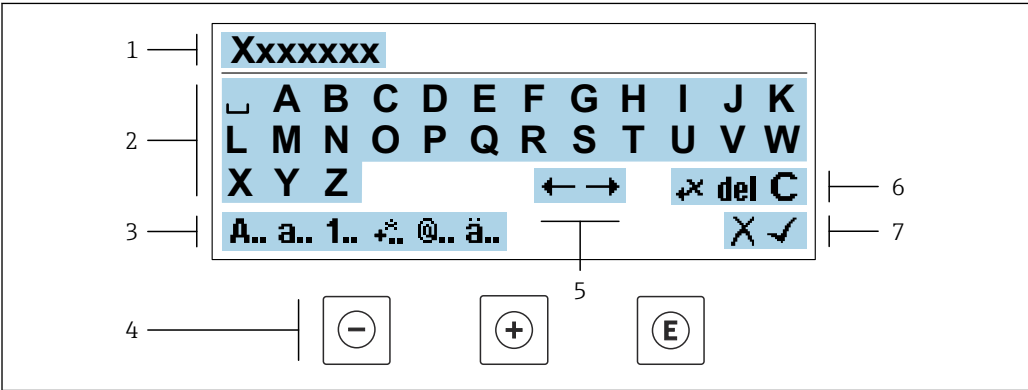


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18 For entering values in parameters (e.g. limit values)

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

Text editor



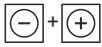
A0034114

19 For entering text in parameters (e.g. device tag)

- 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	Meaning
	Minus key Move the entry position to the left.
	Plus key Move the entry position to the right.

Operating key	Meaning
	Enter key - Pressing the key briefly confirms your selection. - Pressing the key for 2 s confirms your entry.
	Escape key combination (press keys simultaneously) Close the editing view without accepting a change.

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 ° € \$ £ ¥ § @ # / \ ~ & _
ä..	Umlauts and accents

Controlling data entries

Symbol	Meaning
	Move entry position
	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	Meaning
	Minus key <i>In menu, submenu</i> Moves the selection bar upwards in a picklist <i>In wizards</i> Goes to previous parameter <i>In the text and numeric editor</i> Move the entry position to the left.
	Plus key <i>In menu, submenu</i> Moves the selection bar downwards in a picklist <i>In wizards</i> Goes to the next parameter <i>In the text and numeric editor</i> Move the entry position to the right.
	Enter key <i>In the operational display</i> Pressing the key briefly opens the operating menu. <i>In menu, submenu</i> - Pressing the key briefly: - Opens the selected menu, submenu or parameter. - Starts the wizard. - If help text is open, closes the help text of the parameter. - Pressing the key for 2 s in a parameter: - If present, opens the help text for the function of the parameter. <i>In wizards</i> Opens the editing view of the parameter and confirms the parameter value <i>In the text and numeric editor</i> - Pressing the key briefly confirms your selection. - Pressing the key for 2 s confirms your entry.
	Escape key combination (press keys simultaneously) <i>In menu, submenu</i> - Pressing the key briefly: - Exits the current menu level and takes you to the next higher level. - If help text is open, closes the help text of the parameter. - Pressing the key for 2 s returns you to the operational display ("home position"). <i>In wizards</i> Exits the wizard and takes you to the next higher level <i>In the text and numeric editor</i> Exits the Editing view without applying the changes.
	Minus/Enter key combination (press and hold down the keys simultaneously) - If keypad lock is active: - Pressing the key for 3 s deactivates the keypad lock. - If keypad lock is not active: - Pressing the key for 3 s opens the context menu including the option for activating the keypad lock.

8.3.5 Opening the context menu

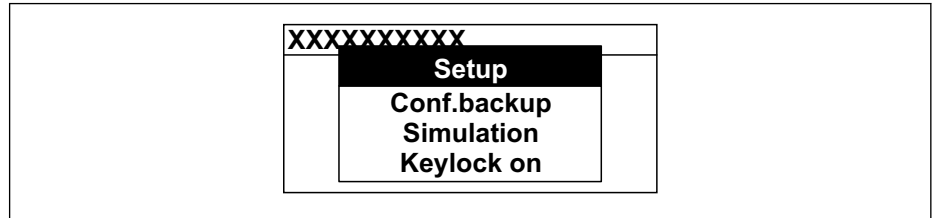
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Data backup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

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



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

Calling up the menu via the context menu

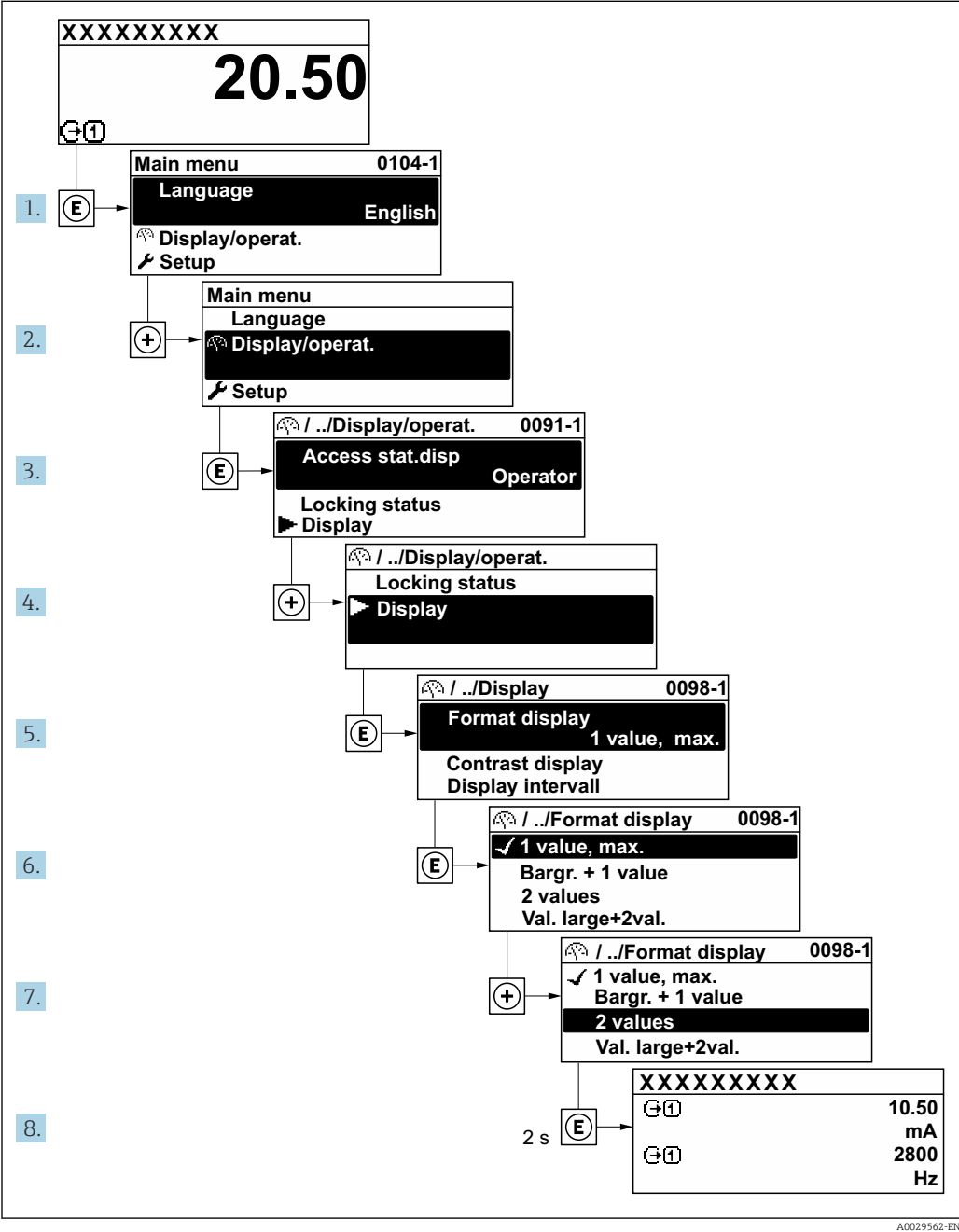
1. Open the context menu.
2. Press  to navigate to the desired menu.
3. Press  to confirm the selection.
↳ The selected menu opens.

8.3.6 Navigating and selecting from list

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

 For an explanation of the navigation view with symbols and operating elements
→  50

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



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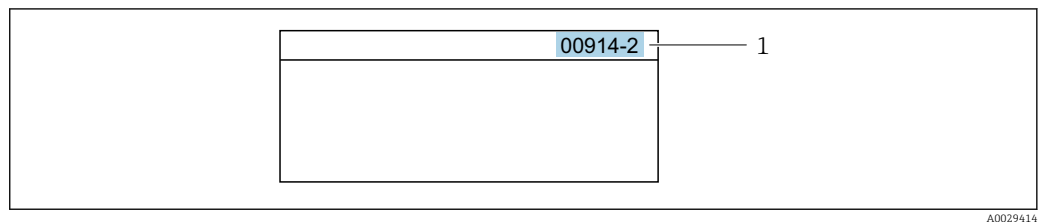
8.3.7 Calling the parameter directly

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

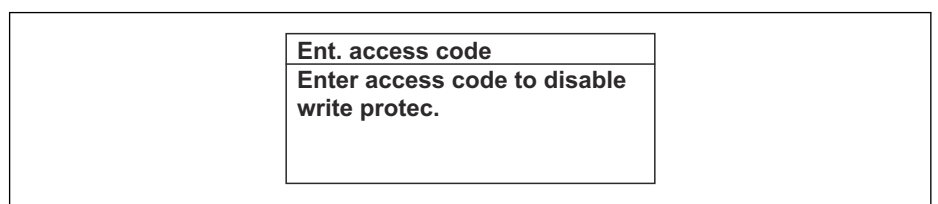
8.3.8 Calling up help text

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



20 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.

Ent. access code

Invalid or out of range input value

Min:0

Max:9999

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

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 →  137.

Defining access authorization for user roles

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

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

Access authorization to parameters: "Maintenance" user role

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

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

Access authorization to parameters: "Operator" user role

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

1) Despite the defined access code, certain parameters can always be modified and thus are excluded from the write protection as they do not affect the measurement: write protection via access code →  137

 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 →  137.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→  115) via the respective access option.

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

2. Enter the access code.

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

8.3.12 Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

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

To activate the keylock manually:

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

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

Switching off the keypad lock

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

8.4 Access to operating menu via web browser

8.4.1 Function range

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

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, see the Special Documentation for the device. →  244

8.4.2 Requirements

Computer hardware

Hardware	Interface	
	RJ45	WLAN
Interface	The computer must have a RJ45 interface. ¹⁾	The operating unit must have a WLAN interface.
Connection	Standard Ethernet cable	Connection via wireless local area network.
Screen	Recommended size: ≥12" (depends on the screen resolution)	

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

Computer software

Software	Interface	
	RJ45	WLAN
Recommended operating systems	- Microsoft Windows 8 or higher. - Mobile operating systems: - iOS - Android  Microsoft Windows XP and Windows 7 is supported.	
Web browsers supported	- Microsoft Edge - Mozilla Firefox - Google Chrome - Safari	

Computer settings

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

 In the event of connection problems: →  197

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 →  65

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 →  65

8.4.3 Connecting the device**Via service interface (CDI-RJ45)***Preparing the measuring device**Proline 500 – digital*

1. Loosen the 4 fixing screws on the housing cover.
2. 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 plug via the standard Ethernet cable .

Proline 500

1. Depending on the housing version:
Loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version:
Unscrew or open the housing cover.
3. Connect the computer to the RJ45 plug 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 the computer to the RJ45 plug via the standard Ethernet cable →  67.
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 device

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

Please note the following to avoid a network conflict:

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

Preparing the mobile terminal

- Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
Select the measuring device using the SSID (e.g. EH__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).
↳ The LED on the display module flashes. It is now possible to operate the measuring device with the web browser, FieldCare or DeviceCare.



The serial number can be found on the nameplate.



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

Terminating the WLAN connection

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

Starting the web browser

1. Start the web browser on the computer.

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

The screenshot shows the login interface of the Endress+Hauser web server. It includes fields for device identification (name, tag, status), a language selection dropdown, and a login section with an access code field and a 'Login' button. A 'Reset access code' button is located at the bottom of the login section.

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- 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 → 197

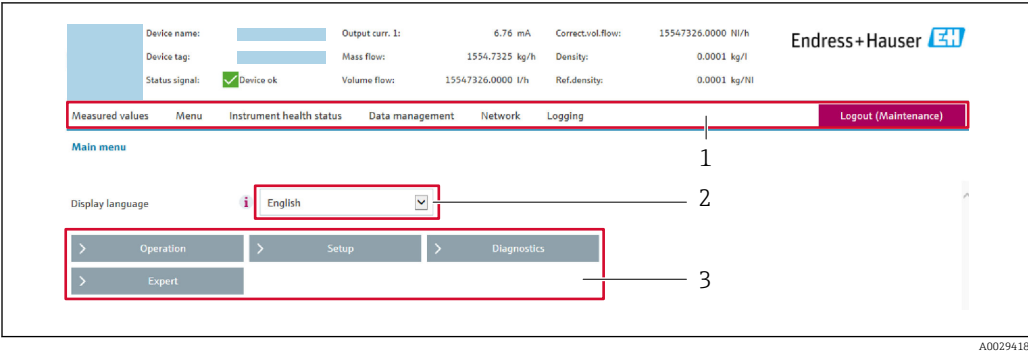
8.4.4 Logging on

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



- 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 → 203
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring instrument
Menu	■ Access to the operating menu from the measuring instrument ■ The structure of the operating menu is the same as for the local display  Detailed information on the "Description of Device Parameters" operating menu
Device status	Displays the diagnostic messages currently pending, listed in order of priority
Data management	Data exchange between computer and measuring instrument: ■ 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 and checking of all the parameters required for establishing the connection to the measuring instrument: ■ Network settings (e.g. IP address, MAC address) ■ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

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

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:

- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

8.4.6 Disabling the Web server

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

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Web server functionality	Switch the Web server on and off.	■ Off ■ HTML Off ■ On	On

Function scope of the "Web server functionality" parameter

Option	Description
Off	■ The Web server is completely disabled. ■ Port 80 is locked.
HTML Off	The HTML version of the Web server is not available.
On	■ The complete Web server functionality is available. ■ JavaScript is used. ■ The password is transferred in an encrypted state. ■ Any change to the password is also transferred in an encrypted state.

Enabling the Web server

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:

- Via local display
- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

8.4.7 Logging out

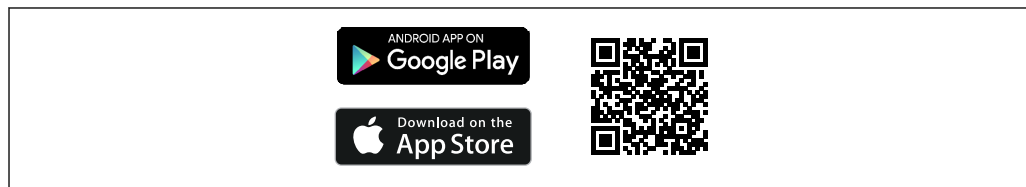
 Before logging out, perform a data backup via the **Data management** function (upload configuration from device) if necessary.

1. Select the **Logout** entry in the function row.
↳ The home page with the Login box appears.
2. Close the Web browser.
3. If no longer needed:
Reset the modified properties of the Internet protocol (TCP/IP) →  61.

8.5 Operation via SmartBlue app

The device can be operated and configured with the SmartBlue App.

- The SmartBlue app must be downloaded onto a mobile device for this purpose
- For information on the compatibility of the SmartBlue app with mobile devices, see **Apple App Store (iOS devices)** or **Google Play Store (Android devices)**
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption.
- The Bluetooth® function can be deactivated after initial device setup.



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21 QR code for free Endress+Hauser SmartBlue App

Download and installation:

1. Scan the QR code or enter **SmartBlue** in the search field of the Apple App Store (iOS) or Google Play Store (Android).
2. Install and start the SmartBlue app.
3. For Android devices: enable location tracking (GPS) (not required for iOS devices).
4. Select a device that is ready to receive from the device list displayed.

Login:

1. Enter the user name: admin
2. Enter the initial password: serial number of the device
3. Change the password after logging in for the first time

Information on password and reset code

For devices that meet the requirements of IEC 62443-4-1 "Secure product development lifecycle management" ("ProtectBlue"):

- If the user-defined password is lost: refer to the user management instructions and the reset button in the operating manual.
- Refer to the associated Security Manual (SD).

For all other devices (without "ProtectBlue"):

- If the user-defined password is lost, access can be restored via a reset code. The reset code is the serial number of the device in reverse. The original password is once again valid after the reset code has been entered.
- The reset code can also be changed in addition to the password.
- If the user-defined reset code is lost, the password can no longer be reset via the SmartBlue app. Contact Endress+Hauser Service in this case.

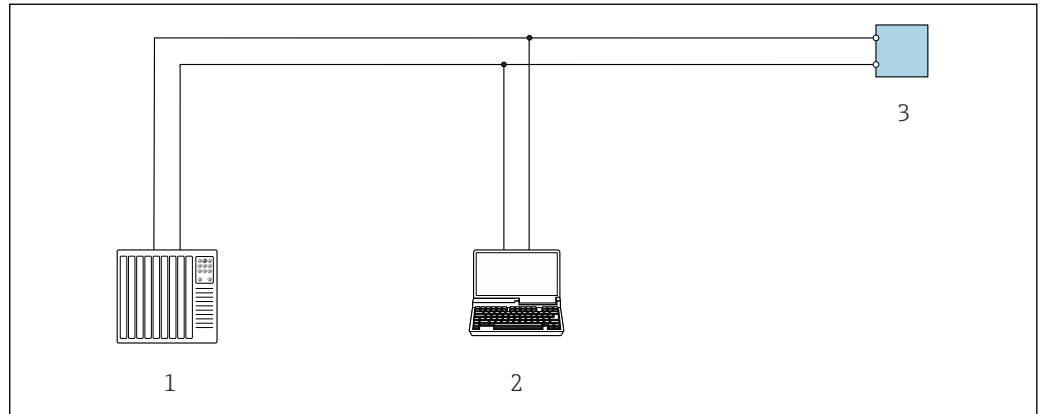
8.6 Access to the operating menu via the operating tool

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

8.6.1 Connecting the operating tool

Via Modbus RS485 protocol

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



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22 Options for remote operation via Modbus RS485 protocol (active)

- 1 Automation system (e.g. PLC)
- 2 Computer with web browser 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)

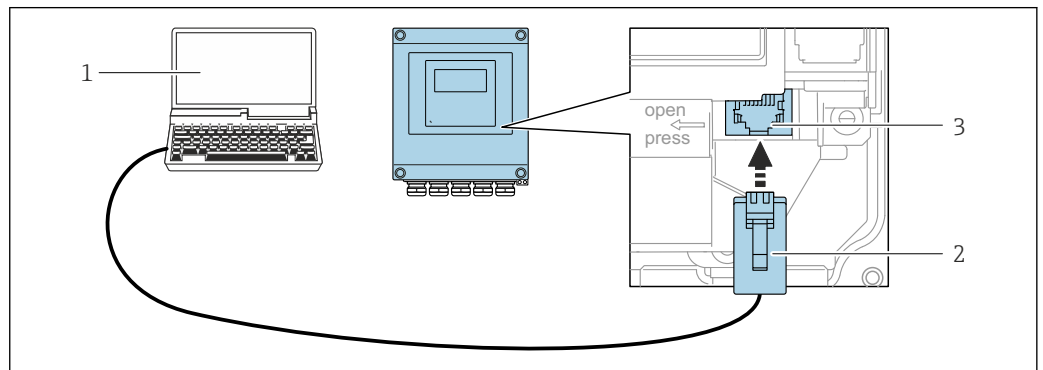
To configure the device on site, a point-to-point connection can be established. The connection is made with the housing open, directly via the device's service interface (CDI-RJ45).

i An adapter for the RJ45 to 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. The connection to the service interface can be established via an M12 connector without opening the device.

Proline 500 – digital transmitter



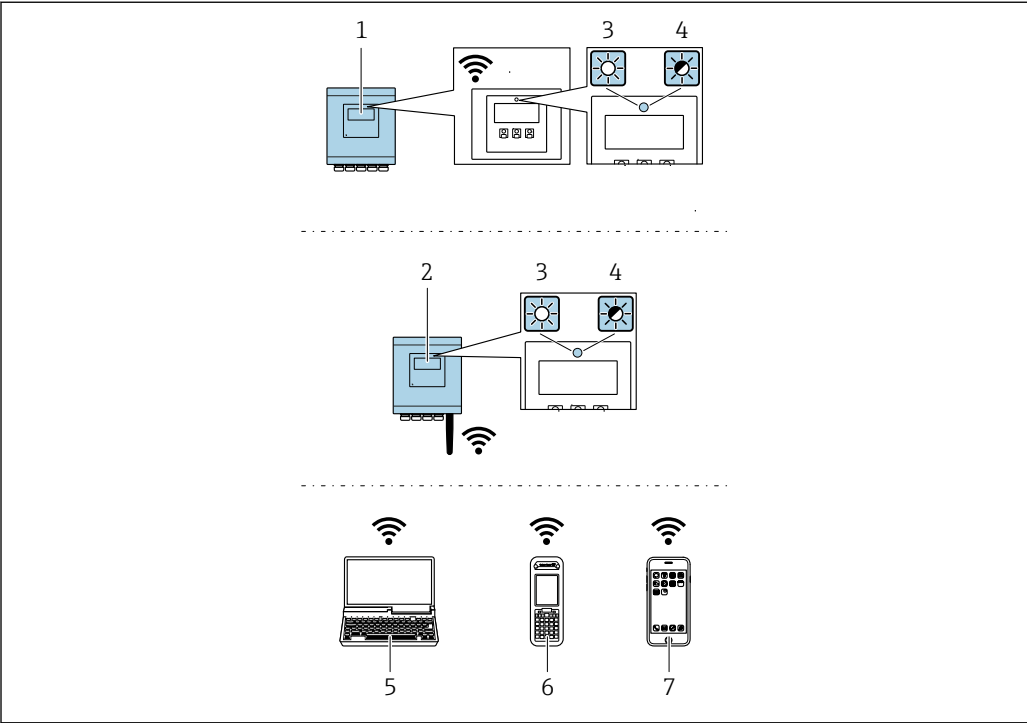
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23 Connection via service interface (CDI-RJ45)

- 1 Computer with web browser for accessing the integrated web server or computer with operating tool, e.g. "FieldCare", "DeviceCare" with COM DTM "CDI Communication TCP/IP"
- 2 Standard Ethernet connecting cable with RJ45 connector
- 3 Service interface (CDI-RJ45) of the measuring instrument 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"



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- 1 Transmitter with integrated WLAN antenna
- 2 Transmitter with external WLAN antenna
- 3 LED lit constantly: WLAN reception is enabled on measuring instrument
- 4 LED flashing: WLAN connection established between operating unit and measuring instrument
- 5 Computer with WLAN interface and web browser for accessing integrated device web server or with operating tool e.g. FieldCare, DeviceCare)
- 6 Mobile handheld terminal with WLAN interface and web browser for accessing integrated device web server or operating tool (e.g. FieldCare, DeviceCare)
- 7 Smartphone 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	IP66/67
Available antennas	- Internal antenna - External antenna (optional) In the event of poor transmission/reception conditions at the place of installation.  Only 1 antenna is active at any one time!
Range	- Internal antenna: typically 10 m (32 ft) - External antenna: typically 50 m (164 ft)
Materials (external antenna)	- Antenna: ASA plastic (acrylonitrile styrene acrylate) and nickel-plated brass - Adapter: Stainless steel and nickel-plated brass - Cable: Polyethylene - Plug: Nickel-plated brass - Angle bracket: Stainless steel

*Configuring the Internet protocol of the mobile device***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

Please note the following to avoid a network conflict:

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

Preparing the mobile terminal

- Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
Select the measuring device using the SSID (e.g. EH__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).
↳ The LED on the display module flashes. It is now possible to operate the measuring device with the web browser, FieldCare or DeviceCare.



The serial number can be found on the nameplate.



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

Terminating the WLAN connection

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

8.6.2 FieldCare

Function range

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

Access is via:

- CDI-RJ45 service interface → 67
- WLAN interface → 68

Typical functions:

- Transmitter parameter configuration
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook



- Operating Instructions BA00027S
- Operating Instructions BA00059S



Source for device description files →  71

8.6.3 DeviceCare

Function range

Tool for connecting and configuring Endress+Hauser field devices.

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



Innovation brochure IN01047S



Source for device description files →  71

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.06.zz	- On the title page of the manual - On the transmitter nameplate - Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	08.2022	-



For an overview of the various firmware versions for the device → 217

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 → Downloads area - USB stick (contact Endress+Hauser) - E-mail → Downloads area
DeviceCare	www.endress.com → Downloads area - E-mail → Downloads area

9.2 Compatibility with previous model

If the device is replaced, the measuring device Promass 500 supports the compatibility of the Modbus registers for the process variables and the diagnostic information with the previous model Promass 83. 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
Corrected volume flow	2011
Density	2013
Reference density	2015
Temperature	2017
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 →  206.

9.3 ModbusRS485 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 instrument supports the following function codes:

Code	Name	Description	Application
03	Read holding register	The controller reads one or more Modbus registers of the measuring instrument. A maximum of 125 consecutive registers can be read with one telegram: 1 register = 2 bytes  The measuring instrument 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 mass flow
04	Read input register	The controller reads one or more Modbus registers of the measuring instrument. A maximum of 125 consecutive registers can be read with one telegram: 1 register = 2 bytes  The measuring instrument 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	Controller writes a new value to one Modbus register of the measuring instrument.  Function code 16 can be used to write multiple registers with a single telegram.	Writing only 1 device parameter Example: Reset totalizer
08	Diagnostics	Controller checks the communication connection to the measuring instrument. 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	Controller writes a new value to multiple Modbus registers of the measuring instrument. A maximum of 120 consecutive registers can be written with one 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 →  74	Writing multiple device parameters Example: ■ Mass flow unit ■ Mass unit
23	Read/Write multiple registers	Controller reads and writes a maximum of 118 Modbus registers of the measuring instrument simultaneously with one telegram. Write access is executed before read access.	Writing and reading multiple device parameters Example: ■ Read mass flow ■ Reset the totalizer



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

9.3.2 Register information



For an overview of device parameters and their corresponding Modbus register information, refer to the "ModbusRS485 section in the "Description of Device Parameters" documentation.register information →  243 →  72.

9.3.3 Response time

Response time of the measuring instrument 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 (MMMMMMMM)	Byte 1 (MMMMMMMM)
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

To ensure that retrieving device parameters via Modbus RS485 is no longer limited to individual device parameters or a group of consecutive device parameters, the measuring instrument provides a special memory area: the Modbus data map for a maximum of 16 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 ModbusRS485 register addresses in the list.
- **Data area**
The measuring instrument 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 and their corresponding Modbus register information, refer to the "ModbusRS485 section in the "Description of Device Parameters" documentation. register information → 243 → 72.

Scan list configuration

For configuration, the ModbusRS485 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 instrument:
Expert → Communication → Modbus data map → Scan list register 0 to 15

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

Configuration of the scan list via Modbus RS485

Carried out using register addresses 5001-5016

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

Reading out data via Modbus RS485

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

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

Data area				
Device parameter value	Modbus RS485 register		Data type*	Access**
	Start register	End register (Float only)		
Value of scan list register 0	5051	5052	Integer/float	Read/write
Value of scan list register 1	5053	5054	Integer/float	Read/write
Value of scan list register ...	...	...	...	...
Value of scan list register 15	5081	5082	Integer/float	Read/write
* Data type depends on the device parameters entered in the scan list. ** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.				

10 Commissioning

10.1 Post-installation and post-connection check

Before commissioning the device:

- ▶ Make sure that the post-installation and post-connection checks have been performed successfully.
- Checklist for "Post-installation" check → 29
- Checklist for "Post-connection" check → 43

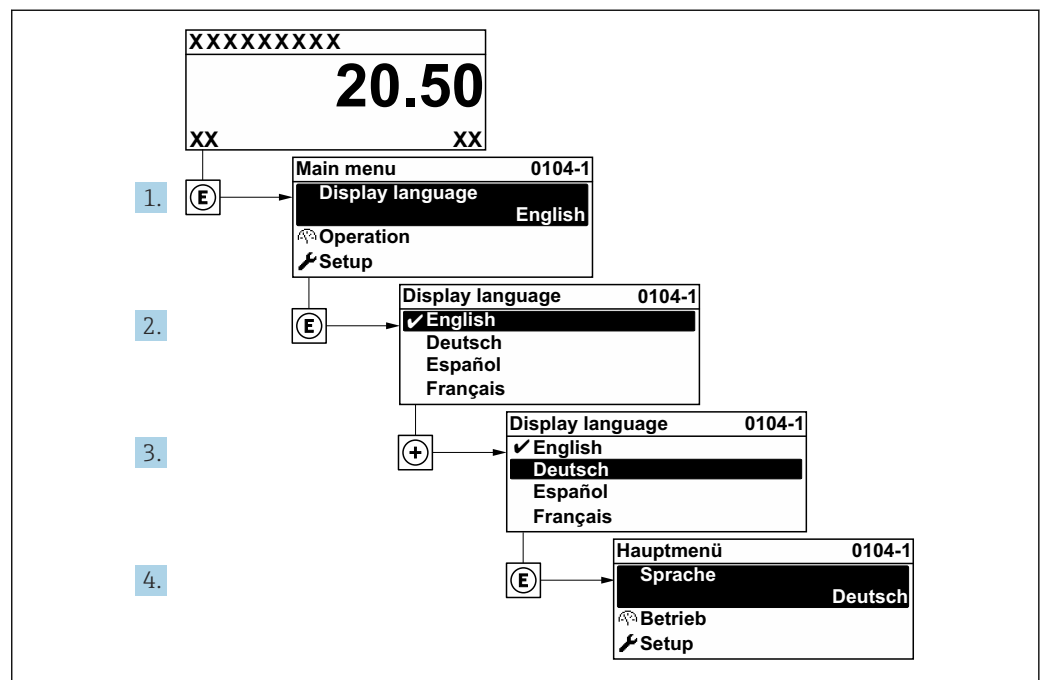
10.2 Switching on the measuring instrument

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

If nothing appears on the local display or if a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 196.

10.3 Setting the operating language

Factory setting: English or ordered local language



24 Taking the example of the local display

10.4 Initializing the measuring instrument

1. Fill the system with liquid (density: 800 to 1 500 kg/m³ (1 764 to 3 307 lb/cf)).
2. Prevent any flow.
3. Repeated flushing can help to eliminate gas pockets.

- 4. Perform device initialization: Expert → Sensor → Disposable component → Commissioning, Modbus register 26321-1 or Profinet.
- 5. Heartbeat Verification and zero point adjustment are performed. This diagnostic message is displayed during this time: Device initialization active.
- 6. Heartbeat Verification and zero point adjustment have been performed: No diagnostic message is displayed.

The measuring instrument is initialized.

Navigation

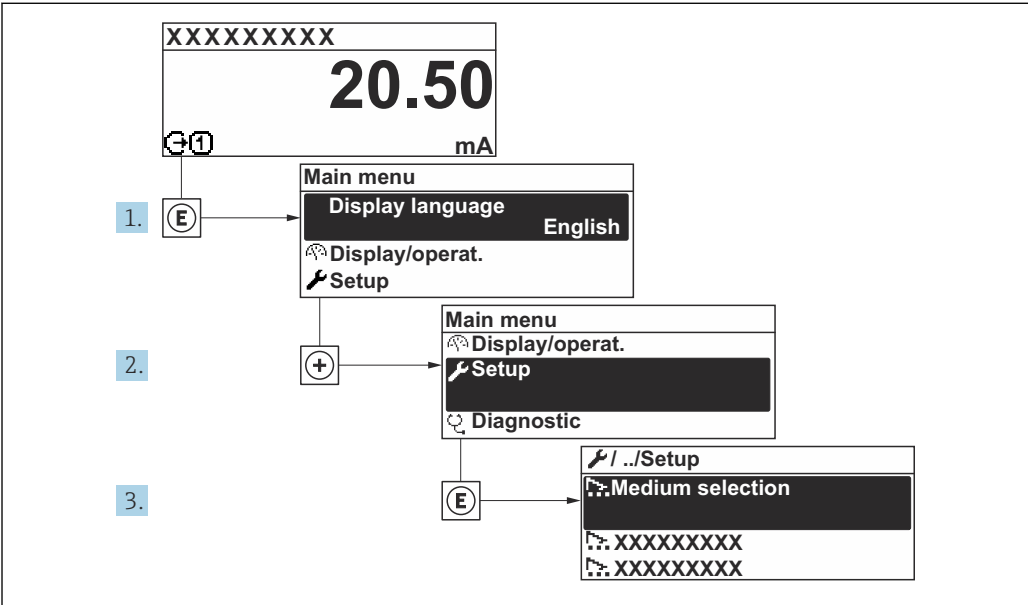
"Expert" menu → Sensor → Disposable component

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Commissioning	Start commissioning of the sensor manually if does not start automatically.	- Start - Busy - Done - Not done	Not done

10.5 Configuring the device

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



25 Navigation to the "Setup" menu using the example of the local display

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

Setup

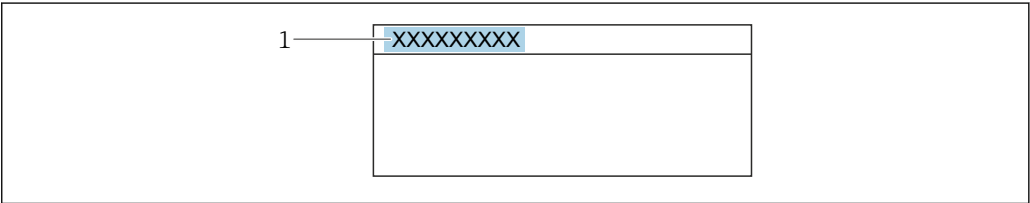
► System units

→ 80

► Communication	→ 82
► Medium selection	→ 84
► I/O configuration	→ 84
► Current input 1 to n	→ 85
► Status input 1 to n	→ 86
► Current output 1 to n	→ 87
► Pulse/frequency/switch output 1 to n	→ 92
► Relay output 1 to n	→ 102
► Double pulse output	→ 105
► Display	→ 106
► Low flow cut off	→ 112
► Partially filled pipe detection	→ 113
► Advanced setup	→ 114

10.5.1 Defining the tag name

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



26 Header of the operational display with tag name

1 Tag name

 Enter the tag name in the "FieldCare" operating tool

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

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

10.5.2 Setting the system units

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

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

Navigation

"Setup" menu → System units

► System units

Mass flow unit

→  81

Mass unit

→  81

Volume flow unit

→  81

Volume unit

→  81

Corrected volume flow unit

→  81

Corrected volume unit

→  81

Density unit

→  81

Reference density unit

→  81

Density 2 unit

→  81

Temperature unit

→  82

Pressure unit

→  82

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Mass flow unit	Select mass flow unit. <i>Effect</i> The selected unit applies to: ■ Output ■ Low flow cut off ■ Simulation process variable	Unit choose list	kg/h
Mass unit	Select mass unit.	Unit choose list	Country-specific: ■ kg ■ lb
Volume flow unit	Select volume flow unit. <i>Effect</i> The selected unit applies to: ■ Output ■ Low flow cut off ■ Simulation process variable	Unit choose list	l/h
Volume unit	Select volume unit.	Unit choose list	Country-specific: ■ l ■ gal (us)
Corrected volume flow unit	Select corrected volume flow unit. <i>Effect</i> The selected unit applies to: Corrected volume flow parameter (→ ⓘ 142)	Unit choose list	NI/h
Corrected volume unit	Select corrected volume unit.	Unit choose list	Country-specific: ■ NI ■ Sft³
Reference density unit	Select reference density unit.	Unit choose list	kg/NI
Density unit	Select density unit. <i>Effect</i> The selected unit applies to: ■ Output ■ Simulation process variable ■ Density adjustment (Expert menu)	Unit choose list	kg/m ³
Density 2 unit	Select second density unit.	Unit choose list	Country-specific: ■ kg/l ■ lb/ft³

Parameter	Description	Selection	Factory setting
Temperature unit	Select temperature unit. <i>Effect</i> The selected unit applies to: ▪ Electronic temperature parameter (6053) ▪ Maximum value parameter (6051) ▪ Minimum value parameter (6052) ▪ External temperature parameter (6080) ▪ Maximum value parameter (6108) ▪ Minimum value parameter (6109) ▪ Maximum value parameter (6029) ▪ Minimum value parameter (6030) ▪ Reference temperature parameter (1816) ▪ Temperature parameter	Unit choose list	Country-specific: ▪ °C ▪ °F
Pressure unit	Select process pressure unit. <i>Effect</i> The unit is taken from: ▪ Pressure value parameter (→ ⓘ 84) ▪ External pressure parameter (→ ⓘ 84) ▪ Pressure value	Unit choose list	bar

10.5.3 Configuring the communication interface

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

Navigation

"Setup" menu → Communication

► Communication

Bus address

→ ⓘ 83

Baudrate

→ ⓘ 83

Data transfer mode

→ ⓘ 83

Parity

→ ⓘ 83

Byte order

→ ⓘ 83

Failure mode

→ ⓘ 83

Parameter overview with brief description

Parameter	Description	User entry / Selection	Factory setting
Bus address	Enter device address.	1 to 247	247
Baudrate	Define data transfer speed.	■ 1200 BAUD ■ 2400 BAUD ■ 4800 BAUD ■ 9600 BAUD ■ 19200 BAUD ■ 38400 BAUD ■ 57600 BAUD ■ 115200 BAUD ■ 230400 BAUD	19200 BAUD
Data transfer mode	Select data transfer mode.	■ ASCII ■ RTU	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	Even
Byte order	Select byte transmission sequence.	■ 0-1-2-3 ■ 3-2-1-0 ■ 1-0-3-2 ■ 2-3-0-1	1-0-3-2
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. NaN ¹⁾	■ NaN value ■ Last valid value	NaN value

1) Not a Number

10.5.4 Selecting and setting the medium

The **Select medium** wizard submenu contains parameters that must be configured in order to select and set the medium.

Navigation

"Setup" menu → Medium selection

▶ Medium selection

Select medium type

→ ⓘ 84

Pressure compensation

→ ⓘ 84

Pressure value

→ ⓘ 84

External pressure

→ ⓘ 84

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Select medium type	–	Use this function to select the type of medium: "Gas" or "Liquid". Select the "Other" option in exceptional cases in order to enter the properties of the medium manually (e.g. for highly compressive liquids such as sulfuric acid).	■ Liquid ■ Gas ■ Other	Liquid
Pressure compensation	–	Select pressure compensation type.	■ Off ■ Fixed value ■ External value ■ Current input 1 * ■ Current input 2 * ■ Current input 3 *	Off
Pressure value	In the Pressure compensation parameter, the Fixed value option is selected.	Enter process pressure to be used for pressure correction.	Positive floating-point number	1.01325 bar
External pressure	In the Pressure compensation parameter, the External value option or the Current input 1...n option is selected.	Shows the process pressure read from the external device.		–

* Visibility depends on order options or device settings

10.5.5 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

► I/O configuration

I/O module 1 to n terminal numbers

I/O module 1 to n information

I/O module 1 to n type

Apply I/O configuration

I/O alteration code

→ 85

→ 85

→ 85

→ 85

→ 85

Parameter overview with brief description

Parameter	Description	User interface / Selection / User entry	Factory setting
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) ■ 20-21 (I/O 4) *	–
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 *	Off
Apply I/O configuration	Apply parameterization of the freely configurable I/O module.	■ No ■ Yes	No
I/O alteration code	Enter the code in order to change the I/O configuration.	Positive integer	0

* Visibility depends on order options or device settings

10.5.6 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

► Current input 1 to n

Current span	→  86
Terminal number	→  86
Terminal number	→  86
0/4 mA value	→  86
20 mA value	→  86
Failure mode	→  86
Terminal number	→  86
Failure value	→  86
Terminal number	→  86

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
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 NE (3.8...20.5 mA) 4...20 mA US (3.9...20.8 mA) 0...20 mA (0...20.5 mA)	4...20 mA NE (3.8...20.5 mA)
Terminal number	–	Shows the terminal numbers used by the current input module.	- Not used 24-25 (I/O 2) 22-23 (I/O 3) 20-21 (I/O 4) *	–
0/4 mA value	–	Enter 4 mA value.	Signed floating-point number	0
20 mA value	–	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter
Failure mode	–	Define input behavior in alarm condition.	- Alarm - Last valid value - Defined value	Alarm
Failure value	In the Failure mode parameter, the Defined value option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

* Visibility depends on order options or device settings

10.5.7 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 1 to n

► Status input 1 to n

Assign status input

→ 87

Terminal number

→ 87

Active level

→ 87

Terminal number

→ 87

Response time status input

→ 87

Terminal number

→ 87

Parameter overview with brief description

Parameter	Description	Selection / User interface / User entry	Factory setting
Assign status input	Select function for the status input.	- Off - Reset totalizer 1 - Reset totalizer 2 - Reset totalizer 3 - Reset all totalizers - Flow override - Zero adjustment - Reset weighted averages * - Reset weighted averages + totalizer 3 *	Off
Terminal number	Shows the terminal numbers used by the status input module.	- Not used 24-25 (I/O 2) 22-23 (I/O 3) 20-21 (I/O 4) *	–
Active level	Define input signal level at which the assigned function is triggered.	- High - Low	High
Response time status input	Define the minimum amount of time the input signal level must be present before the selected function is triggered.	5 to 200 ms	50 ms

* Visibility depends on order options or device settings

10.5.8 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

► Current output 1 to n

Process variable current output	→  89
Terminal number	→  88
Current range output	→  90
Terminal number	→  88
Signal mode	→  88
Terminal number	→  88
Lower range value output	→  90
Upper range value output	→  90
Fixed current	→  90
Terminal number	→  88
Damping current output	→  91
Failure behavior current output	→  91
Terminal number	→  88
Failure current	→  91
Terminal number	→  88

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) ■ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the current output.	■ Active * ■ Passive *	Active

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Process variable current output	–	Select the process variable for the current output.	■ Off * ■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Density ■ Reference density * ■ Temperature ■ Dynamic viscosity * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Reference density alternative * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Concentration * ■ Application specific output 0 * ■ Application specific output 1 * ■ Inhomogeneous medium index ■ Suspended bubbles index * ■ Raw value mass flow ■ Exciter current 0 ■ Exciter current 1 * ■ Oscillation damping 0 ■ Oscillation damping 1 *	Mass flow

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
			■ Oscillation damping fluctuation 0 * ■ Oscillation damping fluctuation 1 * ■ Oscillation frequency 0 ■ Oscillation frequency 1 * ■ Frequency fluctuation 0 * ■ Frequency fluctuation 1 * ■ Oscillation amplitude 0 * ■ HBSI * ■ Pressure * ■ Oscillation amplitude 1 * ■ Signal asymmetry ■ Torsion signal asymmetry * ■ Carrier pipe temperature * ■ Electronics temperature ■ Sensor index coil asymmetry ■ Test point 0 ■ Test point 1	
Current range output	–	Select current range for process value output and upper/lower level for alarm signal.	■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4...20.5 mA) ■ 0...20 mA (0...20.5 mA) ■ Fixed value	Depends on country: ■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA)
Lower range value output	In Current span parameter (→ 90), one of the following options is selected: ■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4...20.5 mA) ■ 0...20 mA (0...20.5 mA)	Enter lower range value for the measured value range.	Signed floating-point number	Depends on country: ■ 0 kg/h ■ 0 lb/min
Upper range value output	In Current span parameter (→ 90), one of the following options is selected: ■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4...20.5 mA) ■ 0...20 mA (0...20.5 mA)	Enter upper range value for the measured value range.	Signed floating-point number	Depends on country and nominal diameter
Fixed current	The Fixed current option is selected in the Current span parameter (→ 90).	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 (→ 89) and one of the following options is selected in the Current span parameter (→ 90): ■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4...20.5 mA) ■ 0...20 mA (0...20.5 mA)	Enter time constant for output damping (PT1 element). Damping reduces the effect of fluctuations in the measured value on the output signal.	0.0 to 999.9 s	1.0 s
Failure behavior current output	A process variable is selected in the Assign current output parameter (→ 89) and one of the following options is selected in the Current span parameter (→ 90): ■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4...20.5 mA) ■ 0...20 mA (0...20.5 mA)	Select output behavior in the event of a device alarm.	■ Min. ■ Max. ■ Last valid value ■ Actual value ■ Fixed value	Max.
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

10.5.9 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

► Pulse/frequency/switch output
1 to n

Operating mode

→ 92

Parameter overview with brief description

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

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output

► Pulse/frequency/switch output
1 to n

Operating mode

Terminal number

Signal mode

Assign pulse output

Pulse scaling

Pulse width

Failure mode

Invert output signal

→ 93

→ 93

→ 93

→ 93

→ 93

→ 93

→ 94

→ 94

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	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3) ■ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	■ Passive ■ Active * ■ Passive NE	Passive
Assign pulse output	The Pulse option is selected in Operating mode parameter.	Select process variable for pulse output.	■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow *	Off
Pulse scaling	The Pulse option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign pulse output parameter (→ 93).	Enter quantity for measured value at which a pulse is output.	Positive floating point number	Depends on country and nominal diameter
Pulse width	The Pulse option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign pulse output parameter (→ 93).	Define time width of the output pulse.	0.05 to 2000 ms	100 ms

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Failure mode	The Pulse option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign pulse output parameter (→ 93).	Select output behavior in the event of a device alarm.	Actual value No pulses	No pulses
Invert output signal	–	Invert the output signal.	No Yes	No

* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output

► Pulse/frequency/switch output
1 to n

Operating mode

→ 95

Terminal number

→ 95

Signal mode

→ 95

Assign frequency output

→ 96

Minimum frequency value

→ 97

Maximum frequency value

→ 97

Measuring value at minimum frequency

→ 97

Measuring value at maximum frequency

→ 97

Failure mode

→ 98

Failure frequency

→ 98

Invert output signal

→ 98

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	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3) ■ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	■ Passive ■ Active * ■ Passive NE	Passive

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Assign frequency output	The Frequency option is selected in Operating mode parameter (→ 92).	Select process variable for frequency output.	■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Density ■ Reference density * ■ Time period signal frequency (TPS) * ■ Temperature ■ Pressure ■ Dynamic viscosity * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Reference density alternative * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Concentration * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Application specific output 0 * ■ Application specific output 1 * ■ Inhomogeneous medium index ■ Suspended bubbles index * ■ HBSI * ■ Raw value mass flow ■ Exciter current 0 ■ Exciter current 1 *	Off

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
			■ Oscillation damping 0 ■ Oscillation damping 1 * ■ Oscillation damping fluctuation 0 * ■ Oscillation damping fluctuation 1 * ■ Oscillation frequency 0 ■ Oscillation frequency 1 * ■ Frequency fluctuation 0 * ■ Frequency fluctuation 1 * ■ Oscillation amplitude 0 * ■ Oscillation amplitude 1 * ■ Signal asymmetry ■ Torsion signal asymmetry * ■ Carrier pipe temperature * ■ Electronics temperature ■ Sensor index coil asymmetry ■ Test point 0 ■ Test point 1	
Minimum frequency value	The Frequency option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign frequency output parameter (→ 96).	Enter minimum frequency.	0.0 to 10 000.0 Hz	0.0 Hz
Maximum frequency value	The Frequency option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign frequency output parameter (→ 96).	Enter maximum frequency.	0.0 to 10 000.0 Hz	10 000.0 Hz
Measuring value at minimum frequency	The Frequency option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign frequency output parameter (→ 96).	Enter measured value for minimum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum frequency	The Frequency option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign frequency output parameter (→ 96).	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Failure mode	The Frequency option is selected in the Operating mode parameter (→ 92) and a process variable is selected in the Assign frequency output parameter (→ 96).	Select output behavior in the event of a device alarm.	■ Actual value ■ Defined value ■ 0 Hz	0 Hz
Failure frequency	In the Operating mode parameter (→ 92), the Frequency option is selected, in the Assign frequency output parameter (→ 96) a process variable is selected, and in the Failure mode parameter, the Defined value option is selected.	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	0.0 Hz
Invert output signal	–	Invert the output signal.	■ No ■ Yes	No

* Visibility depends on order options or device settings

Configuring the switch output

Navigation

"Setup" menu → Pulse/frequency/switch output

► Pulse/frequency/switch output 1 to n		
Operating mode	→ 	99
Terminal number	→ 	99
Signal mode	→ 	99
Switch output function	→ 	100
Assign diagnostic behavior	→ 	100
Assign limit	→ 	101
Assign flow direction check	→ 	102
Assign status	→ 	102
Switch-on value	→ 	102
Switch-off value	→ 	102
Switch-on delay	→ 	102
Switch-off delay	→ 	102
Failure mode	→ 	102
Invert output signal	→ 	102

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	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3) ■ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	■ Passive ■ Active * ■ Passive NE	Passive

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch output function	The Switch option is selected in the Operating mode parameter.	Select function for switch output.	■ Off ■ On ■ Diagnostic behavior ■ Limit ■ Flow direction check ■ Status	Off
Assign diagnostic behavior	■ In the Operating mode parameter, the Switch option is selected. ■ In the Switch output function parameter, the Diagnostic behavior option is selected.	The output is switched on (closed, conductive), if there is a pending diagnostic event of the assigned behavioral category.	■ Alarm ■ Alarm or warning ■ Warning	Alarm

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Assign limit	■ The Switch option is selected in Operating mode parameter. ■ The Limit option is selected in Switch output function parameter.	Select the variable to monitor in case the specified limit value is exceeded. If a limit value is exceeded, the output is switched on (conductive).	■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Density ■ Reference density * ■ Reference density alternative * ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Dynamic viscosity * ■ Concentration * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ Temperature ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ Oscillation damping ■ Pressure ■ Application specific output 0 * ■ Application specific output 1 * ■ Inhomogeneous medium index ■ Suspended bubbles index *	Volume flow

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Assign flow direction check	- The Switch option is selected in the Operating mode parameter. - The Flow direction check option is selected in the Switch output function parameter.	Select process variable for flow direction monitoring.		Mass flow
Assign status	- The Switch option is selected in Operating mode parameter. - The Status option is selected in Switch output function parameter.	Select the device function for which to display the status. If the switch on point is reached, the output is switched on (closed, conductive).	- Partially filled pipe detection - Low flow cut off	Partially filled pipe detection
Switch-on value	- The Switch option is selected in the Operating mode parameter. - The Limit option is selected in the Switch output function parameter.	Enter limit value for switch-on point (process variable > switch-on value = closed, conductive).	Signed floating-point number	Depends on country: 0 kg/h 0 lb/min
Switch-off value	- The Switch option is selected in the Operating mode parameter. - The Limit option is selected in the Switch output function parameter.	Enter limit value for switch-off point (process variable < switch-off value = open, nonconductive).	Signed floating-point number	Depends on country: 0 kg/h 0 lb/min
Switch-on delay	- The Switch option is selected in the Operating mode parameter. - The Limit option is selected in the Switch output function parameter.	Enter a delay before the output is switched on.	0.0 to 100.0 s	0.0 s
Switch-off delay	- The Switch option is selected in the Operating mode parameter. - The Limit option is selected in the Switch output function parameter.	Enter a delay before the output is switched off.	0.0 to 100.0 s	0.0 s
Failure mode	–	Select output behavior in the event of a device alarm.	- Actual status - Open - Closed	Open
Invert output signal	–	Invert the output signal.	- No - Yes	No

* Visibility depends on order options or device settings

10.5.10 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

▶ Relay output 1 to n

Terminal number

→ 103

Relay output function	→  103
Assign flow direction check	→  103
Assign limit	→  104
Assign diagnostic behavior	→  105
Assign status	→  105
Switch-off value	→  105
Switch-off delay	→  105
Switch-on value	→  105
Switch-on delay	→  105
Failure mode	→  105
Switch state	→  105
Powerless relay status	→  105

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) ■ 20-21 (I/O 4)	–
Relay output function	–	Select the function for the relay output.	■ Closed ■ Open ■ Diagnostic behavior ■ Limit ■ Flow direction check ■ Status	Closed
Assign flow direction check	The Flow direction check option is selected in the Relay output function parameter.	Select process variable for flow direction monitoring.		Mass flow

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Assign limit	The Limit option is selected in Relay output function parameter.	Select the variable to monitor in case the specified limit value is exceeded. If a limit value is exceeded, the output is switched on (conductive).	■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Density ■ Reference density * ■ Reference density alternative * ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Dynamic viscosity * ■ Concentration * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ Temperature ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ Oscillation damping ■ Pressure ■ Application specific output 0 * ■ Application specific output 1 * ■ Inhomogeneous medium index ■ Suspended bubbles index *	Mass flow

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Assign diagnostic behavior	In the Relay output function parameter, the Diagnostic behavior option is selected.	The output is switched on (closed, conductive), if there is a pending diagnostic event of the assigned behavioral category.	- Alarm - Alarm or warning - Warning	Alarm
Assign status	In the Relay output function parameter, the Digital Output option is selected.	Select the device function for which to display the status. If the switch on point is reached, the output is switched on (closed, conductive).	- Partially filled pipe detection - Low flow cut off	Partially filled pipe detection
Switch-off value	The Limit option is selected in the Relay output function parameter.	Enter limit value for switch-off point (process variable < switch-off value = open, nonconductive).	Signed floating-point number	Depends on country: 0 kg/h 0 lb/min
Switch-off delay	In the Relay output function parameter, the Limit option is selected.	Enter a delay before the output is switched off.	0.0 to 100.0 s	0.0 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	Depends on country: 0 kg/h 0 lb/min
Switch-on delay	In the Relay output function parameter, the Limit option is selected.	Enter a delay before the output is switched on.	0.0 to 100.0 s	0.0 s
Failure mode	–	Select output behavior in the event of a device alarm.	- Actual status - Open - Closed	Open
Switch state	–	Indicates the current switch state of the output.	- Open - Closed	–
Powerless relay status	–	Select quiescent state for relay.	- Open - Closed	Open

* Visibility depends on order options or device settings

10.5.11 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

► Double pulse output

Signal mode

→ 106

Master terminal number

→ 106

Assign pulse output

→ 106

Measuring mode

→ 106

Value per pulse

→ 106

Pulse width	→  106
Failure mode	→  106
Invert output signal	→  106

Parameter overview with brief description

Parameter	Description	Selection / User interface / User entry	Factory setting
Signal mode	Select the signal mode for the double pulse output.	■ Passive ■ Active* ■ Passive NE	Passive
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)	–
Assign pulse output	Select process variable for pulse output.	■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow* ■ Target mass flow* ■ Carrier mass flow* ■ Target volume flow* ■ Carrier volume flow* ■ Target corrected volume flow* ■ Carrier corrected volume flow* ■ GSV flow* ■ GSV flow alternative* ■ NSV flow* ■ NSV flow alternative* ■ S&W volume flow* ■ Oil mass flow* ■ Water mass flow* ■ Oil volume flow* ■ Water volume flow* ■ Oil corrected volume flow* ■ Water corrected volume flow*	Off
Measuring mode	Select measuring mode for pulse output.	■ Forward flow ■ Forward/Reverse flow ■ Reverse flow ■ Reverse flow compensation	Forward flow
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	0.5 ms
Failure mode	Select output behavior in the event of a device alarm.	■ Actual value ■ No pulses	No pulses
Invert output signal	Invert the output signal.	■ No ■ Yes	No

* Visibility depends on order options or device settings

10.5.12 Configuring the local display

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

Navigation
"Setup" menu → Display

► Display		
Format display	→	 108
Value 1 display	→	 109
0% bargraph value 1	→	 110
100% bargraph value 1	→	 110
Value 2 display	→	 110
Value 3 display	→	 110
0% bargraph value 3	→	 110
100% bargraph value 3	→	 111
Value 4 display	→	 111
Value 5 display	→	 111
Value 6 display	→	 111
Value 7 display	→	 111
Value 8 display	→	 111

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	■ 1 value, max. size ■ 1 bargraph + 1 value ■ 2 values ■ 1 value large + 2 values ■ 4 values	1 value, max. size

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Density ■ Reference density * ■ Density 2 * ■ Time period signal frequency (TPS) * ■ Time period signal (TPS) * ■ Temperature ■ Pressure ■ Dynamic viscosity * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Reference density alternative * ■ Weighted density average * ■ Weighted temperature average * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Concentration * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Application specific output 0 * ■ Application specific output 1 *	Mass flow

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
			■ Inhomogeneous medium index ■ Suspended bubbles index[*] ■ HBSI[*] ■ Raw value mass flow ■ Exciter current 0 ■ Exciter current 1[*] ■ Oscillation damping 0 ■ Oscillation damping 1[*] ■ Oscillation damping fluctuation 0[*] ■ Oscillation damping fluctuation 1[*] ■ Oscillation frequency 0 ■ Oscillation frequency 1[*] ■ Frequency fluctuation 0[*] ■ Frequency fluctuation 1[*] ■ Oscillation amplitude 0[*] ■ Oscillation amplitude 1[*] ■ Signal asymmetry ■ Torsion signal asymmetry[*] ■ Carrier pipe temperature[*] ■ Electronics temperature ■ Sensor index coil asymmetry ■ Test point 0 ■ Test point 1 ■ Current output 1 ■ Current output 2[*] ■ Current output 3[*] ■ Current output 4[*]	
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ■ 0 kg/h ■ 0 lb/min
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None
0% bargraph value 3	A selection was made in the Value 3 display parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ■ 0 kg/h ■ 0 lb/min

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
100% bargraph value 3	A selection was made in the Value 3 display parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None
Value 5 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None
Value 6 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None
Value 7 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None
Value 8 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None

* Visibility depends on order options or device settings

10.5.13 Configuring the low flow cut off

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

Navigation

"Setup" menu → Low flow cut off

► Low flow cut off

Assign process variable

On value low flow cutoff

Off value low flow cutoff

Pressure shock suppression

→ 112

→ 112

→ 112

→ 112

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 ■ Mass flow ■ Volume flow ■ Corrected volume flow[*]	Mass flow
On value low flow cutoff	A process variable is selected in the Assign process variable parameter (→ 112).	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 (→ 112).	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	A process variable is selected in the Assign process variable parameter (→ 112).	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

^{*} Visibility depends on order options or device settings

10.5.14 Partially filled pipe detection

The **Partially filled pipe detection** wizard guides you systematically through all parameters that have to be set for configuring the monitoring of the pipe filling.

Navigation

"Setup" menu → Partially filled pipe detection

▶ Partially filled pipe detection

Assign process variable

→  113

Low value partial filled pipe detection

→  113

High value partial filled pipe detection

→  113

Response time part. filled pipe detect.

→  113

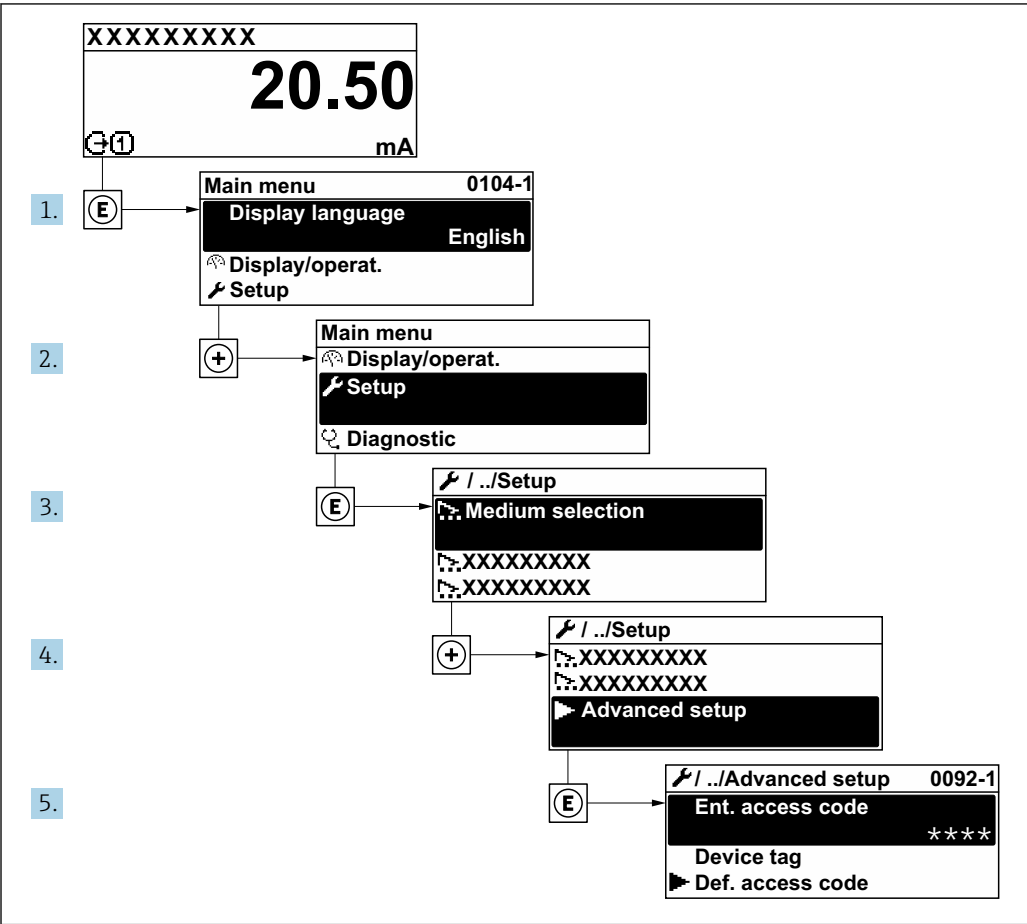
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for partially filled pipe detection.	■ Off ■ Density ■ Calculated reference density	Density
Low value partial filled pipe detection	A process variable is selected in the Assign process variable parameter (→  113).	Enter lower limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Depends on country: ■ 200 kg/m³ ■ 12.5 lb/ft³
High value partial filled pipe detection	A process variable is selected in the Assign process variable parameter (→  113).	Enter upper limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Depends on country: ■ 6 000 kg/m³ ■ 374.6 lb/ft³
Response time part. filled pipe detect.	A process variable is selected in the Assign process variable parameter (→  113).	Use this function to enter the minimum time (hold time) the signal must be present before diagnostic message S962 "Pipe only partly filled" is triggered in the event of a partially filled or empty measuring pipe.	0 to 100 s	1 s

10.6 Advanced settings

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

Navigation to the "Advanced setup" submenu



i The number of submenus and parameters can vary depending on the device version and the available application packages. These submenus and their parameters are explained in the Special Documentation for the device and not in Operating Instructions.

For detailed information on the parameter descriptions for application packages:
Special Documentation for the device → 244

Navigation

"Setup" menu → Advanced setup

▶ Advanced setup		
Enter access code	→	115
▶ Calculated values	→	115
▶ Sensor adjustment	→	116

► Totalizer 1 to n	→ 120
► Display	→ 122
► WLAN settings	→ 129
► Configuration backup	→ 130
► Administration	→ 132

10.6.1 Using the parameter to enter the access code

Navigation
"Setup" menu → Advanced setup

Parameter overview with brief description

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

10.6.2 Calculated process variables

The **Calculated values** submenu contains parameters for calculating the corrected volume flow.

Navigation
"Setup" menu → Advanced setup → Calculated values

► Calculated values	
► Corrected volume flow calculation	→ 115

"Corrected volume flow calculation" submenu

Navigation
"Setup" menu → Advanced setup → Calculated values → Corrected volume flow calculation

► Corrected volume flow calculation	
Select reference density (1812)	→ 116
External reference density (6198)	→ 116
Fixed reference density (1814)	→ 116
Reference temperature (1816)	→ 116

Linear expansion coefficient (1817)	→ 116
Square expansion coefficient (1818)	→ 116

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Select reference density	–	Select reference density for calculating the corrected volume flow.	- Fixed reference density - Calculated reference density - Current input 1 * - Current input 2 * - Current input 3 *	Calculated reference density
External reference density	In the Corrected volume flow calculation parameter, the External reference density option is selected.	Shows external reference density.	Floating point number with sign	–
Fixed reference density	The Fixed reference density option is selected in the Corrected volume flow calculation parameter.	Enter fixed value for reference density.	Positive floating-point number	1 kg/Nl
Reference temperature	The Calculated reference density option is selected in the Corrected volume flow calculation parameter.	Enter reference temperature for calculating the reference density.	–273.15 to 99 999 °C	Country-specific: +20 °C +68 °F
Linear expansion coefficient	The Calculated reference density option is selected in the Corrected volume flow calculation parameter.	Enter linear, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	0.0 1/K
Square expansion coefficient	The Calculated reference density option is selected in the Corrected volume flow calculation parameter.	For media with a non-linear expansion pattern: enter the quadratic, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	0.0 1/K ²

* Visibility depends on order options or device settings

10.6.3 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

► Sensor adjustment
Installation direction
→ 117

► Zero verification	→ 117
► Zero adjustment	→ 119

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Installation direction	Select sign of flow direction.	■ Forward flow ■ Reverse flow	Forward flow

Zero verification and zero adjustment

All measuring instruments are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 232.

Important parameters such as the calibration factor of the disposable measuring tube and other device information determined during factory calibration must remain unchanged. A zero adjustment of the mounted measuring instrument filled with liquid is required for commissioning to offset the sensor's manufacturing tolerances.

This results in an updated zero point that deviates from the original zero point indicated on the factory calibration certificate and is then documented on the Heartbeat Technology verification report.



To achieve the highest possible measurement accuracy at low flow rates, the installation must protect the sensor from mechanical stress during operation.

To get a representative zero point, ensure that:

- any flow in the device is prevented during the adjustment
- the process conditions (e.g. pressure, temperature) are stable and representative

Zero verification and zero adjustment cannot be performed if the following process conditions are present:

- Gas pockets
Ensure that the system has been sufficiently flushed with the medium. Repeat flushing can help to eliminate gas pockets
- Thermal circulation
In the event of temperature differences (e.g. between the measuring tube inlet and outlet section), induced flow can occur even if the valves are closed due to thermal circulation in the device
- Leaks at the valves
If the valves are not leak-tight, flow is not sufficiently prevented when determining the zero point

If these conditions cannot be avoided, it is advisable to keep the factory setting for the zero point.

Zero point verification

The zero point can be verified with the **Zero verification** wizard.

Navigation

"Setup" menu → Advanced setup → Sensor adjustment → Zero verification

► Zero verification	
Process conditions	→ 118

Progress	→ ⓘ 118
Status	→ ⓘ 118
Additional information	→ ⓘ 118
Recommendation:	→ ⓘ 118
Root cause	→ ⓘ 118
Abort cause	→ ⓘ 118
Zero point measured	→ ⓘ 118
Zero point standard deviation	→ ⓘ 118

Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Process conditions	Ensure process conditions as follows.	■ Tubes are completely filled ■ Process operational pressure applied ■ No-flow conditions (closed valves) ■ Process and ambient temperatures stable	–
Progress	Shows the progress of the process.	0 to 100 %	–
Status	Shows the status of the process.	■ Busy ■ Failed ■ Done	–
Additional information	Indicate whether to display additional information.	■ Hide ■ Show	Hide
Recommendation:	Indicates whether an adjustment is recommended. Only recommended if the measured zero point deviates significantly from the current zero point.	■ Do not adjust zero point ■ Adjust zero point	–
Abort cause	Indicates why the wizard was aborted.	■ Check process conditions! ■ A technical issue has occurred	–
Root cause	Shows the diagnostic and remedy.	■ Zero point too high. Ensure no-flow. ■ Zero point is unstable. Ensure no-flow. ■ Fluctuation high. Avoid 2-phase medium.	–
Zero point measured	Shows the zero point measured for the adjustment.	Signed floating-point number	–
Zero point standard deviation	Shows the standard deviation of the zero point measured.	Positive floating-point number	–

Zero adjust

The zero point can be adjusted with the **Zero adjustment** wizard.



- A zero point verification should be performed before a zero adjustment.
- The zero point can also be adjusted manually: Expert → Sensor → Calibration

Navigation

"Setup" menu → Advanced setup → Sensor adjustment → Zero adjustment

► Zero adjustment		
Process conditions	→	119
Progress	→	119
Status	→	119
Root cause	→	120
Abort cause	→	119
Root cause	→	120
Reliability of measured zero point	→	120
Additional information	→	120
Reliability of measured zero point	→	120
Zero point measured	→	120
Zero point standard deviation	→	120
Select action	→	120

Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Process conditions	Ensure process conditions as follows.	■ Tubes are completely filled ■ Process operational pressure applied ■ No-flow conditions (closed valves) ■ Process and ambient temperatures stable	–
Progress	Shows the progress of the process.	0 to 100 %	–
Status	Shows the status of the process.	■ Busy ■ Failed ■ Done	–
Abort cause	Indicates why the wizard was aborted.	■ Check process conditions! ■ A technical issue has occurred	–

Parameter	Description	Selection / User interface	Factory setting
Root cause	Shows the diagnostic and remedy.	- Zero point too high. Ensure no-flow. - Zero point is unstable. Ensure no-flow. - Fluctuation high. Avoid 2-phase medium.	–
Reliability of measured zero point	Indicates the reliability of the zero point measured.	- Not done - Good - Uncertain	–
Additional information	Indicate whether to display additional information.	- Hide - Show	Hide
Zero point measured	Shows the zero point measured for the adjustment.	Signed floating-point number	–
Zero point standard deviation	Shows the standard deviation of the zero point measured.	Positive floating-point number	–
Select action	Select the zero point value to apply.	- Keep current zero point - Apply zero point measured - Apply factory zero point *	Keep current zero point

* Visibility depends on order options or device settings

10.6.4 Configuring the totalizer

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

Navigation

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

► Totalizer 1 to n

Assign process variable 1 to n

→ ⓘ 121

Process variable unit 1 to n

→ ⓘ 121

Totalizer 1 to n operation mode

→ ⓘ 121

Totalizer 1 to n failure behavior

→ ⓘ 121

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable 1 to n	–	Select process variable for totalizer.	■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow[*] ■ Target mass flow[*] ■ Carrier mass flow[*] ■ Target volume flow[*] ■ Carrier volume flow[*] ■ Target corrected volume flow[*] ■ Carrier corrected volume flow[*] ■ GSV flow[*] ■ GSV flow alternative[*] ■ NSV flow[*] ■ NSV flow alternative[*] ■ S&W volume flow[*] ■ Oil mass flow[*] ■ Water mass flow[*] ■ Oil volume flow[*] ■ Water volume flow[*] ■ Oil corrected volume flow[*] ■ Water corrected volume flow[*] ■ Raw value mass flow	Mass flow
Process variable unit 1 to n	A process variable is selected in the Assign process variable parameter (→  121) of the Totalizer 1 to n submenu.	Select the unit for the process variable of the totalizer.	Unit choose list	Depends on country: ■ kg ■ lb
Totalizer 1 to n operation mode	A process variable is selected in the Assign process variable parameter (→  121) of the Totalizer 1 to n submenu.	Select totalizer operation mode, e.g. only totalize forward flow or only totalize reverse flow.	■ Net ■ Forward ■ Reverse	Net
Totalizer 1 to n failure behavior	A process variable is selected in the Assign process variable parameter (→  121) of the Totalizer 1 to n submenu.	Select totalizer behavior in the event of a device alarm.	■ Hold ■ Continue ■ Last valid value + continue	Hold

* Visibility depends on order options or device settings

10.6.5 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

► Display		
Format display	→	📄 124
Value 1 display	→	📄 125
0% bargraph value 1	→	📄 126
100% bargraph value 1	→	📄 126
Decimal places 1	→	📄 126
Value 2 display	→	📄 126
Decimal places 2	→	📄 127
Value 3 display	→	📄 127
0% bargraph value 3	→	📄 127
100% bargraph value 3	→	📄 127
Decimal places 3	→	📄 127
Value 4 display	→	📄 127
Decimal places 4	→	📄 127
Value 5 display	→	📄 127
0% bargraph value 5	→	📄 127
100% bargraph value 5	→	📄 127
Decimal places 5	→	📄 127
Value 6 display	→	📄 127
Decimal places 6	→	📄 128
Value 7 display	→	📄 128

0% bargraph value 7	→  128
100% bargraph value 7	→  128
Decimal places 7	→  128
Value 8 display	→  128
Decimal places 8	→  128
Display language	→  128
Display interval	→  128
Display damping	→  128
Header	→  128
Header text	→  129
Separator	→  129
Backlight	→  129

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

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Density ■ Reference density * ■ Density 2 * ■ Time period signal frequency (TPS) * ■ Time period signal (TPS) * ■ Temperature ■ Pressure ■ Dynamic viscosity * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Reference density alternative * ■ Weighted density average * ■ Weighted temperature average * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Concentration * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Application specific output 0 * ■ Application specific output 1 *	Mass flow

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
			■ Inhomogeneous medium index ■ Suspended bubbles index[*] ■ HBSI[*] ■ Raw value mass flow ■ Exciter current 0 ■ Exciter current 1[*] ■ Oscillation damping 0 ■ Oscillation damping 1[*] ■ Oscillation damping fluctuation 0[*] ■ Oscillation damping fluctuation 1[*] ■ Oscillation frequency 0 ■ Oscillation frequency 1[*] ■ Frequency fluctuation 0[*] ■ Frequency fluctuation 1[*] ■ Oscillation amplitude 0[*] ■ Oscillation amplitude 1[*] ■ Signal asymmetry ■ Torsion signal asymmetry[*] ■ Carrier pipe temperature[*] ■ Electronics temperature ■ Sensor index coil asymmetry ■ Test point 0 ■ Test point 1 ■ Current output 1 ■ Current output 2[*] ■ Current output 3[*] ■ Current output 4[*]	
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ■ 0 kg/h ■ 0 lb/min
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is specified in the Value 1 display parameter.	Select the number of decimal places for the display value.	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
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 ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None
0% bargraph value 3	A selection was made in the Value 3 display parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ■ 0 kg/h ■ 0 lb/min
100% bargraph value 3	A selection was made in the Value 3 display parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
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 ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None
Decimal places 4	A measured value is specified in the Value 4 display parameter.	Select the number of decimal places for the display value.	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 5 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None
0% bargraph value 5	An option was selected in the Value 5 display parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Depends on country: ■ 0 kg/h ■ 0 lb/min
100% bargraph value 5	An option was selected in the Value 5 display parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Decimal places 5	A measured value is specified in the Value 5 display parameter.	Select the number of decimal places for the display value.	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 6 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→ 109)	None

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Decimal places 6	A measured value is specified in the Value 6 display parameter.	Select the number of decimal places for the display value.	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 7 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None
0% bargraph value 7	An option was selected in the Value 7 display parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Depends on country: ■ 0 kg/h ■ 0 lb/min
100% bargraph value 7	An option was selected in the Value 7 display parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Decimal places 7	A measured value is specified in the Value 7 display parameter.	Select the number of decimal places for the display value.	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx ■ x.xxxxx ■ x.xxxxxx	x.xx
Value 8 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see Value 1 display parameter (→  109)	None
Decimal places 8	A measured value is specified in the Value 8 display parameter.	Select the number of decimal places for the display value.	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx ■ x.xxxxx ■ x.xxxxxx	x.xx
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) ■ tiếng Việt (Vietnamese) ■ čeština (Czech)	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	■ Device tag ■ Free text	Device tag

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Header text	The Free text option is selected in the Header parameter.	Enter display header text.	Max. 12 characters, such as letters, numbers or special characters (e.g. @, %, /)	-----
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	■ . (point) ■ , (comma)	. (point)
Backlight	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	Enable

* Visibility depends on order options or device settings

10.6.6 WLAN configuration

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

Navigation

"Setup" menu → Advanced setup → WLAN settings

▶ WLAN settings

WLAN IP address

→ ⓘ 130

Security type

→ ⓘ 130

WLAN passphrase

→ ⓘ 130

Assign SSID name

→ ⓘ 130

SSID name

→ ⓘ 130

Apply changes

→ ⓘ 130

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
WLAN IP address	–	Enter IP address of the WLAN interface of the device.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
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 *	WPA2-PSK
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	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	
Apply changes	–	Use changed WLAN settings.	■ Cancel ■ Ok	Cancel

* Visibility depends on order options or device settings

10.6.7 Configuration management

After commissioning, you can save the current device configuration or restore the previous device configuration. The device configuration is managed via the **Configuration management** parameter.

Navigation

"Setup" menu → Advanced setup → Configuration backup

▶ Configuration backup

Operating time

→  131

Last backup

→  131

Configuration management

→  131

Backup state	→ 131
Comparison result	→ 131

Parameter overview with brief description

Parameter	Description	User interface / Selection	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Last backup	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	Cancel
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	None
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	Check not done

* Visibility depends on order options or device settings

Function range of "Configuration management" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Execute backup	A backup copy of the current device configuration is saved from the HistoROM backup to the 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 display module 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.

10.6.8 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

► Administration

► Define access code

→ 132

► Reset access code

→ 132

Device reset

→ 133

Using the parameter to define the access code

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

Navigation

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

► Define access code

Define access code

→ 132

Confirm access code

→ 132

Parameter overview with brief description

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

Using the parameter to reset the access code

Navigation

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

► Reset access code

Operating time

→ 133

Reset access code

→ 133

Parameter overview with brief description

Parameter	Description	User interface / User entry	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Reset access code	Enter the code provided by Endress+Hauser Technical Support to reset the Maintenance code.  For a reset code, contact your Endress+Hauser service organization. The reset code can only be entered via: ■ Web browser ■ DeviceCare, FieldCare (via CDI-RJ45 service interface) ■ Fieldbus	Character string comprising numbers, letters and special characters	0x00

Using the parameter to reset the device**Navigation**

"Setup" menu → Advanced setup → Administration

Parameter overview with brief description

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

* Visibility depends on order options or device settings

10.7 Simulation

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

Navigation

"Diagnostics" menu → Simulation

► Simulation	
Assign simulation process variable	→  135
Process variable value	→  135
Current input 1 to n simulation	→  136
Value current input 1 to n	→  136
Status input 1 to n simulation	→  137

Input signal level 1 to n	→  137
Current output 1 to n simulation	→  135
Current output value	→  135
Frequency output 1 to n simulation	→  136
Frequency output 1 to n value	→  136
Pulse output simulation 1 to n	→  136
Pulse value 1 to n	→  136
Switch output simulation 1 to n	→  136
Switch state 1 to n	→  136
Relay output 1 to n simulation	→  136
Switch state 1 to n	→  136
Pulse output simulation	→  136
Pulse value	→  136
Device alarm simulation	→  136
Diagnostic event category	→  136
Diagnostic event simulation	→  136

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow[*] ■ Target mass flow[*] ■ Carrier mass flow[*] ■ Target volume flow[*] ■ Carrier volume flow[*] ■ Target corrected volume flow[*] ■ Carrier corrected volume flow[*] ■ Density ■ Reference density[*] ■ Reference density alternative[*] ■ GSV flow[*] ■ GSV flow alternative[*] ■ NSV flow[*] ■ NSV flow alternative[*] ■ S&W volume flow[*] ■ Water cut[*] ■ Oil density[*] ■ Water density[*] ■ Oil mass flow[*] ■ Water mass flow[*] ■ Oil volume flow[*] ■ Water volume flow[*] ■ Oil corrected volume flow[*] ■ Water corrected volume flow[*] ■ Temperature ■ Dynamic viscosity[*] ■ Kinematic viscosity[*] ■ Temp. compensated dynamic viscosity[*] ■ Temp. compensated kinematic viscosity[*] ■ Concentration[*] ■ Time period signal frequency (TPS)[*]	Off
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	0
Current output 1 to n simulation	–	Switch the simulation of the current output on and off.	■ Off ■ On	Off
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	3.59 mA

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
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	Off
Frequency output 1 to n value	In the Frequency simulation 1 to n parameter, the On option is selected.	Enter the frequency value for the simulation.	0.0 to 12 500.0 Hz	0.0 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 (→ 93) defines the pulse width of the pulses output.	■ Off ■ Fixed value ■ Down-counting value	Off
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	0
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	Off
Switch state 1 to n	–	Select the status of the status output for the simulation.	■ Open ■ Closed	Open
Relay output 1 to n simulation	–	Switch simulation of the relay output on and off.	■ Off ■ On	Off
Switch state 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	Open
Pulse output simulation	–	Set and switch off the pulse output simulation.  For Fixed value option: Pulse width parameter defines the pulse width of the pulses output.	■ Off ■ Fixed value ■ Down-counting value	Off
Pulse value	In the Pulse output simulation parameter, the Down-counting value option is selected.	Set and switch off the pulse output simulation.	0 to 65 535	0
Device alarm simulation	–	Switch the device alarm on and off.	■ Off ■ On	Off
Diagnostic event category	–	Select a diagnostic event category.	■ Sensor ■ Electronics ■ Configuration ■ Process	Process
Diagnostic event simulation	–	Select a diagnostic event to simulate this event.	■ Off ■ Diagnostic event picklist (depends on the category selected)	Off
Current input 1 to n simulation	–	Switch simulation of the current input on and off.	■ Off ■ On	Off
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	0 mA

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Status input 1 to n simulation	–	Switch simulation of the status input on and off.	■ Off ■ On	Off
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	High

* Visibility depends on order options or device settings

10.8 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 →  137
- Protect access to local operation via key locking →  59
- Protect access to measuring device via write protection switch →  138

10.8.1 Write protection via access code

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

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

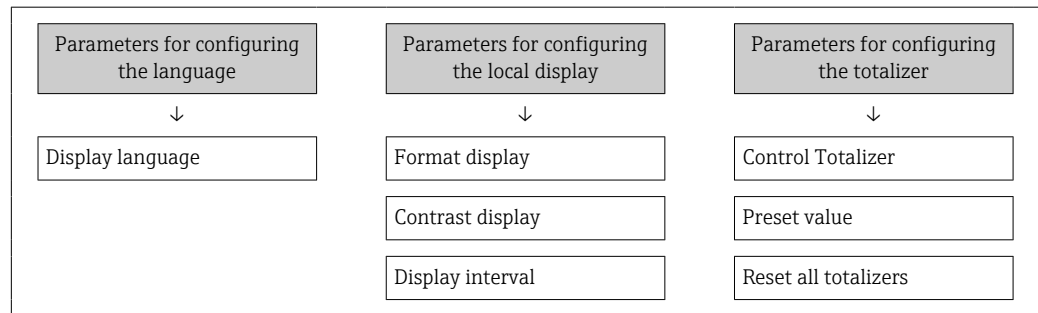
1. Navigate to the **Define access code** parameter (→  132).
2. Maximum of 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→  132) to confirm.

↳ The  symbol appears in front of all write-protected parameters.

-  ■ Disabling parameter write protection via access code →  58.
- If the access code is lost: Resetting the access code →  138.
- The user role with which the user is currently logged in is displayed in **Access status** parameter.
 - Navigation path: Operation → Access status
 - User roles and their access rights →  58
- The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view.
- The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

Parameters which can always be modified via the local display

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



Defining the access code via the web browser

1. Navigate to the **Define access code** parameter (→  132).
 2. Define a 16-digit (max.) numeric code as the access code.
 3. Enter the access code again in the **Confirm access code** parameter (→  132) to confirm.
 - ↳ The web browser switches to the login page.
-  ■ Disabling parameter write protection via access code →  58.
- If the access code is lost: Resetting the access code →  138.
- The **Access status** parameter shows which user role the user is currently logged in with.
- Navigation path: Operation → Access status
 - User roles and their access rights →  58

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

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

-  You can only obtain a reset code from your local Endress+Hauser service organization. The code must be calculated explicitly for every device.
1. Note down the serial number of the device.
 2. Read off the **Operating time** parameter.
 3. Contact the local Endress+Hauser service organization and tell them the serial number and the operating time.
 - ↳ Get the calculated reset code.
 4. Enter the reset code in the **Reset access code** parameter (→  133).
 - ↳ The access code has been reset to the factory setting **0000**. It can be redefined →  137.
-  For IT security reasons, the calculated reset code is only valid for 96 hours from the specified operating time and for the specific serial number. If you cannot return to the device within 96 hours, you should either increase the operating time you read out by a few days or switch off the device.

10.8.2 Write protection via write protection switch

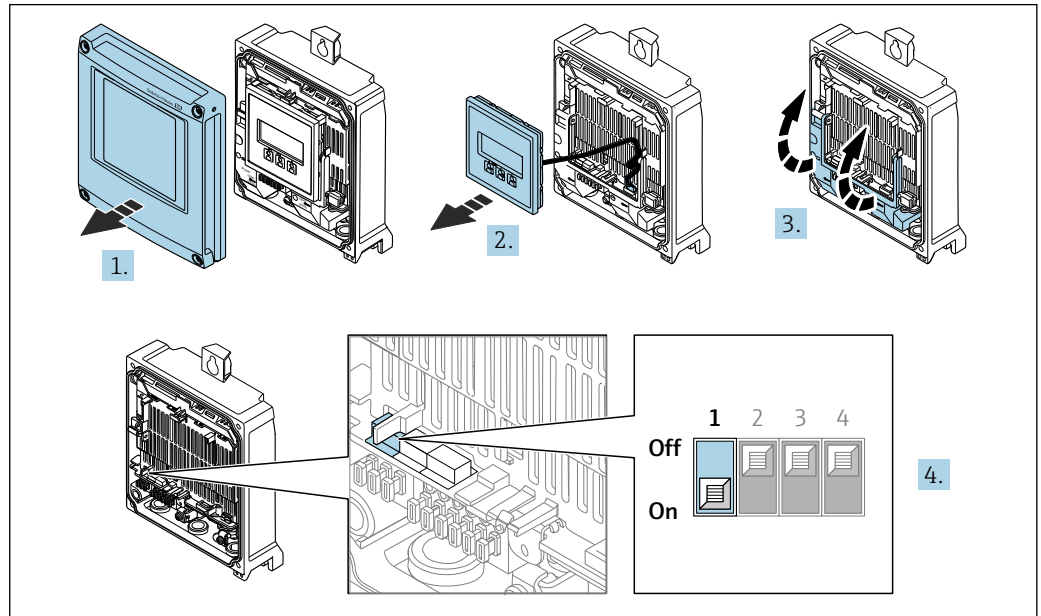
Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.

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

- Via local display
- Via MODBUS RS485 protocol

Proline 500 – digital

Enable/disable write protection

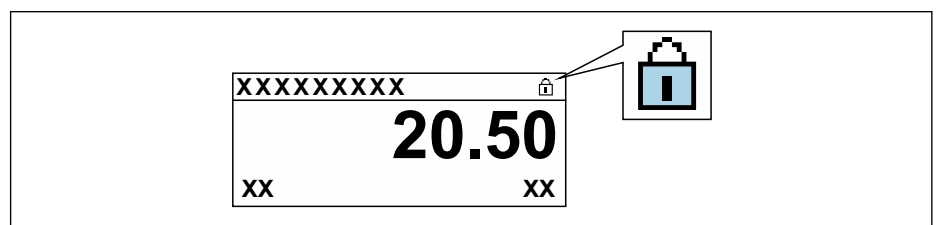


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1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.
4. **Enable or disable write protection:**

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

- ↳ In the **Locking status** parameter, the **Hardware locked** option is displayed → 140. When hardware write protection is enabled, the  symbol appears in the header of the measured value display and in the navigation view in front of the parameters.



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5. Insert the display module.
6. Close the housing cover.
7. **NOTICE**

Excessive tightening torque applied to the fixing screws!

Risk of damaging the plastic transmitter.

- ▶ Tighten the fixing screws as per the tightening torque: 2.5 Nm (1.8 lbf ft)

Tighten the fixing screws.

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 authorization displayed in the Access status parameter applies → 58. 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) → 138.
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 again.

11.2 Adjusting the operating language

-  Detailed information:
- To configure the operating language → 77
 - For information on the operating languages supported by the measuring device → 237

11.3 Configuring the display

- Detailed information:
- On the basic settings for the local display → 106
 - On the advanced settings for the local display → 122

11.4 Reading measured values

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

Navigation

"Diagnostics" menu → Measured values

► Measured values	
► Measured variables	→ 141
► Input values	→ 144
► Output values	→ 145
► Totalizer	→ 143

11.4.1 "Measured variables" submenu

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

Navigation

"Diagnostics" menu → Measured values → Measured variables

► Measured variables		
Mass flow	→ 	141
Volume flow	→ 	141
Corrected volume flow	→ 	142
Density	→ 	142
Reference density	→ 	142
Temperature	→ 	142
Pressure	→ 	142
Concentration	→ 	142
Target mass flow	→ 	142
Carrier mass flow	→ 	142
Target corrected volume flow	→ 	142
Carrier corrected volume flow	→ 	143
Target volume flow	→ 	143
Carrier volume flow	→ 	143

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Mass flow	–	Displays the mass flow that is currently measured. <i>Dependency</i> The unit is taken from: Mass flow unit parameter (→  81)	Signed floating-point number
Volume flow	–	Displays the volume flow that is currently calculated. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→  81).	Signed floating-point number

Parameter	Prerequisite	Description	User interface
Corrected volume flow	–	Displays the corrected volume flow that is currently calculated. <i>Dependency</i> The unit is taken from: Corrected volume flow unit parameter (→ ⓘ 81)	Signed floating-point number
Density	–	Shows the density currently measured. <i>Dependency</i> The unit is taken from the Density unit parameter (→ ⓘ 81).	Signed floating-point number
Reference density	–	Displays the reference density that is currently calculated. <i>Dependency</i> The unit is taken from: Reference density unit parameter (→ ⓘ 81)	Signed floating-point number
Temperature	–	Shows the medium temperature currently measured. <i>Dependency</i> The unit is taken from: Temperature unit parameter (→ ⓘ 82)	Signed floating-point number
Pressure	–	Displays either a fixed or external pressure value. <i>Dependency</i> The unit is taken from the Pressure unit parameter (→ ⓘ 82).	Signed floating-point number
Concentration	For the following order code: Order code for "Application package", option ED "Concentration" ⓘ The software options currently enabled are displayed in the Software option overview parameter.	Displays the concentration that is currently calculated. <i>Dependency</i> The unit is taken from the Concentration unit parameter.	Signed floating-point number
Target mass flow	With the following conditions: Order code for "Application package", option ED "Concentration" ⓘ The software options currently enabled are displayed in the Software option overview parameter.	Displays the mass flow that is currently measured for the target medium. <i>Dependency</i> The unit is taken from: Mass flow unit parameter (→ ⓘ 81)	Signed floating-point number
Carrier mass flow	With the following conditions: Order code for "Application package", option ED "Concentration" ⓘ The software options currently enabled are displayed in the Software option overview parameter.	Displays the mass flow of the carrier medium that is currently measured. <i>Dependency</i> The unit is taken from: Mass flow unit parameter (→ ⓘ 81)	Signed floating-point number
Target corrected volume flow	With the following conditions: ▪ Order code for "Application package", option ED "Concentration" ▪ The Ethanol in water option or %mass / %volume option is selected in the Liquid type parameter. ⓘ The software options currently enabled are displayed in the Software option overview parameter.	Displays the corrected volume flow that is currently measured for the target fluid. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→ ⓘ 81).	Signed floating-point number

Parameter	Prerequisite	Description	User interface
Carrier corrected volume flow	With the following conditions: - Order code for "Application package", option ED "Concentration" - In the Liquid type parameter, the Ethanol in water option or %mass / %volume option is selected.  The software options currently enabled are displayed in the Software option overview parameter.	Displays the corrected volume flow currently measured for the carrier fluid. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→  81).	Signed floating-point number
Target volume flow	With the following conditions: - Order code for "Application package", option ED "Concentration" - The Ethanol in water option or %mass / %volume option is selected in the Liquid type parameter. - The %vol option is selected in the Concentration unit parameter.  The software options currently enabled are displayed in the Software option overview parameter.	Displays the volume flow currently measured for the target medium. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→  81).	Signed floating-point number
Carrier volume flow	With the following conditions: - Order code for "Application package", option ED "Concentration" - The Ethanol in water option or %mass / %volume option is selected in the Liquid type parameter. - The %vol option is selected in the Concentration unit parameter.  The software options currently enabled are displayed in the Software option overview parameter.	Displays the volume flow currently measured for the carrier medium. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→  81).	Signed floating-point number

11.4.2 "Totalizer" submenu

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

Navigation

"Diagnostics" menu → Measured values → Totalizer

► Totalizer	
Totalizer 1 to n value	→  144
Totalizer 1 to n overflow	→  144

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Totalizer 1 to n value	A process variable is selected in the Assign process variable parameter (→ ⓘ 121) of the Totalizer 1 to n submenu.	Displays the current totalizer counter value.	Signed floating-point number
Totalizer 1 to n overflow	A process variable is selected in the Assign process variable parameter (→ ⓘ 121) of the Totalizer 1 to n submenu.	Displays the current totalizer overflow.	Integer with sign

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

► Current input 1 to n

→ ⓘ 144

► Status input 1 to n

→ ⓘ 144

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

► Current input 1 to n

Measured values 1 to n

→ ⓘ 144

Measured current 1 to n

→ ⓘ 144

Parameter overview with brief description

Parameter	Description	User interface
Measured values 1 to n	Displays the current input value.	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

► Status input 1 to n

Value status input

→ 145

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

► Current output 1 to n

→ 145

► Pulse/frequency/switch output 1 to n

→ 146

► Relay output 1 to n

→ 146

► Double pulse output

→ 147

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

► Current output 1 to n

Output current

→ 146

Measured current

→ 146

Parameter overview with brief description

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

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

► Pulse/frequency/switch output 1 to n		
Output frequency		→ 146
Pulse output		→ 146
Switch state		→ 146

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Output frequency	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	The Pulse option is selected in the Operating mode parameter parameter.	Displays the pulse frequency currently output.	Positive floating-point number
Switch state	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

► Relay output 1 to n		
Switch state		→ 147
Switch cycles		→ 147
Max. switch cycles number		→ 147

Parameter overview with brief description

Parameter	Description	User interface
Switch state	Indicates the current switch state of the output.	■ 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

▶ Double pulse output

Pulse output

→ 147

Parameter overview with brief description

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

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu (→ 78)
- Advanced settings using the **Advanced setup** submenu (→ 114)

11.6 Performing a totalizer reset

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

- Control Totalizer
- Reset all totalizers

Navigation

"Operation" menu → Totalizer handling

▶ Totalizer handling

Control Totalizer 1 to n

→ 148

Preset value 1 to n

→ 148

Totalizer value 1 to n	→ 148
Reset all totalizers	→ 148

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Control Totalizer 1 to n	A process variable is selected in the Assign process variable parameter (→ 121) of the Totalizer 1 to n submenu.	Control totalizer value.	■ Totalize ■ Reset + hold * ■ Preset + hold * ■ Reset + totalize ■ Preset + totalize * ■ Hold *	Totalize
Preset value 1 to n	A process variable is selected in the Assign process variable parameter (→ 121) of the Totalizer 1 to n submenu.	Specify start value for totalizer. <i>Dependency</i>  The unit of the selected process variable is defined in the Unit totalizer parameter (→ 121) for the totalizer.	Signed floating-point number	Depends on country: ■ 0 kg ■ 0 lb
Totalizer 1 to n value	A process variable is selected in the Assign process variable parameter (→ 121) of the Totalizer 1 to n submenu.	Displays the current totalizer counter value.	Signed floating-point number	–
Reset all totalizers	–	Reset all totalizers to 0 and start.	■ Cancel ■ Reset + totalize	Cancel

* Visibility depends on order options or device settings

11.6.1 Function scope of "Control Totalizer" parameter

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

1) Visible depending on the order options or device settings

11.6.2 Function range of "Reset all totalizers" parameter

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

11.7 Displaying the measured value history

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

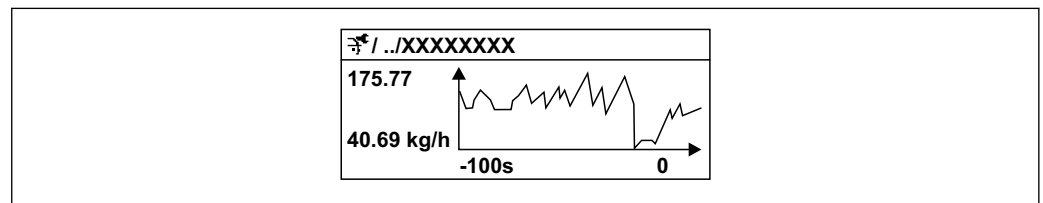


Data logging is also available via:

- Plant Asset Management Tool FieldCare → 69.
- Web browser

Function scope

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



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27 Chart of a measured value trend

- 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	→ 151
Assign channel 2	→ 152
Assign channel 3	→ 152
Assign channel 4	→ 152
Logging interval	→ 153
Clear logging data	→ 153
Data logging	→ 153
Logging delay	→ 153
Data logging control	→ 153

Data logging status	→  153
Entire logging duration	→  153

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign channel 1	The Extended HistoROM application package is available.	Assign process variable to logging channel.	■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow * ■ Density ■ Reference density * ■ Temperature ■ Pressure ■ Dynamic viscosity * ■ Kinematic viscosity * ■ Temp. compensated dynamic viscosity * ■ Temp. compensated kinematic viscosity * ■ GSV flow * ■ GSV flow alternative * ■ NSV flow * ■ NSV flow alternative * ■ S&W volume flow * ■ Reference density alternative * ■ Water cut * ■ Oil density * ■ Water density * ■ Oil mass flow * ■ Water mass flow * ■ Oil volume flow * ■ Water volume flow * ■ Oil corrected volume flow * ■ Water corrected volume flow * ■ Concentration * ■ Target mass flow * ■ Carrier mass flow * ■ Target volume flow * ■ Carrier volume flow * ■ Target corrected volume flow * ■ Carrier corrected volume flow * ■ Application specific output 0 * ■ Application specific output 1 * ■ Inhomogeneous medium index ■ Suspended bubbles index * ■ HBSI * ■ Raw value mass flow ■ Exciter current 0 ■ Exciter current 1 *	Off

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
			■ Oscillation damping 0 ■ Oscillation damping 1 * ■ Oscillation damping fluctuation 0 * ■ Oscillation damping fluctuation 1 * ■ Oscillation frequency 0 ■ Oscillation frequency 1 * ■ Frequency fluctuation 0 * ■ Frequency fluctuation 1 * ■ Oscillation amplitude * ■ Oscillation amplitude 1 * ■ Signal asymmetry ■ Torsion signal asymmetry * ■ Carrier pipe temperature * ■ Electronics temperature ■ Sensor index coil asymmetry ■ Test point 0 ■ Test point 1 ■ Current output 1 ■ Current output 2 * ■ Current output 3 * ■ Current output 4 *	
Assign channel 2	The Extended HistoROM application package is available.  The software options currently enabled are displayed in the Software option overview parameter.	Assign a process variable to logging channel.	For the picklist, see Assign channel 1 parameter (→  151)	Off
Assign channel 3	The Extended HistoROM application package is available.  The software options currently enabled are displayed in the Software option overview parameter.	Assign a process variable to logging channel.	For the picklist, see Assign channel 1 parameter (→  151)	Off
Assign channel 4	The Extended HistoROM application package is available.  The software options currently enabled are displayed in the Software option overview parameter.	Assign a process variable to logging channel.	For the picklist, see Assign channel 1 parameter (→  151)	Off

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Logging interval	The Extended HistoROM application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	0.1 to 3 600.0 s	1.0 s
Clear logging data	The Extended HistoROM application package is available.	Clear the entire logging data.	■ Cancel ■ Clear data	Cancel
Data logging	–	Select the type of data logging.	■ Overwriting ■ Not overwriting	Overwriting
Logging delay	In the Data logging parameter, the Not overwriting option is selected.	Enter the time delay for measured value logging.	0 to 999 h	0 h
Data logging control	In the Data logging parameter, the Not overwriting option is selected.	Start and stop measured value logging.	■ None ■ Delete + start ■ Stop	None
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	Done
Entire logging duration	In the Data logging parameter, the Not overwriting option is selected.	Displays the total logging duration.	Positive floating-point number	0 s

* Visibility depends on order options or device settings

11.8 Gas Fraction Handler

The Gas Fraction Handler improves measurement stability and repeatability in the event of two-phase media and provides valuable diagnostic information for the process.

The function continuously checks for the presence of gas bubbles in liquids or droplets in gases, as this second phase influences the output values for flow and density.

In the case of two-phase media, the Gas Fraction Handler stabilizes the output values and enables better readability for operators and easier interpretation by the process control system. The level of smoothing is adjusted according to the severity of the disturbances introduced by the second phase. In the case of single-phase media, the Gas Fraction Handler does not have any influence on the output values.

Possible options in the Gas Fraction Handler parameter:

- Off: Disables the Gas Fraction Handler. When a second phase is present, large fluctuations in the values output for flow and density will occur.
- Moderate: Use for applications with low levels or intermittent levels of second phase.
- Powerful: Use for applications with very significant levels of second phase.

The Gas Fraction Handler is cumulative to any fixed damping constants applied to flow and density that are set elsewhere in the instrument parameterization.



For detailed information on the parameter descriptions of the Gas Fraction Handler, see the Special Documentation for the device → 244

11.8.1 "Measurement mode" submenu

Navigation

"Expert" menu → Sensor → Measurement mode

► Measurement mode

MFT (Multi-Frequency Technology)

→ 154

Select medium type

→ 154

Select gas type

→ 155

Reference sound velocity

→ 155

Reference sound velocity

→ 155

Temperature coefficient sound velocity

→ 155

Temperature coefficient sound velocity

→ 155

Gas Fraction Handler

→ 155

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
MFT (Multi-Frequency Technology)	–	Enable/disable multi-frequency technology to increase the measuring accuracy in the event of microbubbles in the medium.	No Yes	Yes
Select medium type	–	Use this function to select the type of medium: "Gas" or "Liquid". Select the "Other" option in exceptional cases in order to enter the properties of the medium manually (e.g. for highly compressive liquids such as sulfuric acid).	Liquid Gas Other	Liquid

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Select gas type	In the Medium selection submenu, the Gas option is selected.	Select measured gas type.	■ Air ■ Ammonia NH₃ ■ Argon Ar ■ Sulfur hexafluoride SF₆ ■ Oxygen O₂ ■ Ozone O₃ ■ Nitrogen oxide NO_x ■ Nitrogen N₂ ■ Nitrous oxide N₂O ■ Methane CH₄ ■ Methane CH₄ + 10% Hydrogen H₂ ■ Methane CH₄ + 20% Hydrogen H₂ ■ Methane CH₄ + 30% Hydrogen H₂ ■ Hydrogen H₂ ■ Helium He ■ Hydrogen chloride HCl ■ Hydrogen sulfide H₂S ■ Ethylene C₂H₄ ■ Carbon dioxide CO₂ ■ Carbon monoxide CO ■ Chlorine Cl₂ ■ Butane C₄H₁₀ ■ Propane C₃H₈ ■ Propylene C₃H₆ ■ Ethane C₂H₆ ■ Other	Methane CH ₄
Reference sound velocity	In the Select gas type parameter, the Other option is selected.	Enter sound velocity of the gas at 0 °C (32 °F).	1 to 99 999.9999 m/s	415.0 m/s
Reference sound velocity	In the Select medium type parameter, the Other option is selected.	Enter sound velocity of the medium at 0 °C (32 °F).	Signed floating-point number	1 456 m/s
Temperature coefficient sound velocity	In the Select gas type parameter, the Other option is selected.	Enter the temperature coefficient for the gas sound velocity.	Positive floating point number	0.87 (m/s)/K
Temperature coefficient sound velocity	In the Select medium type parameter, the Other option is selected.	Enter temperature coefficient for the medium sound velocity.	Signed floating-point number	1.3 (m/s)/K
Gas Fraction Handler	–	Activates the Gas Fraction Handler function for two phase media.	■ Off ■ Moderate ■ Powerful	Moderate

11.8.2 "Medium index" submenu

Navigation

"Expert" menu → Application → Medium index

► Medium index	Inhomogeneous medium index (6368)	→ 156
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Cut off inhomogeneous wet gas (6375)	→ 156
Cut off inhomogeneous liquid (6374)	→ 156
Suspended bubbles index (6376)	→ 156
Cut off suspended bubbles (6370)	→ 156

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / User entry	Factory setting
Inhomogeneous medium index	–	Shows the degree of inhomogeneity of the medium.	Signed floating-point number	–
Cut off inhomogeneous wet gas	–	Enter cut off value for wet gas applications. Below this value the 'Inhomogeneous medium index' is set to 0.	Positive floating-point number	0.25
Cut off inhomogeneous liquid	–	Enter cut off value for liquid applications. Below this value the 'Inhomogeneous medium index' is set to 0.	Positive floating-point number	0.05
Suspended bubbles index	The diagnostic index is only available for Promass Q.	Shows the relative amount of suspended bubbles in the medium.	Signed floating-point number	–
Cut off suspended bubbles	The parameter is only available for Promass Q.	Enter the cut off value for suspended bubbles. Below this value the 'Index for suspended bubbles' is set to 0.	Positive floating-point number	0.05

11.9 Heartbeat Verification + Monitoring

11.9.1 Product features

Heartbeat Technology offers diagnostic functionality through continuous self-monitoring, the transmission of additional measured variables to an external Condition Monitoring system and the in situ verification of measuring instruments in the application.

The test scope achieved using these diagnostic and verification tests is expressed as the **total test coverage** (TTC). The total test coverage is calculated using the following formula for random errors (calculation based on FMEDA as per IEC 61508):

$$TTC = (\lambda_{TOT} - \lambda_{du}) / \lambda_{TOT}$$

λ_{TOT} : Rate of all theoretically possible failures

λ_{du} : Rate of undetected dangerous failures

Only the dangerous undetected failures that are not captured by the device diagnostics can falsify the measured value that is output or interrupt the output of measured values.

Heartbeat Technology checks the device function within the specified measuring tolerance with a defined total test coverage. The defined total test coverage is indicated in the product-specific TÜV certificate (TÜV = Technical Inspection Association).

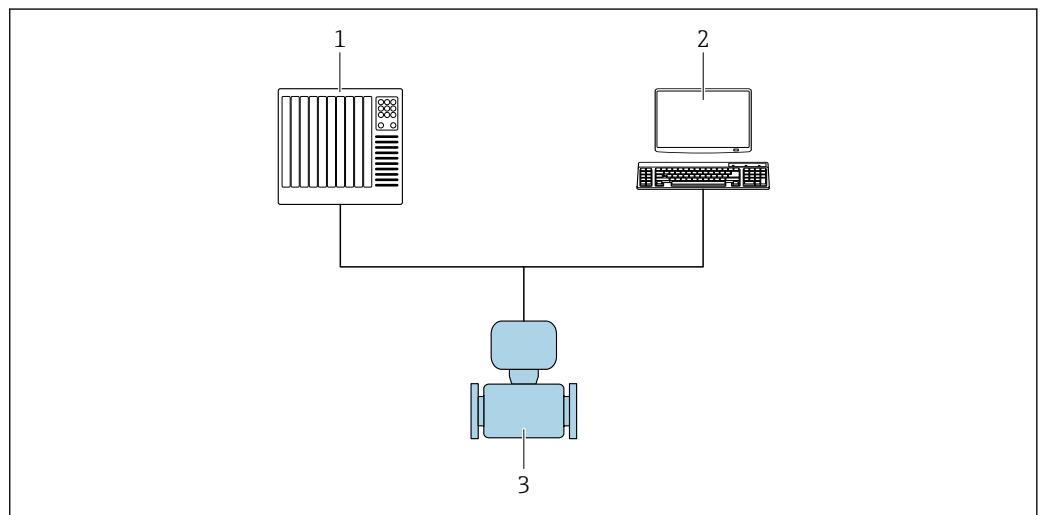


The current value for the total test coverage depends on the configuration and integration of the measuring instrument. It is determined under the following basic conditions:

- Simulation operation not active
- Error behavior, current output set to **Minimum alarm** or **Maximum alarm** and evaluation unit recognizes both alarms
- Settings for diagnostic behavior correspond to factory settings

11.9.2 System integration

The **Heartbeat Technology** are available via the digital interfaces. The features can be used via an asset management system, the automation infrastructure (e.g. PLC) or the Netilion cloud platform.

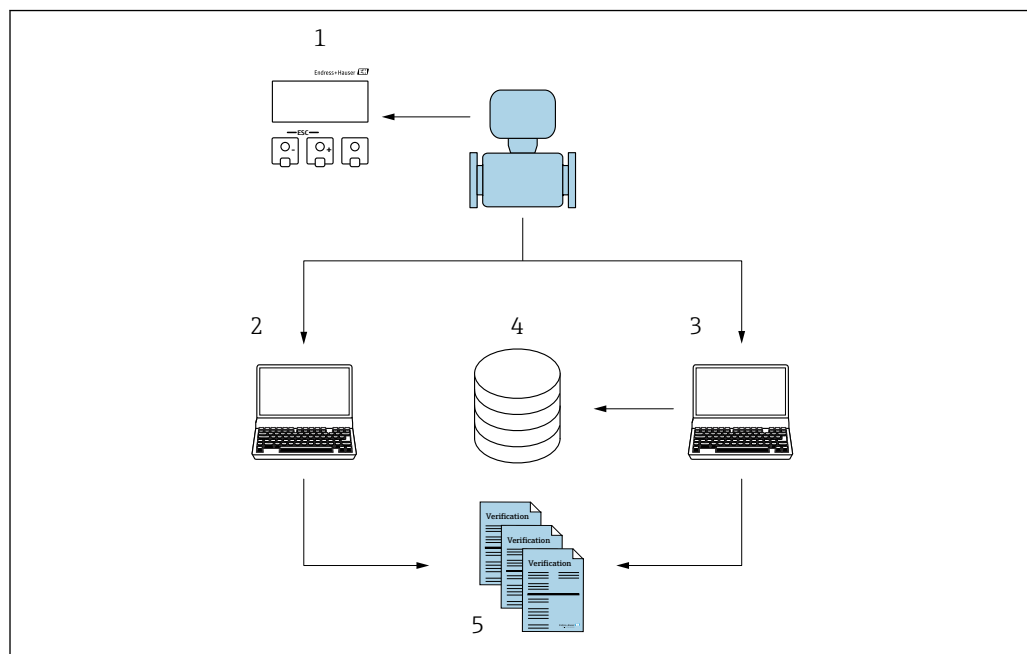


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28 General screen layout

- 1 PLC
- 2 Asset management system
- 3 Measuring instrument

Performing verification and creating a verification report



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- 1 Local display
- 2 Web browser
- 3 FieldCare
- 4 Data memory in the measuring instrument
- 5 Verification report

Run **Heartbeat Verification** via one of the following interfaces:

- System integration interface of a higher-level system
- Local display
- WLAN interface
- Common Data Interface CDI-RJ45

The device must be accessed externally from a higher-level system via the system integration interface in order to start a verification and relay the verification result (Passed or Failed). It is not possible to start the verification via an external status signal and relay the verification results to a higher-level system via the status output.

The detailed results of the verification (8 data record) are saved in the device and provided in the form of a verification report.

Verification reports can be generated with the help of the device DTM, web server integrated in the measuring device or Endress+Hauser's FieldCare plant asset management software.

With the Flow Verification DTM, FieldCare also offers the possibility of data management and of archiving the verification results to create traceable documentation.

The Flow Verification DTM also enables trend analysis – i.e. the ability to monitor, compare and track the verification results of all the verifications performed on the device. This can be used for evaluation purposes, for example to extend recalibration intervals.

Data exchange can take place automatically or be triggered by a user.

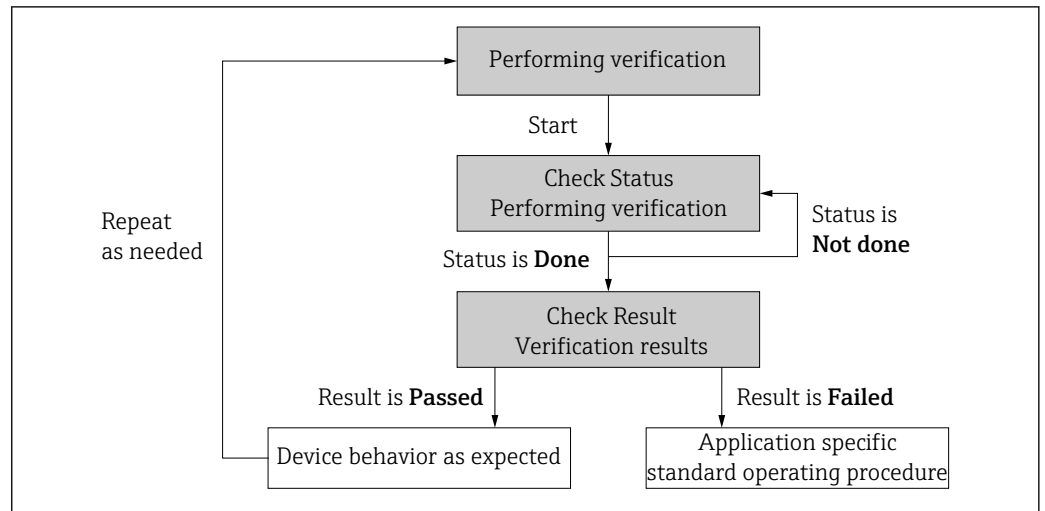
Integration in the PLC system

The verification function integrated in the measuring instrument can be activated by a control system and the results checked.



For further information on "System integration", see the Operating Instructions (documentation code)

The following procedure must be implemented for this purpose:



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Verification result: The overall verification result is indicated in the **Overall result** parameter. Depending on the result, different application-specific measures must be performed by system routines; e.g. a "Maintenance Required" alert is triggered if the result is **Failed**.

Data availability for the user

The data from the **Heartbeat Monitoring** function and the **Heartbeat Verification** function can be made available in different ways.

Device

Heartbeat Verification

- Start verification
- Read out the last verification result.

Heartbeat Monitoring

The user can read the monitoring measured variables in the operating menu.

Asset management system

Heartbeat Verification

- Start verification in the operating menu.
- Read out, archive and document the verification results including detailed results with flow verification DTM and devices DTM.

Heartbeat Monitoring

Configuration of the monitoring function: specify which monitoring parameters are output continuously via the system integration interface.

PLC system

Heartbeat Verification

- Start verification
- The user can read the verification result (pass/fail) in the system.

Heartbeat Monitoring

Configuration of the monitoring function: specify which monitoring parameters are output continuously via the system integration interface.

Data management

The results of a **Heartbeat Verification** are saved as a non-volatile parameter set in the measuring device memory:

- Availability of 8 storage locations for parameter data sets
- New verification results overwrite old data following the FIFO ¹⁾ principle

The results can be documented in the form of a verification report using the web server integrated in the measuring device the Endress+Hauser FieldCare asset management software and Netilion Health.

FieldCare also offers additional capabilities with the Flow Verification DTM:

- Archiving of verification results
- Export of data from these archives
- Trend analysis of verification results (line recorder function)

Data management via Web browser

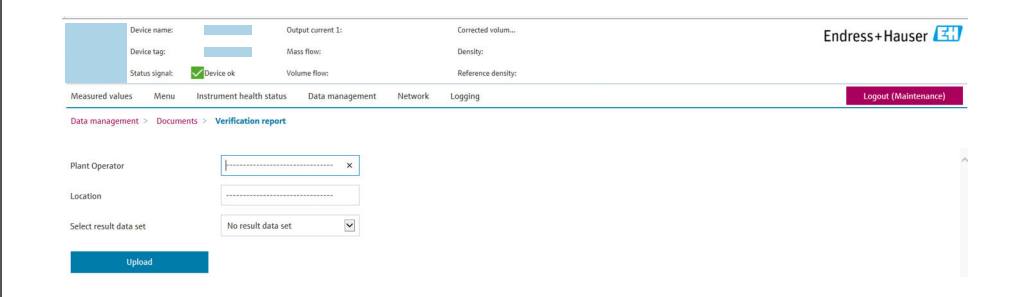
Thanks to the integrated web server, the device can be operated and configured and a **Heartbeat Verification** performed. The results of the verification can be displayed and a verification report can be created.

Printing a verification report

A verification report is created in PDF format.

 Prerequisite: A verification has already been performed.

User interface in the Web browser following login:



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1. Click the navigation buttons **Data management** → **Documents** → **Verification report**.
 - ↳ The input area for downloading verification reports is displayed.
2. Enter the necessary information in the **Plant operator** and **Location** fields.
 - ↳ The information entered here appears in the verification report.
3. Select the result data set.
 - ↳ A result data set is indicated as a time stamp in the drop-down list. If no verification has been performed, the message "No result data set" is displayed here.
4. Click **Upload**.
 - ↳ The Web server generates a verification report in PDF format.

Data management via Device Type Manager (DTM)

Using the device DTM, you can operate the device and perform a **Heartbeat Verification**. The verification results can be displayed and a verification report created.

1) First In – First Out

11.9.3 Heartbeat Verification

Heartbeat Verification checks the device function within the specified measuring tolerance on demand. The result of the verification is "Passed" or "Failed".

The verification data are saved in the device and optionally archived on a PC with the Asset Management Software DeviceCare or FieldCare on a PC. Based on this data, a verification report is generated automatically to ensure that traceable documentation of the verification results is available.

Heartbeat Technology offers two options for Heartbeat Verification:

- **Standard verification**
Verification is performed by the measuring instrument without manual checking of external measured variables.
- **Extended verification** →  169
Verification includes the entry of external measured variables.

Performance characteristics

Heartbeat Verification is performed on demand and complements self-monitoring, which is permanently performed, with an extended check (HBSI deviation).

Extended verification supports checking of the following output modules:

- 4 to 20 mA current output ²⁾
- Pulse/frequency output ³⁾

Standard verification checks the following inputs and outputs:

- 4 to 20 mA current output, active and passive
- Pulse/frequency output, active and passive
- 4 to 20 mA current input, active and passive
- Double pulse output, active and passive
- Relay output

The test is based on device-internal, factory-traceable references that are implemented redundantly in the device. **Heartbeat Verification** confirms the device function on request with the specified total test coverage.

Assessed by an independent body: **Heartbeat Technology** meets the requirement for traceable verification according to DIN EN ISO 9001: 2015 Clause 7.1.5.2 a) Control of monitoring and measuring equipment.

Commissioning

The configuration (factory reference) required as part of **Heartbeat Verification** is recorded during calibration at the factory and permanently stored in the measuring device.

When verification is performed in the application, the current measuring device situation is compared with this factory reference.



Recommendation: Perform initial verification when commissioning the device.

Recording reference data

It is possible to manually record reference data relating to the operator and the location. These reference data appear on the verification report.



Operation continues while the reference data are being recorded.

2) Only for devices with current output

3) Only for devices with pulse/frequency output

Navigation

"Diagnostics" menu → Heartbeat Technology → Performing verification

► Performing verification		
Year	→	📄 162
Month	→	📄 162
Day	→	📄 163
Hour	→	📄 163
AM/PM	→	📄 163
Minute	→	📄 163
Verification mode	→	📄 163
External device information	→	📄 163
Start verification	→	📄 164
Progress	→	📄 164
Measured values	→	📄 164
Output values	→	📄 164
Status	→	📄 165
Verification result	→	📄 165

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Year	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 1): enter the year verification is performed.	9 to 99	21
Month	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 2): enter the month verification is performed.	▪ January ▪ February ▪ March ▪ April ▪ May ▪ June ▪ July ▪ August ▪ September ▪ October ▪ November ▪ December	January

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Day	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 3): enter the day verification is performed.	1 to 31 d	1 d
Hour	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 4): enter the hour verification is performed.	0 to 23 h	12 h
AM/PM	 Can be edited if Heartbeat Verification is not active. The dd.mm.yy hh:mm am/pm option or the mm/dd/yy hh:mm am/pm option is selected in the Date/time format parameter (2812).	Entry for date and time (field 5): enter the morning or afternoon.	■ AM ■ PM	AM
Minute	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 6): enter the minute verification is performed.	0 to 59 min	0 min
Verification mode	Can be edited if the verification status is not active.	Select verification mode. Standard verification: Verification is performed automatically by the device and without manual checking of external measured variables. Extended verification: Similar to internal verification but with the entry of external measured variables (see also "Measured values" parameter).	■ Standard verification ■ Extended verification	Standard verification
External device information	With the following conditions: ■ The Extended verification option is selected in the Verification mode parameter. ■ Can be edited if Heartbeat Verification is not active.	Record measuring equipment for extended verification.	Free text entry	–

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Start verification	–	Start the verification. To carry out a complete verification, select the selection parameters individually. Once the external measured values have been recorded, verification is started using the Start option.	■ Cancel ■ Output 1 low value[*] ■ Output 1 high value[*] ■ Output 2 low value[*] ■ Output 2 high value[*] ■ Output 3 low value[*] ■ Output 3 high value[*] ■ Output 4 low value[*] ■ Output 4 high value[*] ■ Frequency output 1[*] ■ Pulse output 1[*] ■ Frequency output 2[*] ■ Pulse output 2[*] ■ Frequency output 3[*] ■ Double pulse output[*] ■ Start	Cancel
Progress	–	Shows the progress of the process.	0 to 100 %	–
Measured values	One of the following options is selected in the Start verification parameter (→ 164): ■ Output 1 low value ■ Output 1 high value ■ Output 2 low value ■ Output 2 high value ■ Output 3 low value ■ Output 3 high value ■ Output 4 low value ■ Output 4 high value ■ Frequency output 1 ■ Pulse output 1 ■ Frequency output 2 ■ Pulse output 2 ■ Frequency output 3	Use this function to enter the measured values (actual values) for the external measured variables:. ■ Current output: Output current in [mA] ■ Pulse/frequency output: Output frequency in [Hz]	Signed floating-point number	0
Output values	–	Displays the simulated output values (target values) for the external measured variables:. ■ Current output: Output current in [mA]. ■ Pulse/frequency output: Output frequency in [Hz].	Signed floating-point number	–

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Status	–	Displays the current status of the verification.	■ Done ■ Busy ■ Failed ■ Not done	–
Verification result	–	Displays the overall result of the verification.  Detailed description of the classification of the results: →  179	■ Not supported ■ Passed ■ Not done ■ Failed	Not done

* Visibility depends on order options or device settings

Operation

Initial verification

- When commissioning the measuring device:
Perform an initial verification so you can save the results as an initial situation in the measuring device life cycle. As of the 9th verification, printing the verification reports or uploading the data using the Flow Verification DTM is recommended.

Initial verification can be performed in 2 ways:

- Standard verification →  166
- Extended verification →  169

Device behavior and interpretation

Result is "Passed"

All test results are within the specifications.

If the calibration factor and the zero point match the factory settings, there is a high degree of certainty that the measuring device complies with the specification for flow and density.

Verification generally delivers the result Passed in most applications.

Result is "Failed"

One or more test results are outside the specifications.

If the result of the verification is "Failed", take the following measures:

1. Establish defined and stable process conditions.
 - ↳ Ensure a constant process temperature.
Avoid wet gases, two-phase mixtures, pulsating flow, pressure shock and very high flow rates.
2. Repeat verification.
 - ↳ Repeat verification "Passed"
If the result of the second verification is "Passed", the result of the first verification can be ignored. In order to identify possible deviations, compare the current process conditions with the process conditions of a previous verification.

If the result of the verification is "Failed" again, take the following measures:

1. Take remedial action on the basis of the verification results and the diagnostic information of the measuring device.
 - ↳ The cause of the error can be narrowed down by identifying the test group with a "Failed" verification.

2. Provide Endress+Hauser Service with the verification result with the current process conditions.
3. Check the calibration or calibrate the measuring device.
 - ↳ The calibration has the advantage that the "as found" measuring device state is recorded and the actual measured error is determined.

Standard verification

Standard verification is performed automatically by the device and without manual checking of external measured variables.

Diagnostic behavior

The device signals that standard verification is being performed: **△C302 Device verification in progress** diagnostic message

- Factory setting for diagnostic behavior: warning
 - The device continues to measure.
 - The signal outputs and totalizers are not affected.
 - Test duration: approx. 60 seconds.
-  ■ The diagnostic behavior can be changed by the user if necessary:
Expert → System → Diagnostic handling → Diagnostic behavior
If **Alarm** is selected as the diagnostic behavior, the output of measured values is interrupted in the event of an error and the signal outputs and totalizers adopt the defined alarm condition.
- A category is assigned to the relevant diagnostic message of the outputs in the **Diagnostic configuration** submenu.
Expert → Communication → Diagnostic configuration
If the device does not have outputs, they are output as an error. To prevent an error from being output, assign the **No effect (N)** option to any outputs that are not present on the device.



For detailed information on diagnostics and troubleshooting and for diagnostics information and associated remedial measures, see the Operating Instructions .

Performing standard verification

Before verification starts

-  The date and time are saved with the current operating time and the verification results and also appear in the verification report.

The **Year** parameter, **Month**, **Day**, **Hour**, **AM/PM** and **Minute** are used to manually record the data at the time of verification.

1. Enter date and time.

Select the verification mode

2. In the **Verification mode** parameter, select the **Standard verification** option.

Starting the verification test

3. In the **Start verification** parameter, select the **Start** option.
 - ↳ While the verification is being performed, the progress of the verification is indicated as a % (bar graph indicator) in the **Progress** parameter.

Displaying the verification status and result

The current status of standard verification is displayed in the **Status** parameter (→  165):

- **Done**
The verification test is finished.
- **Busy**
The verification test is running.
- **Not done**
A verification has not yet been performed on this measuring device.
- **Failed**
A precondition for performing the verification has not been met, the verification cannot start (e.g. due to unstable process parameters) →  165.

The result of the verification is displayed in the **Overall result** parameter (→  165):

- **Passed**
All the verification tests were successful.
 - **Not done**
A verification has not yet been performed on this measuring device.
 - **Failed**
One or more verification tests were not successful →  165.
-  ■ The overall result of the last verification can always be accessed in the menu.
- **Navigation:**
Diagnostics → Heartbeat Technology → Verification results
 - Detailed information on the verification result (test groups and test status) are shown in the verification report in addition to the overall verification result →  180.
 - If the device does not pass the verification, the results are saved nonetheless and indicated in the verification report.
 - This helps users to perform a targeted search for the cause of the error →  165.

*"Performing verification" submenu***Navigation**

"Diagnostics" menu → Heartbeat Technology → Performing verification

► Performing verification	
Year	→  168
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Verification mode	→  168
External device information	→  175
Start verification	→  168

Progress	→ ⓘ 169
Measured values	→ ⓘ 176
Output values	→ ⓘ 176
Status	→ ⓘ 169
Overall result	→ ⓘ 169

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Year	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 1): enter the year verification is performed.	9 to 99	21
Month	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 2): enter the month verification is performed.	▪ January ▪ February ▪ March ▪ April ▪ May ▪ June ▪ July ▪ August ▪ September ▪ October ▪ November ▪ December	January
Day	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 3): enter the day verification is performed.	1 to 31 d	1 d
Hour	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 4): enter the hour verification is performed.	0 to 23 h	12 h
AM/PM	ⓘ Can be edited if Heartbeat Verification is not active. The dd.mm.yy hh:mm am/pm option or the mm/dd/yy hh:mm am/pm option is selected in the Date/time format parameter (2812).	Entry for date and time (field 5): enter the morning or afternoon.	▪ AM ▪ PM	AM
Minute	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 6): enter the minute verification is performed.	0 to 59 min	0 min
Verification mode	ⓘ Can be edited if Heartbeat Verification is not active.	Select the verification mode. Standard verification Verification is performed automatically by the device and without manual checking of external measured variables.	Standard verification	Standard verification
Start verification	–	Start the verification. Start the verification with the Start option.	▪ Cancel ▪ Start	Cancel

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Progress	–	Shows the progress of the process.	0 to 100 %	–
Status	–	Displays the current status of the verification.	■ Done ■ Busy ■ Failed ■ Not done	–
Verification result	–	Displays the overall result of the verification.  Detailed description of the classification of the results: →  179	■ Not supported ■ Passed ■ Not done ■ Failed	Not done

Extended verification

Extended verification (available only for devices with a current/pulse/frequency output) supplements the standard verification with the output of various measured values. During the verification process, these measured variables are recorded manually with the help of external measuring equipment, for example, and entered in the measuring instrument →  174. The value entered is checked and verified by the measuring instrument to ensure that it complies with the factory specifications. A status (Passed or Failed) is issued accordingly and is documented as an individual result of the verification and taken into account in the overall result.

Permanently predefined output signals, which do not represent the current measured value, are simulated during extended verification of the outputs. To measure the simulated signals, it may be necessary to set the higher-level process control system to a safe state beforehand. In order to perform a verification, the pulse/frequency/switch output must be enabled and assigned to a measured variable.

Extended verification measured variables

Output current (current output)

- Simulation of the measured values for every output physically present on the device
- Simulation "Low value" and "High value"
- Measurement of the two values
- Entry of the two measured values in the verification screen

Output frequency (pulse/frequency output)

- Simulation of the measured values for every output physically present on the device
- Simulation value pulse output: Simulated frequency depending on the pulse width configured
- Simulation value frequency output: Maximum frequency



For more information on simulation, see the Operating Instructions .

Measuring equipment requirements

Recommendations for the measuring equipment

DC current measuring uncertainty	±0.2 %
DC current resolution	10 µA
DC voltage measuring uncertainty	±0.1 %
DC voltage resolution	1 mV
Frequency measuring uncertainty	±0.1 %
Frequency resolution	1 Hz
Temperature coefficient	0.0075 %/°C

Connecting the measuring equipment in the measuring circuit

Determining the terminal assignment for the outputs

The terminal assignment depends on the specific device version.

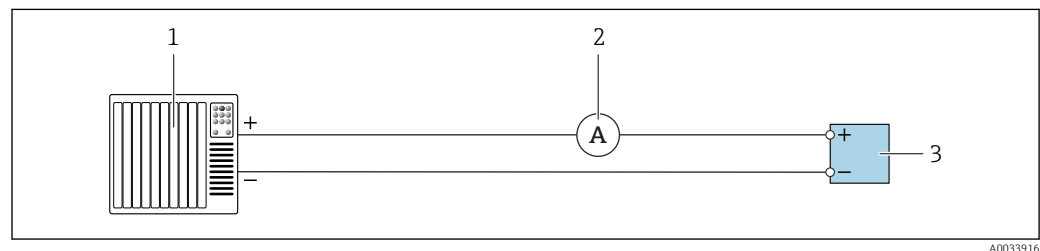
To determine the device-specific terminal assignment:

- See the adhesive label in the terminal cover
- Check the operating menu via the local display, Web browser or operating tool
 - Setup → I/O configuration → I/O module 1 to n terminal numbers
 - Expert → I/O configuration → I/O module 1 to n terminal numbers



For detailed information on terminal assignment, see the Operating Instructions for the device

Active current output



A0033916

29 Extended verification of the active current output

- 1 Automation system with current input (e.g. PLC)
- 2 Ammeter
- 3 Transmitter

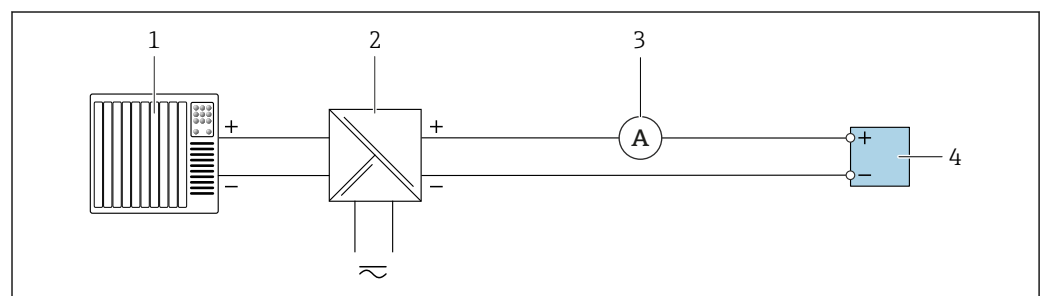
Extended verification of the active current output

- Connect the ammeter to the transmitter by looping it in series into the circuit.

If the automation system is switched off, the measuring circuit may be interrupted as a result. It is then not possible to perform a measurement. If this is the case, proceed as follows:

1. Disconnect the output cables of the current output (+/-) from the automation system.
2. Short the output cables of the current output (+ / -).
3. Connect the ammeter to the transmitter by looping it in series into the circuit.

Passive current output



A0034446

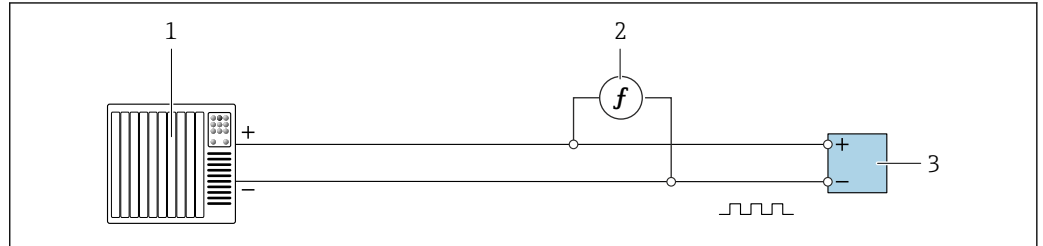
30 Extended verification of the passive current output

- 1 Automation system with current input (e.g. PLC)
- 2 Power supply unit
- 3 Ammeter
- 4 Transmitter

Extended verification of the passive current output

1. Connect the ammeter to the transmitter by looping it in series into the circuit.
2. Connect the power supply unit.

Active pulse/frequency/switch output



A0033911

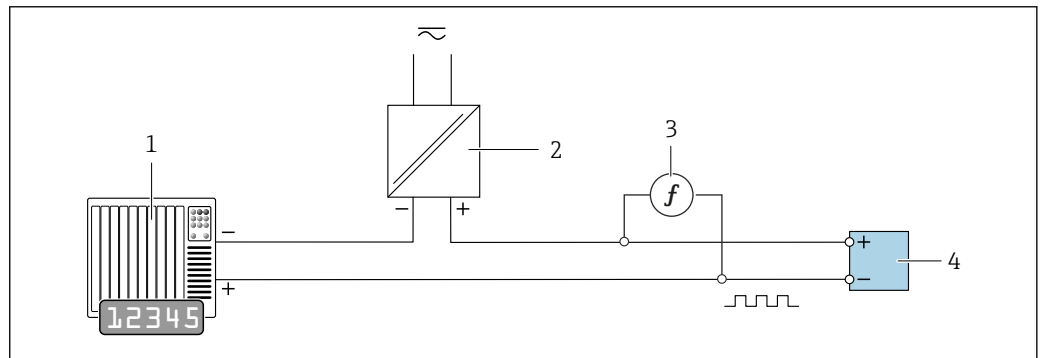
31 Extended verification of the active pulse/frequency output

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Frequency meter
- 3 Transmitter

Extended verification of the active pulse/frequency output

- Connect the frequency meter in parallel to the pulse/frequency output of the transmitter

Passive pulse/frequency/switch output



A0034445

32 Extended verification of the passive pulse/frequency output

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Power supply unit
- 3 Frequency meter
- 4 Transmitter

Extended verification of the passive pulse/frequency output

1. Connect the power supply unit
2. Connect the frequency meter in parallel to the pulse/frequency output of the transmitter

Diagnostic behavior

A diagnostic event signals that the extended verification is being performed:

- The screen alternates between the status signal "C" (Function Check) and the operational display:
Verification is currently active in the device.
- Different diagnostic behaviors, along with the relevant diagnostic codes, can be displayed depending on the device version.
The output selected under the **Start verification** parameter is displayed in all cases, however:
Output 1...n low value option, **Output 1...n high value** option

Diagnostic code	Diagnostic behavior	Options in Start verification
C491	Current output 1 to n simulation active	Output 1...n low value Output 1...n high value
C492	Simulation frequency output 1 to n active	Frequency output 1...n
C493	Simulation pulse output 1 to n active	Pulse output 1...n
C302	△C302 Device verification in progress	

 An extended verification (simulation mode) may be started only if the process plant is not in the automatic mode.

If the **Start** option is selected in the **Start verification** parameter, the following diagnostic event is output on the display (second part of the external verification): **△C302 Device verification in progress** diagnostic message

- Factory setting for diagnostic behavior: warning
- The device continues to measure.
- The totalizers are not affected.
- Test duration (all outputs switched on): approx. 60 seconds.

-  ■ The diagnostic behavior can be changed by the user if necessary:
Expert → System → Diagnostic handling → Diagnostic behavior
If **Alarm** is selected as the diagnostic behavior, the output of measured values is interrupted in the event of an error and the signal outputs and totalizers adopt the defined alarm condition.
- A category is assigned to the relevant diagnostic message of the outputs in the **Diagnostic configuration** submenu.
Expert → Communication → Diagnostic configuration
If the device does not have outputs, they are output as an error. To prevent an error from being output, assign the **No effect (N)** option to any outputs that are not present on the device.

 For detailed information on diagnostics and troubleshooting and for diagnostics information and associated remedial measures, see the Operating Instructions .

Performing extended verification

A full standard verification is performed in the course of the verification. The validity of the entered and measured values of the outputs is checked. Additional standard verification of the outputs does not take place.

NOTICE

If the electrical connections have not been established and the ammeter is not looped in during verification, extended verification is not possible.

- ▶ Establish the electrical connection before starting the extended verification.
- ▶ Loop in ammeter before extended verification starts.

Before verification starts



The date and time are saved with the current operating time and the verification results and also appear in the verification report.

The **Year** parameter, **Month**, **Day**, **Hour**, **AM/PM** and **Minute** are used to manually record the data at the time of verification.

1. Enter date and time.

Select the verification mode

2. In the **Verification mode** parameter, select the **Extended verification** option.

Further parameter settings

3. In the **External device information** parameter, enter a unique ID (e.g. serial number) of the measuring equipment used (max. 32 characters).
4. In the **Start verification** parameter, select one of the options available (e.g. the **Output 1 low value** option).
5. In the **Measured values** parameter, enter the value shown on the external measuring equipment.
6. Repeat steps 4 and 5 until all the output options are checked.
7. Adhere to the sequence indicated and enter the measured values.

The duration of the process and number of outputs depend on the device configuration, on whether the output is switched on and on whether the output is active or passive.

The value displayed in the **Output values** parameter (→ 164) shows the value simulated by the device at the selected output → 170

Starting the verification test

8. In the **Start verification** parameter, select the **Start** option.
 - ↳ While the verification is being performed, the progress of the verification is indicated as a % (bar graph indicator) in the **Progress** parameter.

Displaying the verification status and result

The current status of standard verification is displayed in the **Status** parameter (→ 165):

■ Done

The verification test is finished.

■ Busy

The verification test is running.

■ Not done

A verification has not yet been performed on this measuring device.

■ Failed

A precondition for performing the verification has not been met, the verification cannot start (e.g. due to unstable process parameters) → 165.

The result of the verification is displayed in the **Overall result** parameter (→  165):

- Passed
All the verification tests were successful.
 - Not done
A verification has not yet been performed on this measuring device.
 - Failed
One or more verification tests were not successful →  165.
-  ■ The overall result of the last verification can always be accessed in the menu.
- Navigation:
Diagnostics → Heartbeat Technology → Verification results
 - Detailed information on the verification result (test groups and test status) are shown in the verification report in addition to the overall verification result →  180.
 - If the device does not pass the verification, the results are saved nonetheless and indicated in the verification report.
 - This helps users to perform a targeted search for the cause of the error →  165.

"Performing verification" submenu

Navigation

"Diagnostics" menu → Heartbeat Technology → Performing verification

► Performing verification		
Year		→  175
Month		→  175
Day		→  175
Hour		→  175
AM/PM		→  175
Minute		→  175
Verification mode		→  175
External device information		→  175
Start verification		→  176
Progress		→  176
Measured values		→  176
Output values		→  176
Status		→  177
Verification result		→  177

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Year	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 1): enter the year verification is performed.	9 to 99	21
Month	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 2): enter the month verification is performed.	■ January ■ February ■ March ■ April ■ May ■ June ■ July ■ August ■ September ■ October ■ November ■ December	January
Day	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 3): enter the day verification is performed.	1 to 31 d	1 d
Hour	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 4): enter the hour verification is performed.	0 to 23 h	12 h
AM/PM	 Can be edited if Heartbeat Verification is not active. The dd.mm.yy hh:mm am/pm option or the mm/dd/yy hh:mm am/pm option is selected in the Date/time format parameter (2812).	Entry for date and time (field 5): enter the morning or afternoon.	■ AM ■ PM	AM
Minute	 Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 6): enter the minute verification is performed.	0 to 59 min	0 min
Verification mode	 Can be edited if Heartbeat Verification is not active.	Select the verification mode. Extended verification Standard verification is extended by the additional entry of external measured variables: Measured values parameter.	Extended verification	Standard verification
External device information	With the following conditions: ■ The Extended verification option is selected in the Verification mode parameter. ■ Can be edited if Heartbeat Verification is not active.	Record measuring equipment for extended verification.	Free text entry	–

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Start verification	–	Start the verification. To carry out a complete verification, select the selection parameters individually. Once the external measured values have been recorded, verification is started using the Start option.	■ Cancel ■ Output 1 low value[*] ■ Output 1 high value[*] ■ Output 2 low value[*] ■ Output 2 high value[*] ■ Output 3 low value[*] ■ Output 3 high value[*] ■ Output 4 low value[*] ■ Output 4 high value[*] ■ Frequency output 1[*] ■ Pulse output 1[*] ■ Frequency output 2[*] ■ Pulse output 2[*] ■ Frequency output 3[*] ■ Double pulse output[*] ■ Start	Cancel
Measured values	One of the following options is selected in the Start verification parameter (→ 164): ■ Output 1 low value ■ Output 1 high value ■ Output 2 low value ■ Output 2 high value ■ Output 3 low value ■ Output 3 high value ■ Output 4 low value ■ Output 4 high value ■ Frequency output 1 ■ Pulse output 1 ■ Frequency output 2 ■ Pulse output 2 ■ Frequency output 3	Use this function to enter the measured values (actual values) for the external measured variables: ■ Current output: Output current in [mA] ■ Pulse/frequency output: Output frequency in [Hz]	Signed floating-point number	0
Progress	–	Shows the progress of the process.	0 to 100 %	–
Output values	–	Displays the simulated output values (target values) for the external measured variables: ■ Current output: Output current in [mA]. ■ Pulse/frequency output: Output frequency in [Hz].	Signed floating-point number	–

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Status	–	Displays the current status of the verification.	■ Done ■ Busy ■ Failed ■ Not done	–
Verification result	–	Displays the overall result of the verification.  Detailed description of the classification of the results: →  179	■ Not supported ■ Passed ■ Not done ■ Failed	Not done

* Visibility depends on order options or device settings

Verification results

Access to the verification results:

In the operating menu via the onsite display, operating tool or Web browser

- Diagnostics → Heartbeat Technology → Verification results
- Expert → Diagnostics → Heartbeat Technology → Verification results

Navigation

"Diagnostics" submenu → Heartbeat → Verification results

Navigation

"Expert" menu → Diagnostics → Heartbeat → Verification results

► Verification results	
Date/time	→  178
Verification ID	→  178
Operating time	→  178
Overall result	→  178
Sensor	→  178
Sensor electronic module (ISEM)	→  178
I/O module	→  178
System status	→  178

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface	Factory setting
Date/time (manually entered)	The verification has been performed.	Date and time.	dd.mmmm.yyyy; hh:mm	1 January 2010; 12:00
Verification ID	The verification has been performed.	Displays consecutive numbering of the verification results in the measuring device.	0 to 65 535	0
Operating time	The verification has been performed.	Indicates how long the device has been in operation up to the verification.	Days (d), hours (h), minutes (m), seconds (s)	–
Verification result	–	Displays the overall result of the verification.  Detailed description of the classification of the results: →  179	▪ Not supported ▪ Passed ▪ Not done ▪ Failed	Not done
Sensor	The Failed option was shown in the Overall result parameter.	Displays the result for the sensor.  Detailed description of the classification of the results: →  179	▪ Not supported ▪ Passed ▪ Not done ▪ Failed	Not done
Sensor electronic module (ISEM)	The Failed option was shown in the Overall result parameter.	Displays the result for the sensor electronics module (ISEM).  Detailed description of the classification of the results: →  179	▪ Not supported ▪ Passed ▪ Not done ▪ Failed	Not done
I/O module	The Failed option was shown in the Overall result parameter.	Displays the result for I/O module monitoring of the I/O module. ▪ For current output: Accuracy of the current ▪ For pulse output: Accuracy of pulses ▪ For frequency output: Accuracy of frequency ▪ Current input: Accuracy of the current ▪ Double pulse output: Accuracy of the pulses ▪ Relay output: Number of switching cycles  Heartbeat Verification does not check the digital inputs and outputs and does not issue a result for this.  Detailed description of the classification of the results: →  179	▪ Not supported ▪ Passed ▪ Not done ▪ Not plugged ▪ Failed	Not done
System status	The Failed option was shown in the Overall result parameter.	Displays the system condition. Tests the measuring device for active errors.  Detailed description of the classification of the results: →  179	▪ Not supported ▪ Passed ▪ Not done ▪ Failed	Not done

Classification of results

Individual results

Result	Description
Failed	At least one individual test in the test group was outside the specifications.
Passed	All individual tests in the test group complied with the specifications. The result is also "Passed" if the result of an individual test is "Check not done" and the result of all other tests is "Passed".
Not done	No test has been performed for this test group. For example, because this parameter is not available in the current device configuration.
Not supported	The result is used for internal purposes.
Not plugged	The result is displayed if no I/O module is plugged into the slot.
Off	The result is displayed if a universal module is plugged into the slot and has not been configured. This is equivalent to the slot in question being "deactivated".

Overall results

Result	Description
Failed	At least one test group was outside the specifications.
Passed	All verified test groups complied with the specifications (result "Passed"). The overall result is also "Passed" if the result for an individual test group is "Check not done" and the result for all other test groups is "Passed".
Not done	No verification was performed for any of the test groups (result for all test groups is "Check not done").



Heartbeat Verification confirms the device function within the specified measuring tolerance on demand. Based on redundant reference values in the device that are traceable from the factory, **Heartbeat Technology** meets the requirements of traceable verification in accordance with DIN EN ISO 9001:2015, Clause 7.1.5.2 a Measurement traceability. According to the standard, the user is responsible for specifying the verification interval in accordance with requirements.

Test groups

Test group	Description
Sensor	Electrical components of the sensor (signals, circuits and cables)
HBSI	Electrical, electromechanical and mechanical components of the sensor, including the measuring tube
Sensor electronics module (ISEM)	Electronics module for activating and converting the sensor signals
I/O module	Results of the input and output modules installed on the measuring device
System condition	Test for active measuring device errors of "alarm"-type diagnostic behavior



Test groups and individual tests → 180.



The partial results for a test group (e.g. sensor) contain the result of several individual tests. All the individual tests must be passed for the partial result to pass.

The same applies to the overall verification result: All the partial results must pass for the overall verification result to pass. Information on the individual tests is provided in the verification report and in the partial results by test groups, which can be retrieved with the flow verification DTM.

*Limit values**I/O module*

Output; input	Standard verification	Extended verification
Current output 4 to 20 mA, active and passive	$\pm (100 \mu\text{A (offset)} + 1 \% \text{ of reading})$	- Lower value 4 mA: $\pm 1 \%$ - Upper value 20 mA: $\pm 0.5 \%$
Pulse/frequency/switch output, active and passive	$\pm 0.05 \%$, with a 120 s cycle	- Pulse: $\pm 0.3 \%$ - Frequency: $\pm 0.3 \%$
Current input 4 to 20 mA, active and passive	-20 %: $24 \text{ V} - 20 \% = 19.2 \text{ V}$ - Read back the supply voltage: $> 24 \text{ V} - 20 \% - 5 \% = 18 \text{ V}$ (min. 18 V applied)	–
Double pulse output, active and passive	$\pm 0.05 \%$, with a 120 s cycle	Only standard verification possible.
Relay output	The number of switching cycles depends on the hardware.	Only standard verification possible.

Detailed verification results ⁴⁾

Partial results by test groups and detailed verification results can be viewed in the verification report and retrieved using the flow verification DTM.

This also applies to the process conditions determined at the time of verification.

Process conditions

To increase the comparability of the results, the process conditions that apply at the time of verification are recorded and documented as process conditions on the last page of the verification report.

Process conditions	Description
Mass flow verification value	Current measured value for mass flow
Density verification value	Current measured value for density
Damping verification value	Current measured value for measuring tube damping
Process temperature verification value	Current measured value for medium temperature
Electronic temperature	Current measured value for the electronic temperature in the transmitter

Individual test group results

The individual test group results listed below provide information on the results of the individual tests within a test group.

Sensor

Parameter/individual test	Description	Result/limit value	Interpretation/cause/remedial measures
Inlet sensor coil	Condition of the inlet sensor coil: intact/not intact (short-circuit/open circuit)	No value range - Pass - Fail	- Check connecting cable between sensor and transmitter - Replace sensor
Outlet sensor coil	Condition of the outlet sensor coil: intact/not intact (short-circuit/open circuit)	No value range - Pass - Fail	- Check connecting cable between sensor and transmitter - Replace sensor

⁴⁾ Only available for devices with current/pulse/frequency output

Parameter/individual test	Description	Result/limit value	Interpretation/cause/remedial measures
Measuring tube temperature sensor	Condition of the measuring tube temperature sensor: intact/not intact (short-circuit/open circuit)	No value range ■ Pass ■ Fail	► Check connecting cable between sensor and transmitter ► Replace sensor
Carrier tube temperature sensor	Condition of the carrier tube temperature sensor: intact/not intact (short-circuit/open circuit)	No value range ■ Pass ■ Fail	► Check connecting cable between sensor and transmitter ► Replace sensor
Sensor coil symmetry	Monitoring of the signal amplitude between the inlet and outlet sensor	No value range ■ Pass ■ Fail	Indication of mechanical damage or electronic interference ► Check connecting cable between sensor and transmitter ► Replace sensor
Lateral mode frequency	Monitoring of the oscillation frequency of the measuring tube/tubes	No value range ■ Pass ■ Fail	► Check whether the sensor is outside the operational range ► Check for damage on the measuring tube, e.g. as a result of corrosion ► Check connecting cable between sensor and transmitter ► Replace sensor

HBSI

Parameter/individual test	Description	Result/limit value	Interpretation/cause/remedial measures
HBSI	Monitoring of the relative change of the entire sensor, with all its electrical, mechanical and electromechanical components incorporated in the sensor housing (including the measuring tube, electrodynamic sensors, excitation system, cables etc.), in % of the reference value.	No value range ■ Pass ■ Fail	► Deviations of the HBSI value indicate corrosion, abrasion or other damage, such as shock/impact. If the result is "Failed", the sensor is seriously impaired and must be checked.
Inlet sensor coil	Condition of the inlet sensor coil: intact/not intact (short-circuit/open circuit)	No value range ■ Pass ■ Fail	► Check connecting cable between sensor and transmitter ► Replace sensor
Outlet sensor coil	Condition of the outlet sensor coil: intact/not intact (short-circuit/open circuit)	No value range ■ Pass ■ Fail	► Check connecting cable between sensor and transmitter ► Replace sensor
Measuring tube temperature sensor	Condition of the measuring tube temperature sensor: intact/not intact (short-circuit/open circuit)	No value range ■ Pass ■ Fail	► Check connecting cable between sensor and transmitter ► Replace sensor
Sensor coil symmetry	Monitoring of the signal amplitude between the inlet and outlet sensor	No value range ■ Pass ■ Fail	Indication of mechanical damage or electronic interference ► Check connecting cable between sensor and transmitter ► Replace sensor
Lateral mode frequency	Monitoring of the oscillation frequency of the measuring tube/tubes	No value range ■ Pass ■ Fail	► Check whether the sensor is outside the operational range ► Check for damage on the measuring tube, e.g. as a result of corrosion ► Check connecting cable between sensor and transmitter ► Replace sensor

Sensor electronics module (ISEM)

Parameter/individual test	Description	Result/limit value	Interpretation/cause/remedial measures
Supply voltage	Monitoring of the main supply voltage of the sensor electronics module Execution: Monitoring of the supply voltage for the sensor electronics module guarantees that the system is functioning correctly.	No value range - Pass - Fail	Sensor electronics module (ISEM) defective Replace sensor electronics module (ISEM)
Zero point monitoring	Test of the entire signal path, amplitude and zero point.	No value range - Pass - Fail	Sensor electronics module (ISEM) defective Replace sensor electronics module (ISEM)
Reference clock	Monitoring of the reference clock for flow and density measurement	No value range - Pass - Fail	Sensor electronics module (ISEM) defective Replace sensor electronics module (ISEM)
Reference temperature	Temperature measurement monitoring	No value range - Pass - Fail	Sensor electronics module (ISEM) defective Replace sensor electronics module (ISEM)

System condition

Parameter/individual test	Description	Result/limit value	Interpretation/cause/remedial measures
System condition	System condition monitoring	No value range - Passed - Failed - Not done	Causes System error during verification Corrective action Check diagnostic event in the Event logbook submenu.

I/O modules

Parameter/individual test	Description	Result/limit value	Interpretation/cause/remedial actions
Output 1 to n	Checking all input and output modules installed on the measuring instrument ¹⁾	No value range - Passed - Failed - Not done  Limit values →  180	Causes - Output values out of specification - I/O modules defective Corrective action - Check the wiring. - Check connections. - Check load (current output). - Replace the I/O module.

1) Only available for devices with current/pulse/frequency output

Verification report

The verification results can be documented via the web server, DeviceCare or FieldCare operating tools in the form of a verification report →  160. The verification report is created on the basis of the data records saved in the measuring device after verification. As the verification results are automatically and uniquely identified with a verification ID and the operating time, they are suitable for the traceable documentation of the verification of measuring devices.

First page: identification

Measuring point identification, identification of the verification results and confirmation of completion:

- Plant operator: customer reference
- Device information
 - Information on the place of operation (tag) and the current configuration of the measuring point
 - Management of the information in the device
 - Display on the verification report
- Calibration
 - Information on the calibration factor and zero point setting for the sensor
 - These values must correspond to those from the last calibration or repeat calibration in order to comply with factory specifications
- Verification information
 - The operating time and verification ID are used to uniquely assign the verification results for the traceable documentation of the verification
 - Storage and display of the manual date and time entry as well as the current operating time in the device
 - Verification mode: standard verification or extended verification
- Overall verification result:
 - Overall result of the verification "Passed": All the results have been "Passed"
 - Overall result of the verification "Failed": One or more individual results have been "Failed"

Second page: test results

Details on the individual results for all test groups:

- System operator
- Test groups →  180
 - Sensor
 - HBSI
 - System condition
 - I/O modules

Third page (and subsequent pages, if applicable): measured values and visualization

Numerical values and graphic presentation of all the values recorded:

- System operator
- Test object
- Unit
- Current: measured value
- Min.: lower limit
- Max.: upper limit
- Visualization: graphic presentation of the measured value, within the lower and upper limits.

Last page: process conditions

Information on the process conditions that applied during the verification:

- Flow
- Process temperature
- Electronics temperature
- Density
- Damping

As a prerequisite for the validity of the verification report, the **Heartbeat Verification** feature must be activated on the measuring device concerned and must have been

performed by an operator tasked to carry out this job by the customer. Alternatively, the Endress+Hauser service organization or a service provider authorized by Endress+Hauser can be tasked with performing the verification.



Individual test groups and description of individual tests: →  180

Interpreting and using the verification results

Heartbeat Verification uses the self-monitoring function of the Proline devices to check the measuring device functionality. During the verification process, the system checks whether the measuring device components comply with the factory specifications. Both the sensor and the electronics modules are included in the tests.

Compared to flow calibration, which assesses the flow measuring performance directly (primary measured variable), **Heartbeat Verification** checks the function of the measuring chain from the sensor to the outputs.

During this process, device-internal parameters that are correlated with flow measurement are checked (secondary measured variables, comparative values). The check is based on reference values that were recorded during the factory calibration.

If a verification is passed, this confirms that the comparative values checked are within the factory specification and that the measuring device is working correctly. At the same time, zero point and calibration factor of the sensor can be traced via the verification report. To ensure that the measuring device complies with the factory specification, these values must correspond to those of the last calibration or repeat calibration.

-  ■ Confirmation of compliance with the flow specification with 100 % test coverage can only be obtained by verifying the primary measured variable (flow) by means of recalibration or proving.
- **Heartbeat Verification** confirms on demand that the device is functioning within the specified measuring tolerance and the specified total test coverage TTC.

Recommended course of action if the result of a verification is "Failed"

If the result of a verification is **Failed**, it is advisable to begin by repeating the verification.

Ideally, ensure defined and stable process conditions in order to rule out process-specific influences as much as possible. When repeating the verification, it is advisable to compare the current process conditions to those of the previous verification in order to identify any deviations.

-  The process conditions for the previous verification are documented on the last page of the verification report or can be called up using the flow verification DTM
→  180.

Additional remedial measures if the result of a verification is "Failed"

- Calibrate the measuring device
The calibration has the advantage that the "as found" measuring device state is recorded and the actual measured error is determined.
- Direct remedial measures
Take remedial action on the basis of the verification results and the diagnostic information of the measuring device. Narrow down the possible cause of the error by identifying the test group that **failed** the verification.

-  For detailed information on diagnostics and troubleshooting and for diagnostics information and associated remedial measures, see the Operating Instructions .

11.9.4 Heartbeat Monitoring

With Heartbeat Monitoring, additional measured values are output continuously and monitored and interpreted in an external Condition Monitoring system, enabling early detection of changes to the measuring instrument and in the process. The information obtained in this way helps users to manage measures relating to maintenance or process optimization. Possible applications of Condition Monitoring include the detection of build-up formation or wear due to corrosion.

Commissioning

Assign the diagnostic parameters to the outputs for commissioning. After commissioning, the parameters are available at the outputs and, in the case of digital communication, they are typically continuously available.

Description of the monitoring parameters

The following monitoring parameters can be assigned to the various outputs of the measuring instrument for continuous transmission to a Condition Monitoring system.

 Some measured variables are only available if the **Heartbeat Verification + Monitoring** application package is enabled in the measuring device.

Measured variable	Description	Value range
Electronics temperature	Temperature of the electronics in the set system unit	-50 to +90 °C ¹⁾
Exciter current 0	Exciter current of the measuring tube/tubes in mA	±100 mA
Frequency fluctuation 0	Fluctuation of the oscillation frequency of the measuring tube/tubes	¹⁾
Oscillation damping fluctuation 0	Fluctuation of the mechanical damping of the measuring tube/tubes	¹⁾
Oscillation amplitude 0	Relative mechanical oscillation amplitude of the measuring tube/tubes in % of the target value	0 to 100 %  Can be > 100% temporarily.
Oscillation frequency 0	Oscillation frequency of the measuring tube/tubes in Hz	¹⁾
Oscillation damping 0	Mechanical damping of the measuring tubes/tube in A/m	0 to 100 000 ¹⁾
Signal asymmetry	Relative deviation of the signal amplitude between the inlet and outlet sensor in %	0 to 25 %
	Temperature of the sensor carrier tube in the set system unit	Depends on the medium temperature. -200 to +350 °C

1) Depends on the sensor type, version and nominal diameter

 For information on using the parameters and interpreting the measurement results, see [\(Verweisziel existiert nicht, aber @y.link.required=true\)](#).

HBSI monitoring

Enables monitoring of the **HBSI** parameter (Heartbeat Sensor Integrity). This parameter monitors the sensor (measuring tube, electrodynamic sensors, exciter system, cables etc.) for changes that can cause deviations in flow and density measurement.

HBSI Monitoring is periodically available for all other sensors. The function must be enabled during commissioning in order to use the additional measured variable.

Enabling and disabling HBSI Monitoring

Navigation

"Setup" menu → Advanced setup → Heartbeat setup → Heartbeat Monitoring

► Heartbeat Monitoring

Activate monitoring	→ 187
HBSI cycle time	→ 187

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Activate monitoring	–	Activate monitoring to enable cyclic transmission of the HBSI measured value.	■ Off ■ Time-controlled HBSI ■ Continuous HBSI	On
HBSI cycle time	In the Activate monitoring parameter, the Time-controlled HBSI option is selected.	This parameter can be used to set the cycle time for determining the HBSI measured value.	0.5 to 4 320 h	12 h

Displaying the monitoring results

Display via the device-integrated web server or via FDI packages

The current values of all monitoring parameters except the **HBSI** parameter and **HBSI value reliability** parameter can be accessed via the following navigation: Expert → Sensor → Testpoints

The current **HBSI** parameter value and **HBSI value reliability** parameter can be accessed via the following navigation: Diagnostics → Heartbeat Technology → Monitoring results



For measuring instruments with a local display, the value can also be configured as a display value.

For **HBSI** parameter, the value must be activated so that it is shown on the display.

Navigation

"Diagnostics" menu → Heartbeat Technology → Monitoring results

► Monitoring results	
HBSI	→ 187
HBSI value reliability	→ 187

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
HBSI	Shows the relative change of the sensor in relation to the reference point. This relative change can lead to a measurement error.	Signed floating-point number	0 %
HBSI value reliability	Shows the status of the HBSI value. Uncertain or Bad: Due to difficult process conditions over a long time no HBSI value could be determined.	■ Good ■ Uncertain ■ Bad	Uncertain

Configuration of the outputs and local display

With the application package "Heartbeat Verification + Monitoring", the user has additional monitoring parameters available → 186 . The following examples illustrate how a monitoring measured variable is assigned to a current output or is shown on the local display.

*Example: Configuring the current output***Select the monitoring measured variable for current output**

1. Prerequisite:
Setup → I/O configuration
↳ Configurable I/O module displays the **I/O module type** parameter with **Current output** option
2. Setup → Current output
3. Select the monitoring measured variable for the current output in the **Assign current output** parameter

Navigation

"Setup" menu → Current output → Assign current output

*Example: Configuring the local display***Select the measured value that is shown on the local display**

1. Setup → Display → Value 1 display
2. Select the measured value.

Operation

The benefits of **Heartbeat Monitoring** are in direct correlation with the recorded data selection and their interpretation. Good data interpretation is critical for deciding whether a problem has occurred and when and how maintenance should be scheduled or performed (good knowledge of the application is required). The elimination of process effects that cause misleading warnings or interpretation must also be ensured. For this reason it is important to compare the recorded data against a process reference.

With Heartbeat Monitoring it is possible to display and output additional monitoring-specific measured values for monitoring in an external Condition Monitoring system during continuous operation.

Condition Monitoring focuses on measured variables that indicate a change in the performance of the device brought about by process-specific influences. There are two difference categories of process-specific influences:

- Temporary process-specific influences that impact the measuring function directly and therefore result in a higher level of measurement uncertainty than would normally be expected (e.g. measurement of multiphase fluids). These process-specific influences generally do not affect the integrity of the device but do impact measuring performance temporarily.
- Process-specific influences that only impact the integrity of the sensor over the medium term but which also bring about a gradual change in the measuring performance (e.g. formation of buildup in the sensor).

Devices with **Heartbeat Monitoring** offer a range of parameters that are particularly suitable for monitoring specific, application-related influences:

- Formation of buildup in the sensor
- Corrosive or abrasive fluids
- Multi-phase fluids (gas content in liquid fluids)
- Wet gases
- Applications in which the sensor is exposed to a programmed amount of wear.

The results of Condition Monitoring must always be interpreted in the context of the application.

Possible interpretation of the monitoring parameters

This section describes the interpretation of certain monitoring parameters in connection with the process and the application.

Monitoring parameter	Possible reasons for deviation
Mass flow	If the mass flow can be kept constant and can be repeated, a deviation from the reference indicates a zero point shift.
Density	A deviation from the reference may be caused by a change in the resonance frequency of the measuring tube, e.g. due to coating/buildup in the measuring tube, corrosion or abrasion.
Reference density	The reference density values can be interpreted in the same way as the density values. If it is not possible to keep the liquid temperature entirely constant, you can analyze the reference density (density at a constant temperature, e.g. at 20 °C) instead of the density. Make sure that the parameters required for calculating the reference density have been configured correctly.
Temperature	Use this diagnostics parameter to monitor the process temperature.
Oscillation damping	A deviation from the reference state can be caused by a change in the measuring tube damping, e.g. by mechanical changes (formation of coating or buildup, fouling).
Signal asymmetry	A deviation is an indicator of abrasion or corrosion.
Frequency fluctuation	A deviation in the frequency fluctuation is an indicator of rapidly changing process conditions, e.g. gas content in a liquid medium or moisture in gaseous media.
Tube damping fluctuation	A deviation in the tube damping fluctuation is an indicator of rapidly changing process conditions, e.g. gas content in a liquid medium.
HBSI	A deviation in the HBSI indicates a change of the entire sensor, with all its electrical, mechanical and electromechanical components incorporated in the sensor housing (including the measuring tube, electrodynamic pick-ups, excitation system, cables etc.). ■ In the event of deposits/buildup, fouling in the sensor: or In the event of abrasion or corrosion in the sensor: Inspect the sensor, clean the measuring tube if necessary ■ In case of mechanical damage or aging of sensor and excitation coils: Replace the sensor
Electronic temperature	Indication of high ambient temperatures or heat transfer from the process, e.g. due to installation conditions (incorrect insulation of the pipework).

Description of typical applications

Coating or deposit buildup in the measuring tube

If the process causes coating or deposits to form in the measuring tubes of the measuring instrument, **Heartbeat Monitoring** can be used to monitor this application.

Relevant monitoring parameters:

- Oscillation damping
Oscillation damping is a number that defines the ratio of the exciter current to the oscillation amplitude of the tubes. Coating or deposit buildup in the measuring tube have a significant influence on this value. Note: Medium viscosity and entrained gas in liquid media can also influence the Oscillation damping .
- HBSI (→  187) torsion mode (Promass I)
In the case of Promass I, the **HBSI** parameter (→  187) is also suitable for detecting deposits and the formation of buildup in the measuring tube. The shift from the baseline value depends on whether the buildup forming on the measuring tube is soft or hard.
- Density
Mechanical changes to the tubes cause a shift in the resonance frequency. The formation of buildup and deposits reduces the resonance frequency. This causes the measured density value to increase compared to the reference value. Note: A reliable comparison with the reference value requires a reference condition, i.e. a medium of known density or an empty measuring tube.

Corrosion or abrasion in the measuring tube

If there is evidence or the suspicion that the process is causing corrosion or abrasion in the measuring tubes of the measuring instrument, **Heartbeat Monitoring** can be used for this application.

Relevant monitoring parameters:

- HBSI (→  187)
A Coriolis mass flow meter measures mass flow by exciting the measuring tubes at their resonance frequency and evaluating the phase shift between the inlet and outlet sensors. To determine the HBSI value, the tube is excited at a higher frequency and the resulting oscillation amplitude is assessed. If, for example, abrasion reduces the stiffness of the tube, less energy is required for excitation and less current is needed - the HBSI value increases.
- Sensor asymmetry
Corrosion or abrasion is rarely constant over the entire length of the measuring tube. Wear often appears at the inlet – i.e. in areas with higher medium velocity. Changes to the sensor asymmetry may be caused by corrosion or abrasion in the Coriolis sensor.
- Density
Mechanical changes to the tubes cause a shift in the resonance frequency. If the density has changed in relation to the reference value, this can indicate eroded or corroded measuring tubes. Note: A reliable comparison with the reference value requires a reference condition, i.e. a medium of known density or an empty measuring tube.

Application with multiphase fluids

If there is evidence or the suspicion that multiphase conditions are present in the process, **Heartbeat Monitoring** can be used for the following applications:

- Air entrained in liquids
- Wet gas

Relevant monitoring parameters:

- Frequency fluctuation
If the process is stopped or if constant process conditions are present, a value close to 0 can be expected. An increase in the current value in applications involving liquids is an indicator of gas content in the fluid. In applications with gaseous fluids, the Frequency fluctuation is a good indicator of wet gas, as the fluctuation in the frequency indicates that a fluid is not homogeneous.
- Oscillation damping and Oscillation damping fluctuation
An increase in oscillation damping coupled with a rapid change in Oscillation damping is an indicator of multiphase conditions in the process (particularly gas content in liquid fluids), as these conditions cause increased damping in the measuring tube. The changes in the Oscillation damping are caused by the changing gas concentration and distribution of the gas in the liquid.

11.9.5 ModbusRS485 register information

Notes

Structure of the register information

The individual parts of a parameter description are described in the following section:

Navigation: navigation path to the parameter					
Parameter	Register	Data type	Access type	Display/selection/entry	→ 
Name of parameter	Indicated in decimal numerical format	- Float length = 4 byte - Integer length = 1, 2 or 4 byte - String length, depending on parameter	Possible type of access to parameter: - Read access via function codes 03, 04 or 23 - Write access via function codes 06, 16 or 23	Options List of the individual options for the parameter - Option 1 - Option 2 - Option 3 ⁽⁺⁾  ⁽⁺⁾ = Factory setting depends on country, order options or device settings User entry Specific value or input range of the parameter	Page number information and cross-reference to the standard parameter description

NOTICE

If non-volatile device parameters are modified via the MODBUS RS485 function codes 06, 16 or 23, the change is saved in the EEPROM of the measuring instrument.

The number of writes to the EEPROM is technically restricted to a maximum of 1 million.

- Make sure to comply with this limit since, if it is exceeded, data loss and measuring instrument failure will result.
- Avoid constantly writing non-volatile device parameters via the MODBUS RS485.

Address model

The ModbusRS485 addresses of the measuring instrument are implemented in accordance with the "Modbus Applications Protocol Specification V1.1".

In addition, systems are also used that operate with the register address model described in the "Modicon Modbus Protocol Reference Guide (PI-MBUS-300 Rev. J)".

Depending on the function code used, a number is added at the start of the register address with this specification:

- "3" → "Read" access
- "4" → "Write" access

Function code	Access type	Register in accordance with "Modbus Applications Protocol Specification"	Register in accordance with "Modicon Modbus Protocol Reference Guide"
03 04 23 43/14	Read	XXXX Example: mass flow = 2007	3XXXX Example: mass flow = 32007
06 16 23	Write	XXXX Example: reset totalizer = 6401	4XXXX Example: reset totalizer = 46401

Overview of the Heartbeat operating menu

The following tables provide an overview of the structure of the Heartbeat Technology operating menu along with the parameters. The page reference indicates where the associated description of the submenu or parameter can be found.

"Heartbeat setup" submenu

Navigation

"Setup" menu → Advanced setup → Heartbeat setup

▶ Heartbeat setup	
▶ Heartbeat Monitoring	→ 192
Activate monitoring	→ 192
HBSI cycle time	→ 192

Register information

"Heartbeat Monitoring" submenu

Navigation: Heartbeat setup → Heartbeat Monitoring					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 192
Activate monitoring	2088	Integer	Read / Write	0 = Off 2 = Time-controlled HBSI 3 = Continuous HBSI	187
HBSI cycle time	28625 to 28626	Float	Read / Write	0.5 to 4 320 h	187

"Heartbeat Technology" submenu

Navigation

"Diagnostics" menu → Heartbeat Technology

▶ Heartbeat Technology	
▶ Performing verification	→ 194
Year	→ 194
Month	→ 194
Day	→ 194
Hour	→ 194
AM/PM	→ 194
Minute	→ 194

Verification mode	→  194
External device information	→  194
Start verification	→  194
Progress	→  194
Measured values	→  194
Output values	→  194
Status	→  194
Verification result	→  194
► Verification results	→  195
Date/time (manually entered)	→  195
Verification ID	→  195
Operating time	→  195
Verification result	→  195
Sensor	→  195
Sensor electronic module (ISEM)	→  195
I/O module	→  195
System status	→  195
► Monitoring results	→  195
HBSI	→  195
HBSI value reliability	→  195

Register information

"Performing verification" wizard

Navigation: Heartbeat Technology → Performing verification					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 
Year	2495	Integer	Read / Write	9 to 99	162
Month	2494	Integer	Read / Write	0 = January 1 = February 2 = March 3 = April 4 = May 5 = June 6 = July 7 = August 8 = September 9 = October 10 = November 11 = December	162
Day	2493	Integer	Read / Write	1 to 31 d	163
Hour	2492	Integer	Read / Write	0 to 23 h	163
AM/PM	2496	Integer	Read / Write	0 = AM 1 = PM	163
Minute	2467	Integer	Read / Write	0 to 59 min	163
Verification mode	2366	Integer	Read / Write	0 = Standard verification 1 = Extended verification	163
External device information	20493 to 20508	String	Read / Write	Free text entry	163
Start verification	2270	Integer	Read / Write	0 = Cancel 1 = Start 10 = Output 1 low value * 11 = Output 1 high value * 12 = Output 2 low value * 13 = Output 2 high value * 14 = Output 3 low value * 15 = Output 3 high value * 16 = Output 4 low value * 17 = Output 4 high value * 20 = Pulse output 1 * 21 = Frequency output 1 * 22 = Pulse output 2 * 23 = Frequency output 2 * 24 = Double pulse output * 25 = Frequency output 3 *	164
Progress	6797	Integer	Read	0 to 100 %	118
Measured values	5512 to 5513	Float	Read / Write	Signed floating-point number	164
Output values	5516 to 5517	Float	Read	Signed floating-point number	164
Status	2079	Integer	Read	0 = Failed 1 = Done 3 = Not done 8 = Busy	165
Verification result	2355	Integer	Read	0 = Failed 2 = Passed 3 = Not done 250 = Not supported	165

* Visibility depends on order options or device settings

"Verification results" submenu

Navigation: Heartbeat Technology → Verification results					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 
Date/time (manually entered)	2372 to 2381	String	Read	dd.mmmm.yyyy; hh:mm	178
Verification ID	2315	Integer	Read	0 to 65 535	178
Operating time	3346	String	Read	Days (d), hours (h), minutes (m), seconds (s)	178
Verification result	2355	Integer	Read	0 = Failed 2 = Passed 3 = Not done 250 = Not supported	165
Sensor	2384	Integer	Read	0 = Failed 2 = Passed 3 = Not done 250 = Not supported	178
Sensor electronic module (ISEM)	2385	Integer	Read	0 = Failed 2 = Passed 3 = Not done 250 = Not supported	178
I/O module	2386	Integer	Read	0 = Failed 2 = Passed 3 = Not done 250 = Not supported 254 = Not plugged	178
System status	5790	Integer	Read	0 = Failed 2 = Passed 3 = Not done 250 = Not supported	178

"Monitoring results" submenu

Navigation: Heartbeat Technology → Monitoring results					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 
HBSI	2358 to 2359	Float	Read	Signed floating-point number	187
HBSI value reliability	34882	Integer	Read	0 = Bad 64 = Uncertain 128 = Good	187

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Fault	Possible causes	Remedial action
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display dark and no output signals	Supply voltage does not match the voltage specified on the nameplate.	Apply the correct supply voltage → 36.
Local display dark and no output signals	Supply voltage has incorrect polarity.	Reverse polarity of supply voltage.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the electrical contact between the cable and terminals 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 → 219.
Local display dark and no output signals	The connector between the main electronics module and display module is not plugged in correctly.	Check the connection and correct if necessary.
Local display cannot be read, but signal output is within the valid range	Display is set too bright or too dark.	- Set the display brighter by simultaneously pressing $\boxplus$ + $\boxminus$. - Set the display darker by simultaneously pressing $\boxminus$ + $\boxplus$.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 219.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial actions → 206
Text on local display appears in a language that cannot be understood.	The selected operating language cannot be understood.	- Press $\boxminus$ + $\boxplus$ for 2 s ("home position"). - Press $\boxminus$. - Configure the required 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 → 219.

For output signals

Fault	Possible causes	Remedial action
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 219.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Parameter configuration error	Check and adjust parameter configuration.
Device is measuring incorrectly.	Configuration error or device is operated outside the application.	- Check and correct parameter configuration. - Observe limit values specified in the "Technical Data".

For access

Fault	Possible causes	Remedial action
Write access to parameters is not possible.	Hardware write protection is enabled.	Set the write protection switch on the main electronics module to the OFF position → 138.
Write access to parameters is not possible.	Current user role has limited access authorization.	1. Check user role → 58. 2. Enter correct customer-specific access code → 58.
Connection via Modbus RS485 is not possible.	Modbus RS485 bus cable is connected incorrectly.	Check the terminal assignment → 32.
Connection via Modbus RS485 is not possible.	Modbus RS485 cable is incorrectly terminated.	Check the terminating resistor → 41.
Connection via Modbus RS485 is not possible.	Settings for the communication interface are incorrect.	Check the Modbus RS485 configuration → 82.
Connection to the web server is not possible.	Web server is disabled.	Use the "FieldCare" or "DeviceCare" operating tool to check if the web server of the device is enabled and enable if necessary → 65.
	The Ethernet interface on the PC is incorrectly configured.	▶ Check the properties of the Internet protocol (TCP/IP) → 61. ▶ Check the network settings with the IT manager.
Connection to the web server is not possible.	The IP address on the PC is incorrectly configured.	Check the IP address: 192.168.1.212 → 61
Connection to the web server is not possible.	WLAN access data are incorrect.	■ Check WLAN network status. ■ Log on to the device again using WLAN access data. ■ Check that WLAN is enabled on the measuring instrument and operating unit → 61.
	WLAN communication is disabled.	–
Unable to connect to web server, FieldCare or DeviceCare.	WLAN network is not 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 unit outside reception range: Check network status on operating unit. ■ To improve network performance, use an external WLAN antenna.
	Parallel WLAN and Ethernet communication	■ Check network settings. ■ Temporarily enable only the WLAN as an interface.
Web browser is frozen and operation no longer possible	Data transfer is active.	Wait until data transfer or current action is finished.
	Connection lost	▶ Check cable connection and power supply. ▶ Refresh the web browser and restart if necessary.
Display of web browser content is difficult to read or incomplete.	Web browser version used is not optimal.	▶ Use correct web browser version → 60. ▶ Empty the web browser cache. ▶ Restart the web browser.
	Unsuitable view settings.	Change the font size/display ratio of the web browser.
Incomplete or no display of content in the web browser	■ JavaScript is not enabled. ■ JavaScript cannot be enabled.	▶ Enable JavaScript. ▶ Enter <code>http://XXX.XXX.X.XX/servlet/basic.html</code> as the IP address.

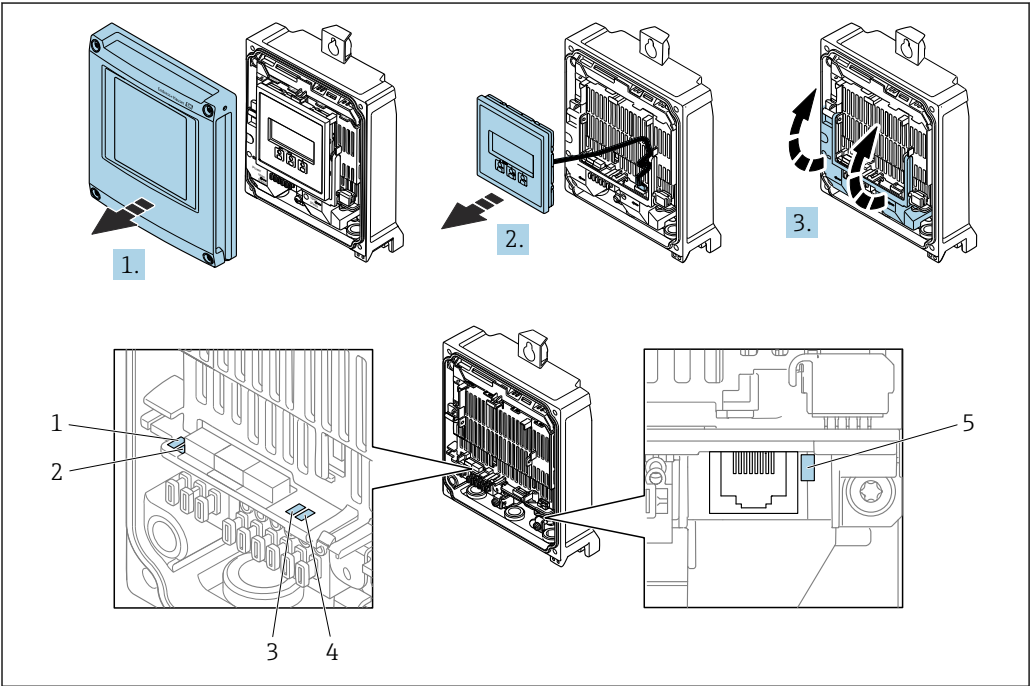
Fault	Possible causes	Remedial action
Operation with FieldCare or DeviceCare via service interface CDI-RJ45 (port 8000) is not possible.	Firewall of the PC or network is blocking communication.	Depending on the settings of the firewall used on the PC or in the network, the firewall must be adapted or disabled to allow FieldCare/ DeviceCare access.
Flashing the firmware with FieldCare or DeviceCare via service interface CDI-RJ45 (port 8000 or TFTP ports) is not possible.	Firewall of the PC or network is blocking communication.	Depending on the settings of the firewall used on the PC or in the network, the firewall must be adapted or disabled to allow FieldCare/ DeviceCare access.

12.2 Diagnostic information via LEDs

12.2.1 Transmitter

Proline 500 – digital

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



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

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

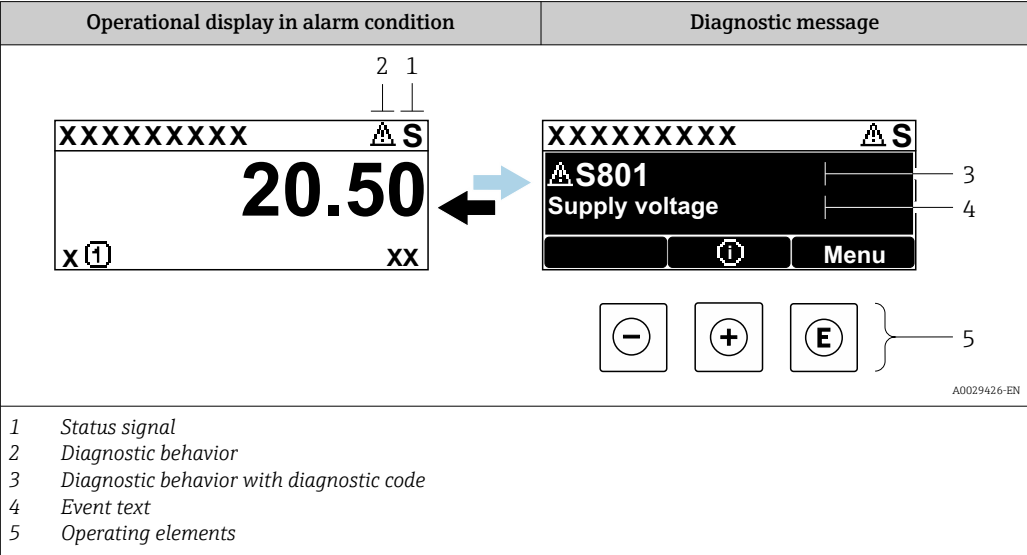
LED	Color	Meaning
1 Supply voltage	Off	Supply voltage is off or too low.
	Green	Supply voltage is OK.
2 Device status (normal operation)	Off	Firmware error
	Green	Device status is OK.

LED	Color	Meaning
	Flashing green	Device is not configured.
	Flashing red	A diagnostic event with "Warning" diagnostic behavior has occurred.
	Red	A diagnostic event with "Alarm" 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 instrument are displayed as a diagnostic message in alternation with the operational display.



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

-  Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter →  211
 - Via submenus →  211

Status signals

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

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

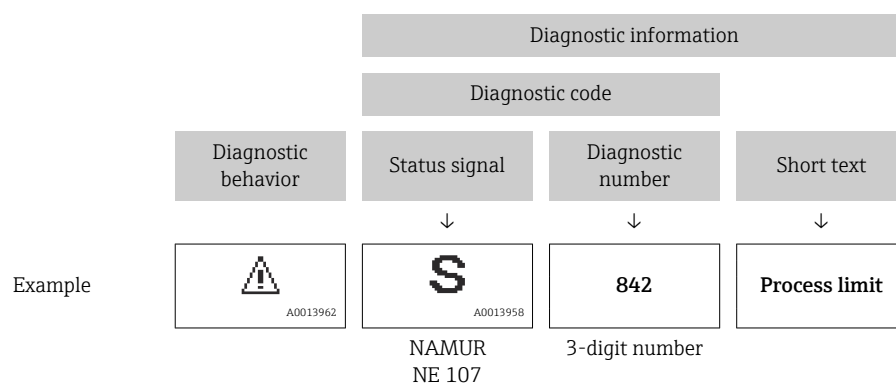
Symbol	Meaning
F	Failure A device error has occurred. The measured value is no longer valid.
C	Function check The device is in the service mode (e.g. during a simulation).
S	Out of specification The device is being operated: Outside its technical specification limits (e.g. outside the process temperature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

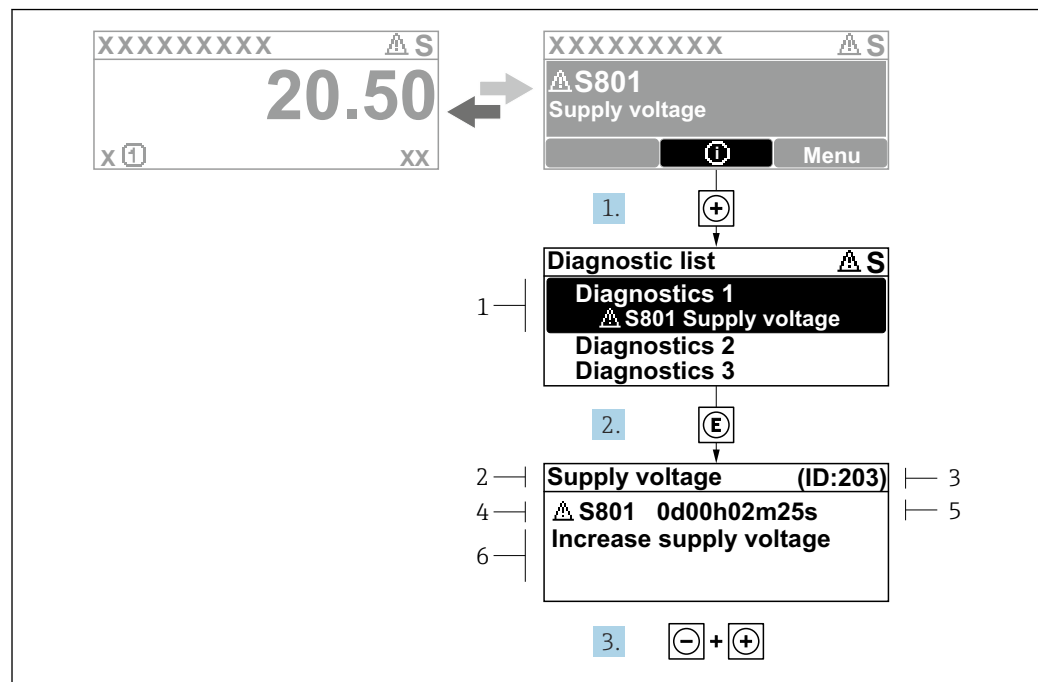
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Operating key	Meaning
	Plus key <i>In menu, submenu</i> Opens the message about the remedial measures.
	Enter key <i>In menu, submenu</i> Opens the operating menu.

12.3.2 Calling up remedial actions



A0029431-EN

33 Message for remedial actions

- 1 Diagnostic information
- 2 Event text
- 3 Service ID
- 4 Diagnostic behavior with diagnostic code
- 5 Operating time of occurrence
- 6 Remedial actions

1. The user is in the diagnostic message.
Press $\oplus$ (① symbol).
↳ The **Diagnostic list** submenu opens.
2. Select the desired diagnostic event with $\oplus$ or $\ominus$ and press $\boxplus$.
↳ The message about the remedial measures opens.
3. Press $\ominus + \oplus$ simultaneously.
↳ The message about the remedial measures closes.

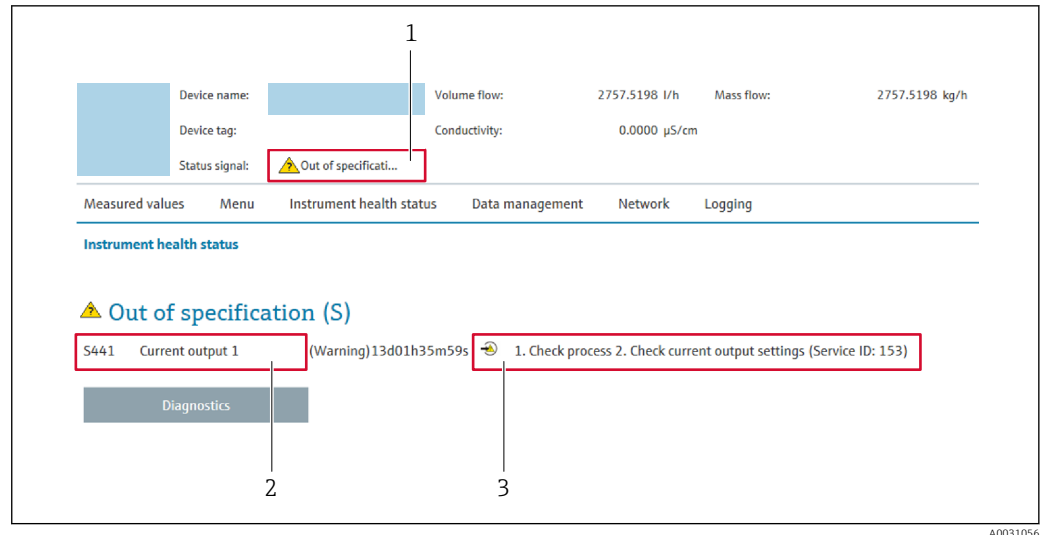
The user is in the **Diagnostics** menu in the **Diagnostic list** submenu. A list of active diagnostics is displayed. The user can select a diagnostic event.

1. Press $\boxplus$.
↳ The message for the remedial actions for the selected diagnostic event opens.
2. Press $\ominus + \oplus$ simultaneously.
↳ The message about the remedial actions 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 Remedial measures with service ID

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

- Via parameter → 211
- Via submenu → 211

Status signals

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

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

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

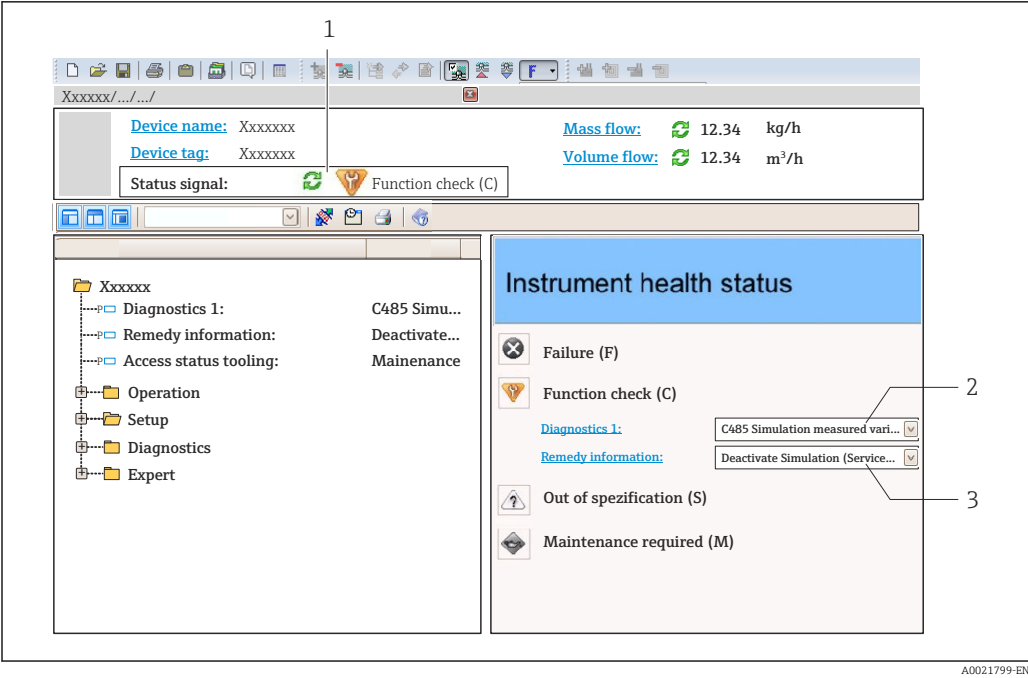
12.4.2 Calling up remedial actions

Remedial actions are provided for each diagnostic event to ensure that problems can be rectified quickly. These actions are displayed 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.



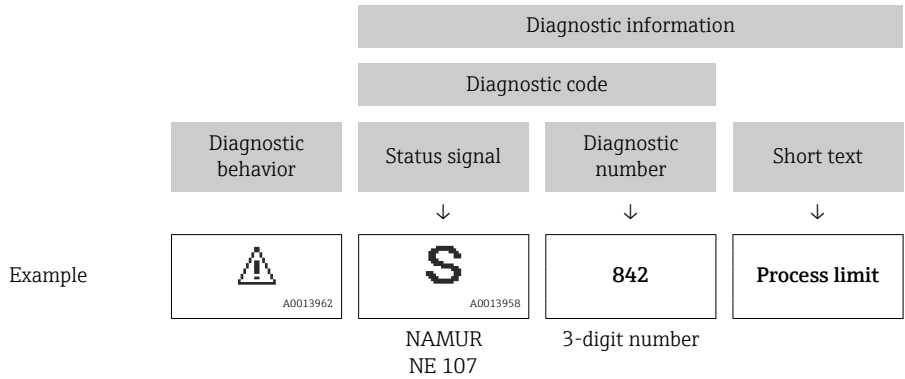
- 1 Status area with status signal → 200
- 2 Diagnostic information → 201
- 3 Remedial actions with service ID

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

- Via parameter → 211
- Via submenu → 211

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 the ModbusRS485 register addresses.

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

 For an overview of diagnostic events with diagnosis number and diagnosis code
→  206

12.6.2 Configuring error response mode

The error response mode for Modbus RS485 communication can be configured in the **Modbus configuration** submenu using 1 parameter.

Navigation path

Setup → Communication

Parameter overview with brief description

Parameter	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 only displayed in the Event logbook submenu (Event list submenu) and is not displayed in alternating sequence with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.8 Overview of diagnostic information

 In the case of some items of diagnostic information, the diagnostic behavior can be changed. Adapting the diagnostic information →  205

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
002	Sensor unknown	1. Check if the correct sensor is mounted 2. Check if the 2-D matrix code on the sensor is undamaged	F	Alarm
022	Temperature sensor defective	1. If available: Check connection cable between sensor and transmitter 2. Check or replace sensor electronic module (ISEM) 3. Replace sensor	F	Alarm
046	Sensor limit exceeded	1. Check process conditions 2. Check sensor	S	Warning ¹⁾
062	Sensor connection faulty	1. If available: Check connection cable between sensor and transmitter 2. Check or replace sensor electronic module (ISEM) 3. Replace sensor	F	Alarm
063	Exciter current faulty	1. If available: Check connection cable between sensor and transmitter 2. Check or replace sensor electronic module (ISEM) 3. Replace sensor	F	Alarm
082	Data storage inconsistent	Check module connections	F	Alarm
083	Memory content inconsistent	1. Restart device 2. Restore S-DAT data 3. Replace S-DAT	F	Alarm
119	Sensor initialization active	Sensor initialization in progress, please wait	C	Warning
140	Sensor signal asymmetrical	1. If available: Check connection cable between sensor and transmitter 2. Check or replace sensor electronic module (ISEM) 3. Replace sensor	S	Alarm ¹⁾
141	Zero adjustment failed	1. Check process conditions 2. Repeat commissioning procedure 3. Check sensor	F	Alarm
142	Sensor index coil asymmetry too high	Check sensor	S	Warning ¹⁾
144	Measurement error too high	1. Check process conditions 2. Check or change sensor	F	Alarm ¹⁾

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
242	Firmware incompatible	1. Check firmware version 2. Flash or replace electronic module	F	Alarm
252	Module incompatible	1. Check electronic modules 2. Check if correct modules are available (e.g. NEx, Ex) 3. Replace electronic modules	F	Alarm
262	Module connection interrupted	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics 2. Check or replace ISEM or main electronics	F	Alarm
270	Main electronics defective	1. Restart device 2. Replace main electronic module	F	Alarm
271	Main electronics faulty	1. Restart device 2. Replace main electronic module	F	Alarm
272	Main electronics faulty	Restart device	F	Alarm
273	Main electronics defective	1. Pay attention to display emergency operation 2. Replace main electronics	F	Alarm
275	I/O module defective	Change I/O module	F	Alarm
276	I/O module faulty	1. Restart device 2. Change I/O module	F	Alarm
283	Memory content inconsistent	Restart device	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning ¹⁾
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
304	Device verification failed	1. Check verification report 2. Repeat commissioning procedure 3. Check sensor	F	Alarm ¹⁾
311	Sensor electronics (ISEM) faulty	Maintenance required! Do not reset device	M	Warning
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
332	Writing in HistoROM backup failed	1. Replace user interface board 2. 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
369	Matrix code scanner defective	Replace matrix code scanner	F	Alarm
371	Temperature sensor defective	Contact service	M	Warning

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
374	Sensor electronics (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	S	Warning ¹⁾
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	1. If available: Check connection cable between sensor and transmitter 2. Replace main electronic module 3. Replace sensor electronic module (ISEM)	F	Alarm
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	Reset device	F	Alarm
387	HistoROM data faulty	Contact service organization	F	Alarm
Diagnostic of configuration				
410	Data transfer failed	1. Retry data transfer 2. Check connection	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 to n required	Carry out trim	M	Warning
437	Configuration incompatible	1. Update firmware 2. Execute factory reset	F	Alarm
438	Dataset different	1. Check dataset file 2. Check device parameterization 3. Download new device parameterization	M	Warning
441	Current output 1 to n saturated	1. Check current output settings 2. Check process	S	Warning ¹⁾
442	Frequency output 1 to n saturated	1. Check frequency output settings 2. Check process	S	Warning ¹⁾
443	Pulse output 1 to n saturated	1. Check pulse output settings 2. Check process	S	Warning ¹⁾
444	Current input 1 to n saturated	1. Check current input settings 2. Check connected device 3. Check process	S	Warning ¹⁾
453	Flow override active	Deactivate flow override	C	Warning
484	Failure mode simulation active	Deactivate simulation	C	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
486	Current input 1 to n simulation active	Deactivate simulation	C	Warning
491	Current output 1 to n simulation active	Deactivate simulation	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
492	Frequency output 1 to n simulation active	Deactivate simulation frequency output	C	Warning
493	Pulse output simulation active	Deactivate simulation pulse output	C	Warning
494	Switch output 1 to n simulation active	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	C	Warning
496	Status input 1 to n simulation active	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 electronic 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
528	Concentration calculation not possible	Out of valid range of the selected calculation algorithm 1. Check concentration settings 2. Check measured values, e.g. density or temperature	S	Alarm
529	Concentration calculation not accurate	Out of valid range of the selected calculation algorithm 1. Check concentration settings 2. Check measured values, e.g. density or temperature	S	Warning
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
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
543	Double pulse output	1. Check process 2. Check pulse output settings	S	Warning ¹⁾
593	Double pulse output 1 simulation	Deactivate simulation pulse output	C	Warning
594	Relay output 1 to n simulation active	Deactivate simulation switch output	C	Warning
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 ¹⁾
Diagnostic of process				
803	Loop current 1 faulty	1. Check wiring 2. Change I/O module	F	Alarm
830	Ambient temperature too high	Reduce ambient temp. around the sensor housing	S	Warning ¹⁾
831	Ambient temperature too low	Increase ambient temp. around the sensor housing	S	Warning ¹⁾
832	Electronics temperature too high	Reduce ambient temperature	S	Warning ¹⁾

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
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⁾
842	Process value below limit	Low flow cut off active! Check low flow cut off configuration	S	Warning ¹⁾
862	Partly filled pipe	1. Check for gas in process 2. Adjust detection limits	S	Warning ¹⁾
882	Input signal faulty	1. Check input signal parameterization 2. Check external device 3. Check process conditions	F	Alarm
910	Tubes not oscillating	1. If available: Check connection cable between sensor and transmitter 2. Check or replace sensor electronic module (ISEM) 3. Check sensor	F	Alarm
912	Medium inhomogeneous	1. Check process cond. 2. Increase system pressure	S	Warning ¹⁾
913	Medium unsuitable	1. Check process conditions 2. Check electronic modules or sensor	S	Warning ¹⁾
915	Viscosity out of specification	1. Avoid 2-phase flow 2. Increase system pressure 3. Verify viscosity and density are within range 4. Check process conditions	S	Warning ¹⁾
941	API/ASTM temperature out of specification	1. Check process temperature with selected API/ASTM commodity group 2. Check API/ASTM-related parameters	S	Warning ¹⁾
942	API/ASTM density out of specification	1. Check process density with selected API/ASTM commodity group 2. Check API/ASTM-related parameters	S	Warning ¹⁾
943	API pressure out of specification	1. Check process pressure with selected API commodity group 2. Check API related parameters	S	Warning ¹⁾
944	Monitoring failed	Check process conditions for Heartbeat Monitoring	S	Warning ¹⁾
948	Oscillation damping too high	Check process conditions	S	Warning ¹⁾
984	Condensation risk	1. Decrease ambient temperature 2. Increase medium temperature	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.

 Accessing the remedial action for a diagnostic event:

- Via local display →  200
- Via web browser →  202
- Via "FieldCare" operating tool →  203
- Via "DeviceCare" operating tool →  203

 Other pending diagnostic events can be displayed in the **Diagnostic list** submenu →  211.

Navigation

"Diagnostics" menu

 Diagnostics	
Actual diagnostics	→  211
Previous diagnostics	→  211
Operating time from restart	→  211
Operating time	→  211

Parameter overview with brief description

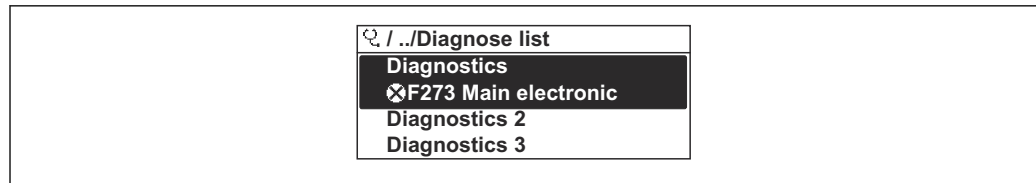
Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occurred diagnostic event along with its diagnostic information.  If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Symbol 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 are 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



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34 Using the example of the local display

i Accessing the remedial action for a diagnostic event:

- Via local display → 200
- Via web browser → 202
- Via "FieldCare" operating tool → 203
- Via "DeviceCare" operating tool → 203

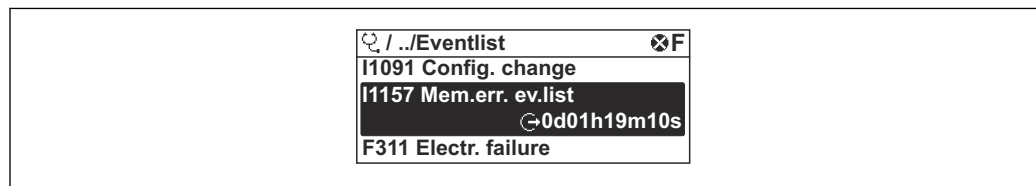
12.11 Event logbook

12.11.1 Reading out the event logbook

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

Navigation path

Diagnostics menu → **Event logbook** submenu → Event logbook



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35 Using the example of the local display

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

The event history includes entries for:

- Diagnostic events → 206
- Information events → 213

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

- Diagnostic event
 - ☹: Occurrence of the event
 - ⌚: End of the event
- Information event
 - ☹: Occurrence of the event

i Accessing the remedial action for a diagnostic event:

- Via local display → 200
- Via web browser → 202
- Via "FieldCare" operating tool → 203
- Via "DeviceCare" operating tool → 203

i Filtering the displayed event messages → 213

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
I1111	Density adjust failure
I11280	ZeroPT verified and adjustm. recommended
I11281	ZeroPT verif. and adjust. not recommend.
I1137	Electronics changed
I1151	History reset
I1155	Reset electronics temperature
I1156	Memory error trend
I1157	Memory error event list
I1209	Density adjustment ok
I1221	Zero point adjust failure
I1222	Zero point adjustment ok
I1256	Display: access status changed
I1278	I/O module restarted
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
I1447	Record application reference data
I1448	Application reference data recorded
I1449	Recording application ref. data failed

Info number	Info name
I1450	Monitoring off
I1451	Monitoring on
I1457	Measurement error verification failed
I1459	I/O module verification failed
I1460	HBSI verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1517	Custody transfer active
I1518	Custody transfer inactive
I1618	I/O module 2 replaced
I1619	I/O module 3 replaced
I1621	I/O module 4 replaced
I1622	Calibration changed
I1624	All totalizers reset
I1625	Write protection activated
I1626	Write protection deactivated
I1627	Web server: login successful
I1628	Display: login successful
I1629	CDI: login successful
I1631	Web server access changed
I1632	Display: login failed
I1633	CDI: login failed
I1634	Reset to factory settings
I1635	Reset to delivery settings
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 device

The entire device configuration or some of the configuration can be reset to a defined state with the **Device reset** parameter (→  133).

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 the customer-specific value. All other parameters are reset to the factory setting.
Restart device	The restart resets every parameter with data stored in volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restores the data that is saved on the S-DAT. Additional information: This function can be used to resolve the memory issue "083 Memory content inconsistent" or to restore the S-DAT data when a new S-DAT has been installed.  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

► Device information

Device tag

Serial number

Firmware version

Device name

Manufacturer

Order code

Extended order code 1

Extended order code 2

Extended order code 3

ENP version

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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. @, %, /).	Promass
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.	Character string comprising numbers, letters and special characters	–
Manufacturer	Displays the manufacturer.	Character string comprising numbers, letters and special characters	Endress+Hauser
Order code	Shows the device order code.	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.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code.  The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code.  The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00

12.14 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware Changes	Documentation type	Documentation
08.2022	01.06.zz	Option 58	■ New gas type: methane with hydrogen ■ Eight display values on local display ■ Zero verification and zero adjustment wizard ■ New density unit: °API ■ New diagnostic parameters ■ Additional languages for Heartbeat Technology Reports	Operating Instructions	
09.2019	01.05.zz	Option 64	■ Gas fraction handler ■ Adaptive filter, gas entrainment index ■ Application-specific input module ■ Upgrading of the petroleum application package	Operating Instructions	

 It is possible to flash the firmware to the current version or an existing previous version via the service interface. For the compatibility of the firmware version, see the "Device history and compatibility" section

 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. 85B
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 work

No special maintenance work is required.

13.1.1 Cleaning

Cleaning of surfaces not in contact with the medium

1. Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
2. Do not use sharp objects or aggressive cleaning agents that could damage surfaces (e.g. displays, housing) and seals.
3. Do not use high-pressure steam.
4. Ensure compliance with the protection class of the device.

NOTICE

Cleaning agents can damage the surfaces!

Incorrect cleaning agents can damage the surfaces!

- ▶ Do not use cleaning agents containing concentrated mineral acids, alkalis or organic solvents e.g. benzyl alcohol, methylene chloride, xylene, concentrated glycerol cleaners or acetone.

Cleaning of surfaces in contact with the medium

Note the following for cleaning and sterilization in place (CIP/SIP):

- Use only cleaning agents to which the materials in contact with the medium are sufficiently resistant.
- Observe the permitted maximum medium temperature.

13.2 Measuring and test equipment

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

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

List of some of the measuring and testing equipment: →  222

13.3 Maintenance services

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

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

14 Repair

14.1 General notes

14.1.1 Repair and conversion concept

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

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

14.1.2 Notes for repair and conversion

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

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

14.2 Spare parts

Device Viewer (www.endress.com/deviceviewer):

All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.



Measuring device serial number:

- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→  216) in the **Device information** submenu.

14.3 Repair services

Endress+Hauser offers a wide range of services.



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

14.4 Return

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

1. Refer to the web page for information: <https://www.endress.com>
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

14.5 Disposal



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

14.5.1 Removing the measuring instrument

1. Switch off the device.

WARNING

Danger to persons from process conditions!

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

2. Carry out the installation and connection steps from the "Installing the device" and "Connecting the device" sections in reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring instrument

WARNING

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

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

Observe the following notes during disposal:

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

14.5.3 Disposal of single-use measuring tube

Observe the following notes during disposal:

- ▶ Depending on the medium: autoclaving or incineration.
- ▶ Recycle steel part after autoclaving or incineration.

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

Accessory	Description
Transmitter Proline 500 – digital	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software  Proline 500 – digital transmitter: Order number: 8X5BXX-*****A  Proline 500 – digital transmitter: Installation Instructions EA01151D
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 →  68.  Order number: 71351317  Installation Instructions EA01238D
Connecting cable Proline 500 – digital Sensor – Transmitter	The connecting cable can be ordered directly with the measuring instrument (order code for "Cable, sensor connection") or as an accessory (order number DK8012). The following cable lengths are available: order code for "Cable, sensor connection" ▪ Option C: 2 m (6 ft) ▪ Option J: 5 m (15 ft) ▪ Option L: 10 m (30 ft)  Maximum possible cable length for a Proline 500 – digital connecting cable: 300 m (1 000 ft)

15.1.2 For the sensor

Accessories	Description
Disposable measuring tube	 Order number: ▪ DN 1/8": DK8014-04SBOAADA2 ▪ DN 1/4": DK8014-06SBOABFA2 ▪ DN 1/2": DK8014-15SBOACFA2 ▪ DN 1": DK8014-25SBOADFA2

15.2 Service-specific accessories

Accessory	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring instruments: ▪ Choice of measuring instruments for industrial requirements ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and measurement accuracy. ▪ Graphic display of the calculation results ▪ Determining the partial order code. Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator
Netilion	IIoT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem, Endress+Hauser allows you to optimize your plant performance, digitize workflows, share knowledge, and enhance collaboration. Based on decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem that enables you to gain useful insights from data. These insights can be used to optimize processes, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.  Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices.  ▪ Technical Information: TI01134S ▪ Innovation brochure: IN01047S

16 Technical data

16.1 Application

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	Mass flow measurement based on the Coriolis measuring principle
Measuring system	The measuring system consists of a transmitter, a sensor and a disposable measuring tube. ■ The device is available for front panel mounting: The transmitter and sensor are mounted in physically separate locations and are connected via connecting cables. ■ The device is available in a table-top version: The transmitter and sensor form a mechanical unit. For information on the structure of the measuring instrument →  13

16.3 Input

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured variables

- Volume flow
- Corrected volume flow
- Reference density

Measuring range

Measuring range for liquids

Full scale value defined at 0.2 bar pressure loss.

DN		Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[in]	[kg/min]	[lb/min]
4	$\frac{1}{8}$	0 to 2	0 to 4.4
6	$\frac{1}{4}$	0 to 4.8	0 to 10.6
15	$\frac{1}{2}$	0 to 28.6	0 to 63.1
25	1	0 to 75	0 to 165.3

Recommended measuring range

 Flow limit →  237

Operable flow range

Over 1000 : 1.

Flow rates above the preset full scale value do not override the electronics unit, with the result that the totalizer values are registered correctly.

Input signal

External measured values

To increase the measurement accuracy of certain measured variables, the automation system can continuously write various measured values to the measuring instrument:

- pressure to increase measurement accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase measurement accuracy

Current input

The measured values are written from the automation system to the measuring device via the current input →  224.

Digital communication

The measured values are written by the automation system 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 μ A
Voltage drop	Typically: 0.6 to 2 V for 3.6 to 22 mA (passive)
Maximum input voltage	$\leq$ 30 V (passive)
Open-circuit voltage	$\leq$ 28.8 V (active)
Possible input variables	■ Pressure ■ Temperature ■ Density

Status input

Maximum input values	■ DC -3 to 30 V ■ If status input is active (ON): $R_i > 3 \text{ k}\Omega$
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 range	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 μ A
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  The range of options increases if the measuring device has one or more application packages.

Pulse/frequency/switch output

Function	Can be configured as pulse, frequency or switch output
Version	Open collector Can be set to: ■ Active ■ Passive ■ Passive NAMUR  Ex-i, passive
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: $\leq$ 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	Configurable
Assignable measured variables	■ Mass flow ■ Volume flow ■ Corrected volume flow  The range of options increases if the measuring device has one or more application packages.
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	Configurable: 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	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Electronics temperature ■ Oscillation frequency 0 ■ Oscillation damping 0 ■ Signal asymmetry ■ Exciter current 0  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	■ Disable ■ On ■ Diagnostic behavior ■ Limit ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Totalizer 1-3 ■ Flow direction monitoring ■ Status ■ Partially filled pipe detection ■ 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	■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature  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	■ Disable ■ On ■ Diagnostic behavior ■ Limit ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Totalizer 1-3 ■ Flow direction monitoring ■ Status ■ Partially filled pipe detection ■ 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

Current output 4-20 mA	
Failure mode	Configurable: ■ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ■ 4 to 20 mA in accordance with US ■ Min. value: 3.59 mA ■ Max. value: 22.5 mA ■ Definable value between: 3.59 to 22.5 mA ■ Actual value ■ Last valid value
Current output 4-20 mA	
Failure mode	Configurable: ■ Maximum alarm: 22 mA ■ Definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Configurable: ■ Actual value ■ No pulses
Frequency output	
Failure mode	Configurable: ■ Actual value ■ 0 Hz ■ Definable value between: 2 to 12 500 Hz
Switch output	
Failure mode	Configurable: ■ 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 lighting indicates a device error.

 Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
Modbus RS485
- Via service interface
 - Service interface CDI-RJ45
 - WLAN interface
- Plain text display
With information on cause and remedial actions

Web browser

Plain text display	With information on cause and remedial measures
--------------------	---

LEDs

Status information	Status indicated by various LEDs The following information is displayed depending on the device version: ■ Supply voltage active ■ Data transmission active ■ Device alarm/error has occurred  Diagnostic information via LEDs →  198
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Low flow cut off The switch points for low flow cut off are user-selectable.

Galvanic isolation The outputs are galvanically isolated:

- from the power supply
- from one another
- from the protective ground connection (PE)

Protocol-specific data	Protocol	Modbus Applications Protocol Specification V1.1
	Response times	■ Direct data access: typically 25 to 50 ms ■ Auto-scan buffer (data range): typically 3 to 5 ms
	Device type	Slave
	Slave address range	1 to 247
	Broadcast address range	0
	Function codes	■ 03: Read holding register ■ 04: Read input register ■ 06: Write single registers ■ 08: Diagnostics ■ 16: Write multiple registers ■ 23: Read/write multiple registers

Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transmission mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485.  For Modbus register information
System integration	Information regarding system integration →  72. ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

16.5 Power supply

Terminal assignment →  32

Supply voltage	Order code for "Power supply"		Terminal voltage	Frequency range
	Option I		DC 24 V	±20%
			AC 100 to 240 V	–15 to 10%
				50/60 Hz

Power consumption **Transmitter**
Max. 10 W (active power)

switch-on current	Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21
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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 memory or in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Overcurrent protection element
The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own.

- The circuit breaker must be easy to reach and labeled accordingly.
- Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.

Electrical connection →  34

Potential equalization →  37

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

Cable specification →  30

Overvoltage protection	Mains voltage fluctuations	→  231
	Overvoltage category	Overvoltage category II
	Short-term, temporary overvoltage	Between cable and ground up to 1200 V, for max. 5 s
	Long-term, temporary overvoltage	Between cable and ground up to 500 V

16.6 Performance characteristics

Reference operating conditions

- Error limits based on ISO 11631
- Water
 - +15 to +45 °C (+59 to +113 °F)
 - 2 to 6 bar (29 to 87 psi)
- Data as indicated in the calibration protocol
- Accuracy based on accredited calibration rigs according to ISO 17025

 To obtain measured errors, use the *Applicator* sizing tool →  222

Maximum measurement error

o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature

 In non-condensing environment.

Base accuracy

 Design fundamentals →  234

Mass flow and volume flow (liquids)

±0.5 % o.r.

Temperature

±2.5 °C (±4.5 °F)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/min]	[lb/min]
4	$\frac{1}{8}$	0.0006	0.00132
6	$\frac{1}{4}$	0.0023	0.00507
15	$\frac{1}{2}$	0.0082	0.01808
25	1	0.0227	0.05004

Flow values

Flow values as turndown parameters depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
4	450	45	22.5	9	4.5	0.9
6	1000	100	50	20	10	2
15	6 500	650	325	130	65	13
25	18 000	1 800	900	360	180	36

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[inch]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
$\frac{1}{8}$	16.54	1.654	0.827	0.331	0.165	0.033
$\frac{1}{4}$	36.75	3.675	1.838	0.735	0.368	0.074
$\frac{1}{2}$	238.9	23.89	11.95	4.778	2.389	0.478
1	661.5	66.15	33.08	13.23	6.615	1.323

Accuracy of outputs

The outputs have the following base accuracy specifications:

Current output

Accuracy	$\pm 5 \mu\text{A}$
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Pulse/frequency output

o.r. = of reading

Accuracy	Max. $\pm 50 \text{ ppm}$ o.r. (over the entire ambient temperature range)
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Repeatability

o.r. = of reading; $1 \text{ g/cm}^3 = 1 \text{ kg/l}$; T = medium temperature

Base repeatability

Design fundamentals → 234

Mass flow and volume flow (liquids)

±0.25 % o.r.

Density (liquids)

- Basic accuracy:
±0.01 g/cm³
- Repeatability:
±0.005 g/cm³

Temperature

±0.125 °C (±0.225 °F)

Response time	The response time depends on the configuration (damping).				
Influence of ambient temperature	Current output <table border="1"> <tr> <td>Temperature coefficient</td><td>Max. 1 µA/°C</td></tr> </table> Pulse/frequency output <table border="1"> <tr> <td>Temperature coefficient</td><td>No additional effect. Included in accuracy.</td></tr> </table>	Temperature coefficient	Max. 1 µA/°C	Temperature coefficient	No additional effect. Included in accuracy.
Temperature coefficient	Max. 1 µA/°C				
Temperature coefficient	No additional effect. Included in accuracy.				
Influence of medium temperature	Mass flow o.f.s. = of full scale value If there is a difference between the temperature during zero adjustment and the process temperature, the additional measurement error of the sensors is typically ±0.0002 %o.f.s./°C (±0.0001 % o. f.s./°F). The influence is reduced when the zero adjustment is performed at process temperature. Density Density performance is identical across the entire temperature range. Temperature ±0.005 · T °C (± 0.005 · (T – 32) °F)				
Influence of medium pressure	A difference between the calibration pressure and process pressure does not affect measurement accuracy.  A pressure of >0.2 bar is required for an accurate measurement. Pressures lower than this can lead to incorrect measurement results due to cavitation and the formation of air bubbles.				
Design fundamentals	o.r. = of reading, o.f.s. = of full scale value BaseAccu = base accuracy in % o.r., BaseRepeat = base repeatability in % o.r. MeasValue = measured value; ZeroPoint = zero point stability				

Calculation of the maximum measured error as a function of the flow rate

Flow rate	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021332	$\pm \text{BaseAccu}$ A0021339
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021333	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021334

Calculation of the maximum repeatability as a function of the flow rate

Flow rate	Maximum repeatability in % o.r.
$\geq \frac{\frac{1}{2} \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021335	$\pm \text{BaseRepeat}$ A0021340
$< \frac{\frac{1}{2} \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021336	$\pm \frac{1}{2} \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021337

16.7 Installation

Installation requirements →  21

16.8 Environment

Ambient temperature range →  22

Storage temperature −40 to +70 °C (−40 to +158 °F)

Climate class DIN EN 60068-2-38 (test Z/AD)

Relative humidity The device is suitable for use in indoor areas with a relative humidity of 5 to 40%.

Operating height According to EN 61010-1
≤ 2 000 m (6 562 ft)

Degree of protection

Transmitter

- IP66/67, Type 4X enclosure, suitable for pollution degree 4
- When the housing is open: IP20, Type 1 enclosure, suitable for pollution degree 2
- Display module: IP20, Type 1 enclosure, suitable for pollution degree 2

Sensor

- IP54
- When the housing is open: IP20

External WLAN antenna

IP66/67, type 4X enclosure

Vibration resistance and shock resistance**Sinusoidal vibration similar to IEC 60068-2-6**

Sensor

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

Transmitter

- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

Broadband random vibration similar to IEC 60068-2-64

Sensor

- 10 to 200 Hz, 0.003 g²/Hz
- 200 to 2 000 Hz, 0.001 g²/Hz
- Total: 1.54 g rms

Transmitter

- 10 to 200 Hz, 0.01 g²/Hz
- 200 to 2 000 Hz, 0.003 g²/Hz
- Total: 2.70 g rms

Half-sine shocks similar to IEC 60068-2-27

- Sensor
6 ms 30 g
- Transmitter
6 ms 50 g

Rough handling shocks similar to IEC 60068-2-31**Mechanical load**

- Transmitter housing, sensor and disposable measuring tube:
- Protect against mechanical effects, such as shock or impact
 - Do not use as a ladder or climbing aid

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21), NAMUR Recommendation 21 (NE 21) is fulfilled when the device is installed in accordance with NAMUR Recommendation 98 (NE 98).
- As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4



Details are provided in the Declaration of Conformity.



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

16.9 Process**Medium temperature range**

3 to 60 °C (37.4 to 140 °F)

Medium density800 to 1 500 kg/m³ (1 764 to 3 307 lb/cf)**Medium pressure**

6 bar (87 psi)

Flow limit	Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.  For an overview of the full scale values for the measuring range, see the "Measuring range" section →  224 ■ The minimum recommended full scale value is approx. 1/20 of the maximum full scale value ■ For the most common applications, 20 to 50 % of the maximum full scale value can be considered ideal ■ A low full scale value must be selected for abrasive media (such as liquids with entrained solids): flow velocity < 1 m/s (< 3 ft/s).  To calculate the flow limit, use the <i>Applicator</i> sizing tool →  222
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Pressure loss	 To calculate the pressure loss, use the <i>Applicator</i> sizing tool →  222
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16.10 Mechanical construction

Design, dimensions	 For the dimensions and installed lengths of the device, see the "Technical Information" document, "Mechanical construction" section
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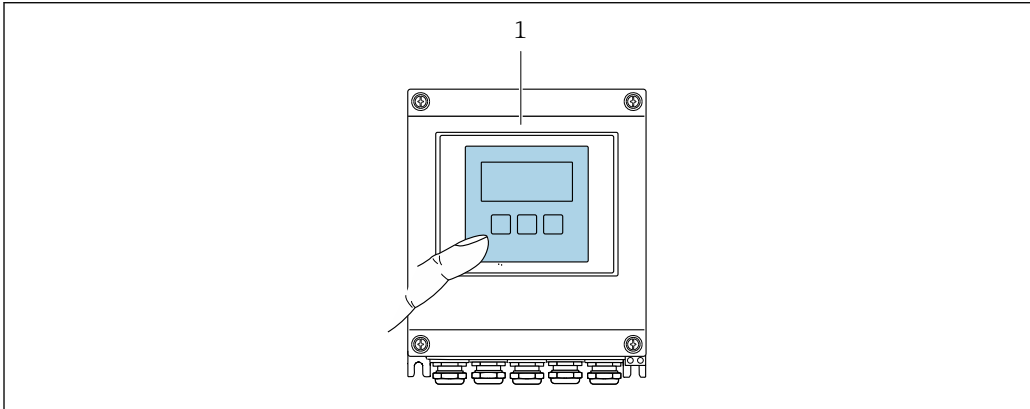
Process connections	Hose connection nipple: Covestro Makrolon RX1805 PC
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Surface roughness	All data relate to parts in contact with medium. The following surface roughness categories can be ordered: ■ Steel: Ra ≤ 1.6 μm (63 μin)⁵⁾ ■ Plastic: Ra ≤ 0.76 μm (30 μin)
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16.11 User interface

Languages	Can be operated in the following languages: ■ Via local operation English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Vietnamese, Czech, Swedish ■ Via web browser English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Vietnamese, Czech, Swedish ■ Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese
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5) Ra according to ISO 21920

Onsite operation	Via display module Equipment level: ■ 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 →  68  A0037255  36 <i>Operation with touch control</i> 1 <i>Proline 500 – digital</i> <i>Display elements</i> ■ 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 <i>Operating elements</i> External operation via touch control (3 optical keys) without opening the housing: , , 												
Remote operation	→  67												
Service interface	→  67												
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. <table><tr><th>Supported operating tools</th><th>Operating unit</th><th>Interface</th><th>Additional information</th></tr><tr><td>Web browser</td><td>Notebook, PC or tablet with web browser</td><td> ■ Service interface CDI-RJ45 ■ WLAN interface </td><td>Special Documentation for device → 244</td></tr><tr><td>DeviceCare SFE100</td><td>Notebook, PC or tablet with Microsoft Windows system</td><td> ■ Service interface CDI-RJ45 ■ WLAN interface ■ Fieldbus protocol </td><td>→ 222</td></tr></table>	Supported operating tools	Operating unit	Interface	Additional information	Web browser	Notebook, PC or tablet with web browser	■ Service interface CDI-RJ45 ■ WLAN interface	Special Documentation for device → 244	DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	■ Service interface CDI-RJ45 ■ WLAN interface ■ Fieldbus protocol	→ 222
Supported operating tools	Operating unit	Interface	Additional information										
Web browser	Notebook, PC or tablet with web browser	■ Service interface CDI-RJ45 ■ WLAN interface	Special Documentation for device → 244										
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	■ Service interface CDI-RJ45 ■ WLAN interface ■ Fieldbus protocol	→ 222										

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	- Service interface CDI-RJ45 - WLAN interface - Fieldbus protocol	→  222
Field Xpert	SMT70/77/50	- All fieldbus protocols - WLAN interface - Bluetooth - Service interface CDI-RJ45	Operating Instructions BA01202S Device description files: Use update function of handheld terminal

 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:

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

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

Web server

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

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 measuring instrument:

- Upload the configuration from the measuring instrument (XML format, configuration backup)
- Save the configuration to the measuring instrument (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 Technology verification report (PDF file, only available with the **Heartbeat Verification** application package)
- Flash firmware version for device firmware upgrade, for example
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package)

HistoROM data management

The measuring instrument 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, e.g. diagnostic events ■ Parameter data record backup ■ Device firmware package	■ Measured value logging ("Extended HistoROM" order option) ■ Current parameter data record (used by firmware at run time) ■ Indicator (minimum/maximum values) ■ Totalizer value	■ Sensor data: e.g. nominal diameter ■ Serial number ■ Calibration data ■ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface PC board in the connection compartment	Can be plugged into the user interface PC board in the connection compartment	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 transmission

Manual

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

Event list

Automatic

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

Data logging**Manual**

If the **Extended HistoROM** application package (order option) is enabled:

- Recording of 1 to 4 channels of up to 1 000 measured values (up to 250 measured values per channel)
- User configurable recording interval
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

16.12 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

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

CE mark	The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
UKCA marking	The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark. Contact address Endress+Hauser UK: Endress+Hauser Ltd. Floats Road Manchester M23 9NF United Kingdom www.uk.endress.com
RCM marking	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Material certificate	■ Bioburden ■ Inorganic and organic residues ■ Cytotoxicity growth inhibition ■ Sensitization ■ Systemic toxicity ■ GC/MS fingerprints a. extraction ■ Physico-chemical resistance ■ Biocompatibility of plastics ■ Hemolysis ■ ISO Class 7 clean room ■ Medical devices QM ■ Conformities ■ Ingredients for rubber parts ■ Ingredients for plastic parts ■ Medical packaging

- Gamma radiation
- O-ring standard
- FDA



A comprehensive listing of the serial number-specific disposable measuring tube can be found in the certificate of conformity for single-use requirements in the biopharmaceutical industry.

Radio approval

The measuring instrument has radio approval.



For detailed information on the radio approval, see the Special Documentation
→ 244

Additional certification

CRN approval

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device.

Tests and certificates

Pressure test, internal process, test report (order code for "Test, certificate", option JB)

External standards and guidelines

- EN 60529
Degrees of protection provided by enclosure (IP code)
- IEC/EN 60068-2-6
Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal).
- IEC/EN 60068-2-31
Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices.
- EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- GB 30439.5
Safety requirements for industrial automation products - Part 5: Flowmeter safety requirements
- EN 61326-1/-2-3
EMC requirements for electrical equipment for measurement, control and laboratory use
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 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 diagnostics of field devices
- NAMUR NE 131
Requirements for field devices for standard applications
- NAMUR NE 132
Coriolis mass meter

- ETSI EN 300 328
Guidelines for 2.4 GHz radio components.
- EN 301489
Electromagnetic compatibility and radio spectrum matters (ERM).
- Animal Free (ADI)

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 → 244

16.14 Accessories



Overview of accessories available to order → 221

16.15 Documentation



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

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

Standard documentation **Brief Operating Instructions**

Brief Operating Instructions for the sensor

Measuring instrument	Documentation code
Proline Promass U	KA01686D

Brief operating instructions for transmitter

Measuring instrument	Documentation code
Proline 500 – digital	KA01319D
Proline 500	KA01318D

Technical information

Measuring instrument	Documentation code
Promass U 500	TI01783D

Description of Device Parameters

Measuring instrument	Documentation code
Promass 500	GP01062D

Device-dependent
additional documentation

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
Web server	SD01667D
Gas fraction handler	SD02584D
Modbus TCP system integration	SD03383D

Installation Instructions

Contents	Note
Installation instructions for spare part sets and accessories	▪ Access the overview of all the available spare part sets via <i>Device Viewer</i> → 📖 219 ▪ Accessories available for order with Installation Instructions → 📖 221

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