BA02343D/06/EN/01.24-00
71642634
2024-05-17

Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Proline Promass U 500

Coriolis flowmeter
PROFINET with Ethernet-APL/SPE

Endress+Hauser
People for Process Automation

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

Table of contents

1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

1.2.2 Electrical symbols

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

1.2.3 Communication-specific symbols

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

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

1.2.4 Tool symbols

Symbol	Meaning
	Torx screwdriver
	Phillips head screwdriver
	Open-ended wrench

1.2.5 Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
▶	Notice or individual step to be observed
1., 2., 3.…	Series of steps
↳	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.6 Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1., 2., 3., …	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
≈➡	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

Ethernet-APL™
Registered trademark of the PROFIBUS Nutzerorganisation e.V. (PROFIBUS User Organization), Karlsruhe, Germany

2 Safety instructions

2.1 Requirements for the personnel

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

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

The operating personnel must fulfill the following requirements:

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

2.2 Intended use

Application and media

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

To ensure that the measuring device remains in proper condition for the operation time:

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

Incorrect use

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

⚠ WARNING

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

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

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

When working on and with the device:
- ▶ Wear the required personal protective equipment as per national regulations.

2.4 Operational safety

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

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!
- ▶ If modifications are nevertheless required, consult with the manufacturer.

Repair

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

2.5 Product safety

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

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

2.6 IT security

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

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

2.7 Device-specific IT security

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

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

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

2.7.1 Protecting access via hardware write protection

Write access to the parameters of the device via the local display, 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 → 🗎 155.

2.7.2 Protecting access via a password

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

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

User-specific access code

Write access to the device parameters via the local display, web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 🗎 154).

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

WLAN passphrase: Operation as WLAN access point

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface (→ 🗎 69), 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 (→ 🗎 146).

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 safety reasons.
- Follow the general rules for generating a secure password when defining and managing the access code and network key.
- The user is responsible for the management and careful handling of the access code and network key.
- For information on configuring the access code or on what to do if you lose the password, for example, see "Write protection via access code" → 🗎 154.

2.7.3 Access via web server

The device can be operated and configured via a web browser with the integrated web server. The connection is established via the service interface (CDI-RJ45), the terminal connection for signal transmission with PROFINET with Ethernet-APL /SPE (IO1) or WLAN interface.

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

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

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

2.7.4 Access via service interface (CDI-RJ45)

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

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

3 Product description

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

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

3.1 Product design

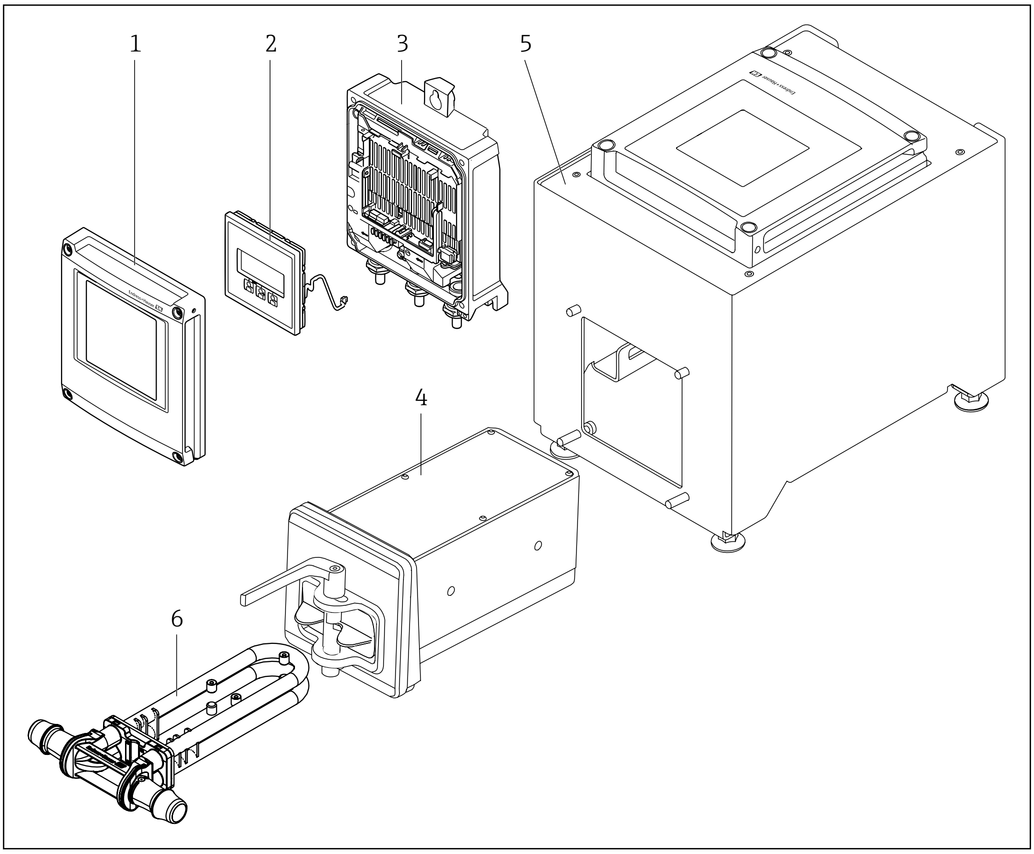
3.1.1 Proline 500 – digital

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.

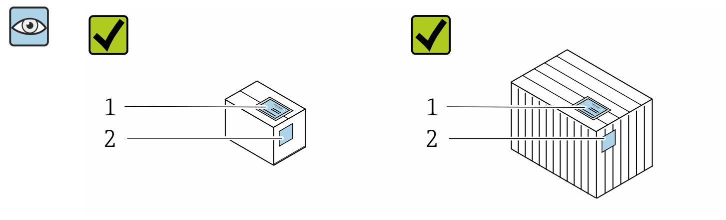


1 Important components of a measuring device

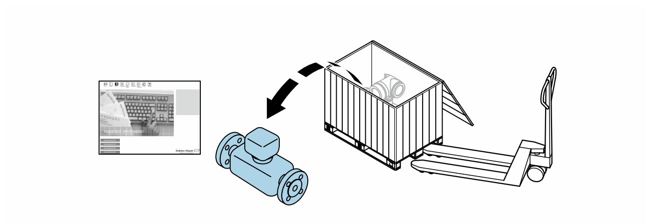
1 *Electronics compartment cover*
2 *Display module*
3 *Transmitter housing*
4 *Sensor with integrated ISEM electronics*
5 *Table version with integrated transmitter*
6 *Disposable measuring tube*

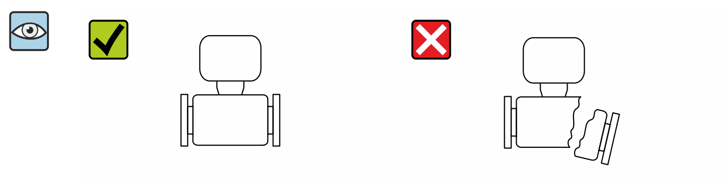
4 Incoming acceptance and product identification

4.1 Incoming acceptance

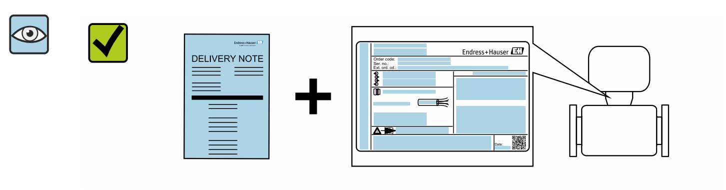


Are the order codes on the delivery note (1) and the product sticker (2) identical?





Are the goods undamaged?



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

Is the envelope present with accompanying documents?

The disposable is not part of the device delivery and must be ordered separately.

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations app*: Product identification→ 15.

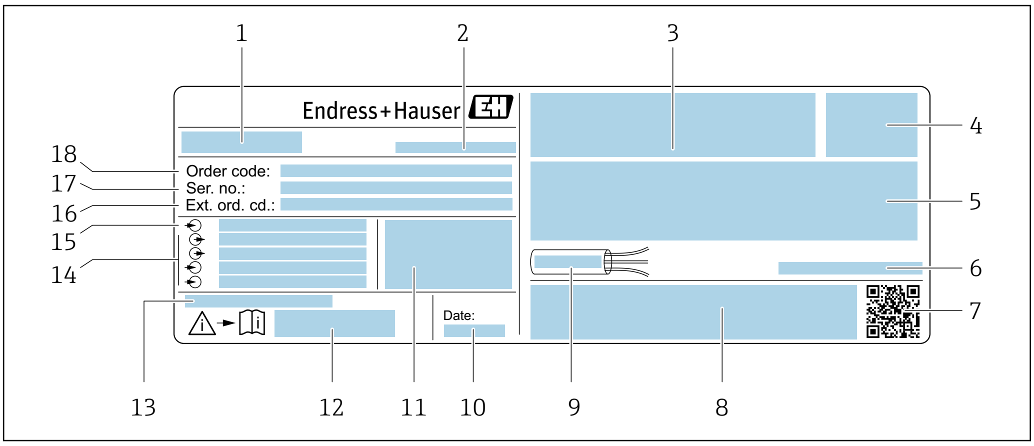
4.2 Product identification

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

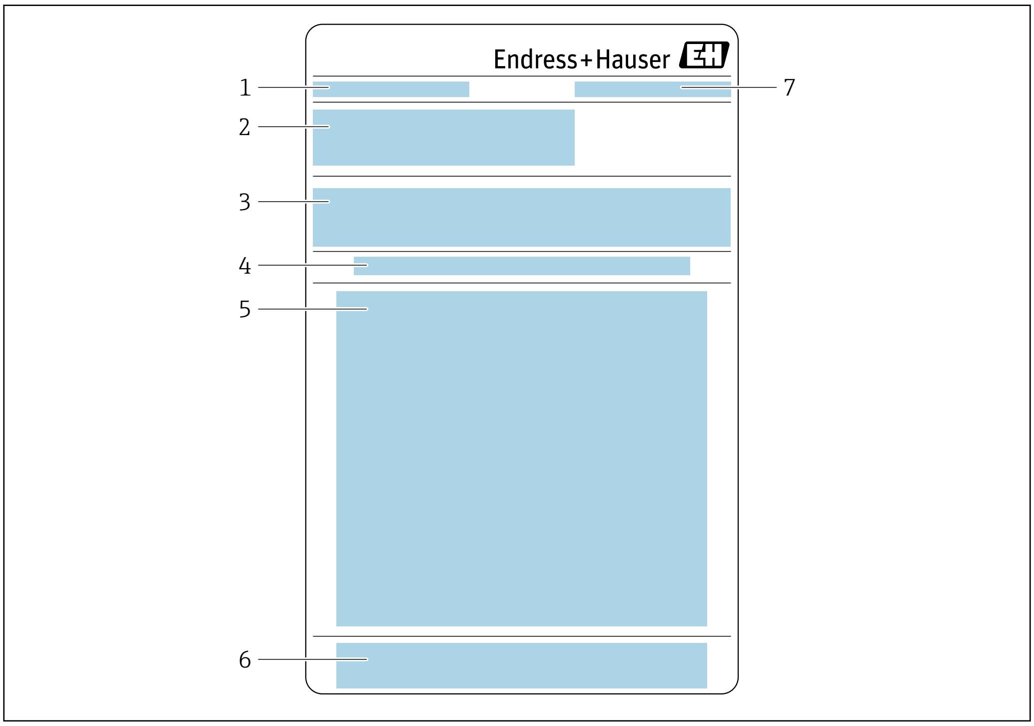
Proline 500 – digital



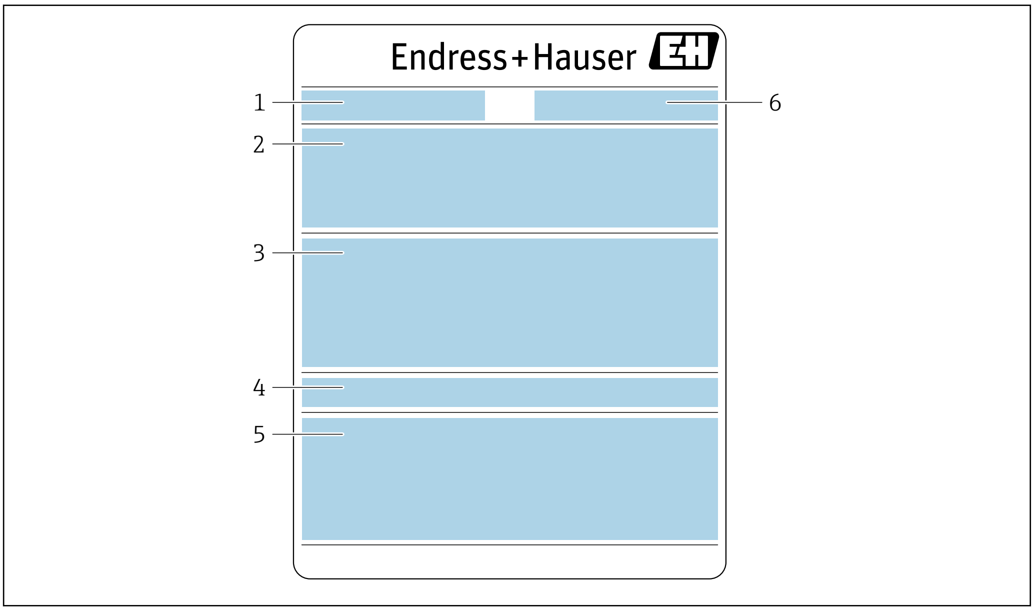
2 Example of a transmitter nameplate

1 *Name of the transmitter*
2 *Manufacturer address/certificate holder*
3 *Space for approvals*
4 *Degree of protection*
5 *Electrical connection data: available inputs and outputs*
6 *Allowable ambient temperature (T_a)*
7 *2-D matrix code*
8 *Space for approvals and certificates: e.g. CE mark, RCM tick*
9 *Permitted temperature range for cable*
10 *Date of manufacture: 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



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



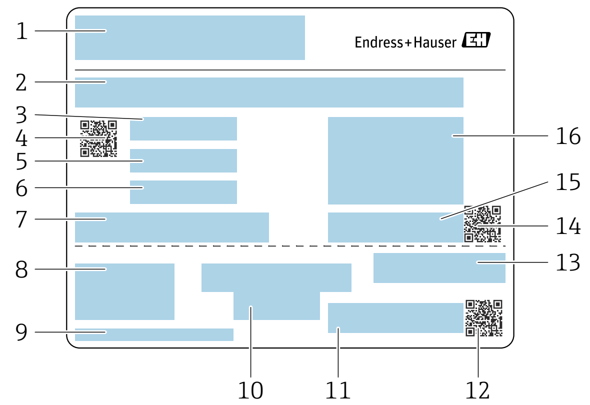
A0054699

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

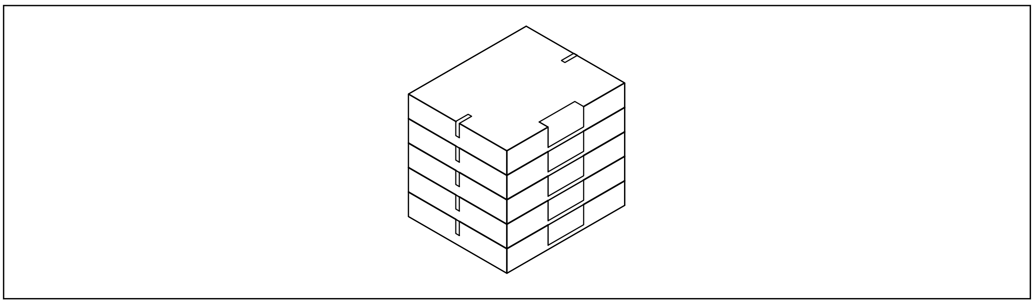
Symbol	Meaning
⚠	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. Please consult the documentation for the measuring device to discover the type of potential danger and measures to avoid it.
	Reference to documentation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

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:

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



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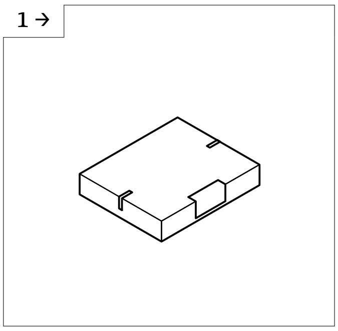
Storage temperature → 🗎 306

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

1 →



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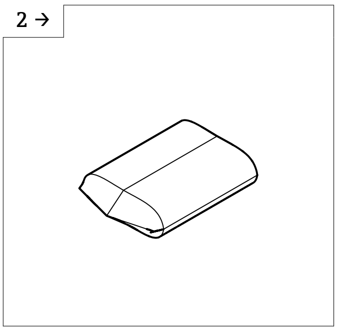
▶ Transport from the warehouse to the airlock in the box.

2 →



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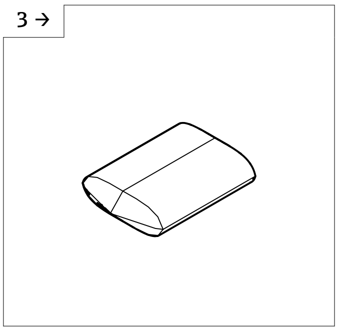
▶ Remove the box before the first airlock.

3 →



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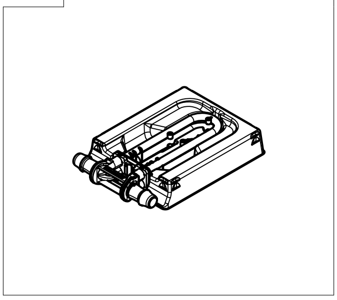
▶ Remove the first plastic packaging inside the airlock.

4 →



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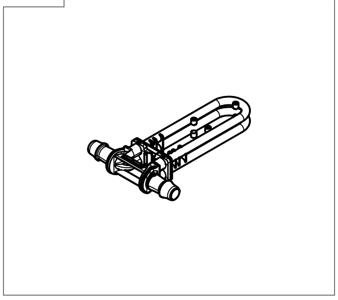
- Remove the last plastic packaging in the clean room.
- If the disposable measuring tube is integrated into an assembly prior to commissioning, the stability packaging must remain in place to protect the measuring tube.

5 →



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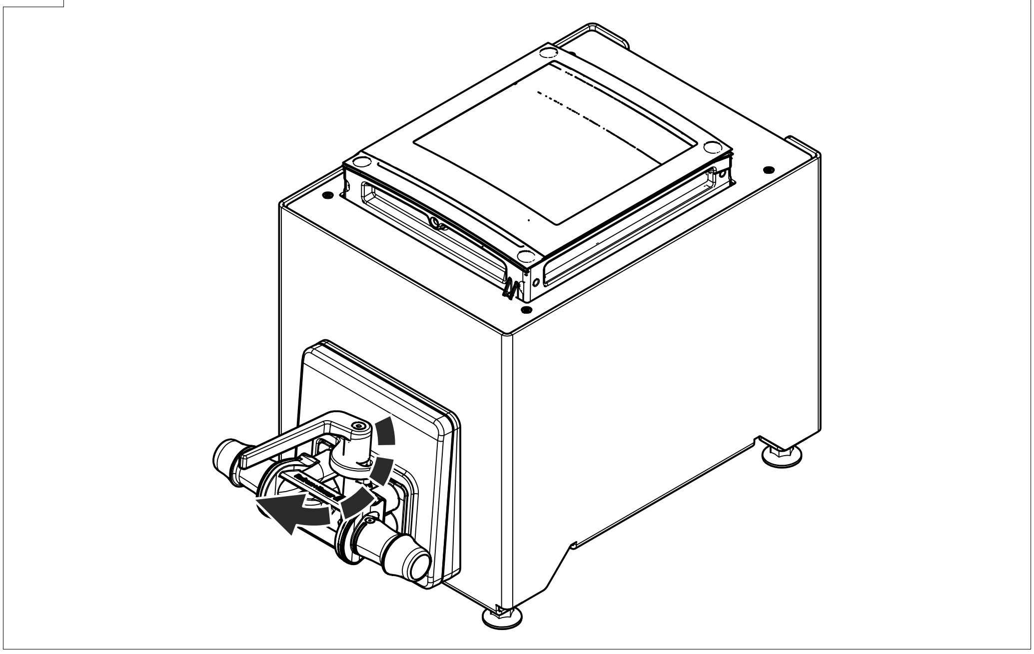
- Remove the disposable measuring tube from the stability packaging and secure it in the sensor immediately.

6



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- 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

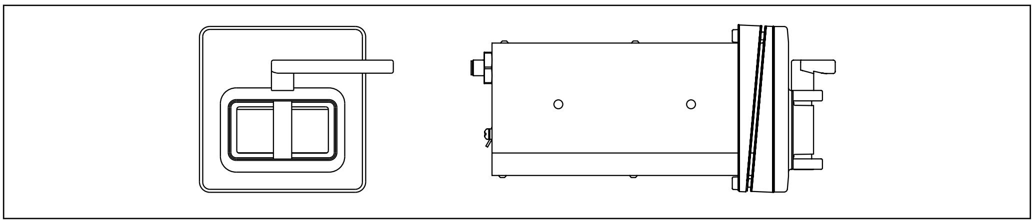
6 Mounting

6.1 Mounting requirements

6.1.1 Installation position

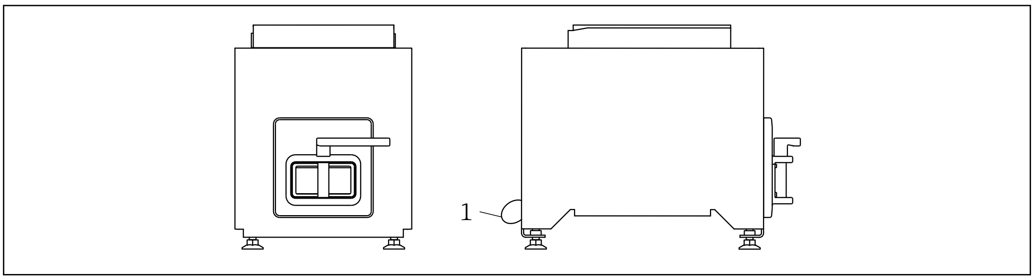
Installation point

Front panel mounting



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

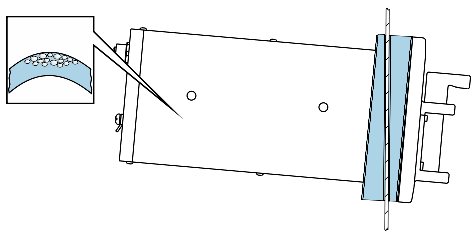
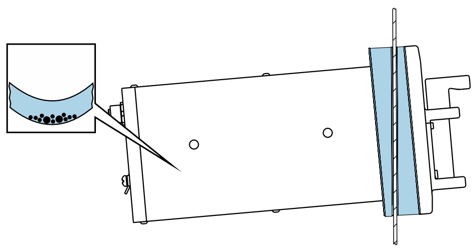
Table version



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 Environment and process requirements

Ambient temperature range

Measuring device	+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 → 🗎 307

Vibrations

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

6.1.3 Special mounting 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 → 🗎 312

Biotech

When installing in biotech applications, please refer to the information in the "Certificates and approvals/biotech" section → 🗎 312

6.2 Mounting the measuring device

6.2.1 Required tools

For sensor

For process connections: Use a suitable mounting tool.

6.2.2 Preparing the measuring device

▸ Remove all remaining transport packaging.

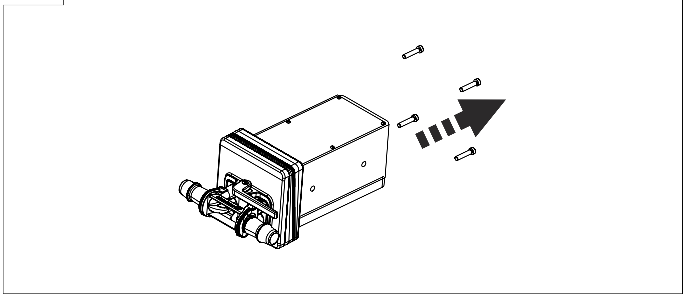
6.2.3 Mounting the measuring device

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

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

Mount the sensor in the front panel.

1 →



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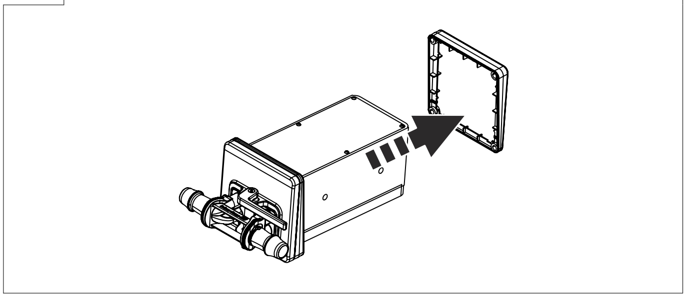
▶ Remove the screws.

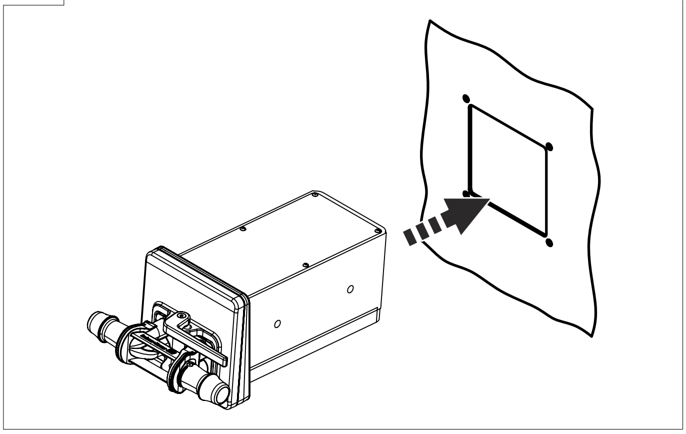
2 →



A0054238

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

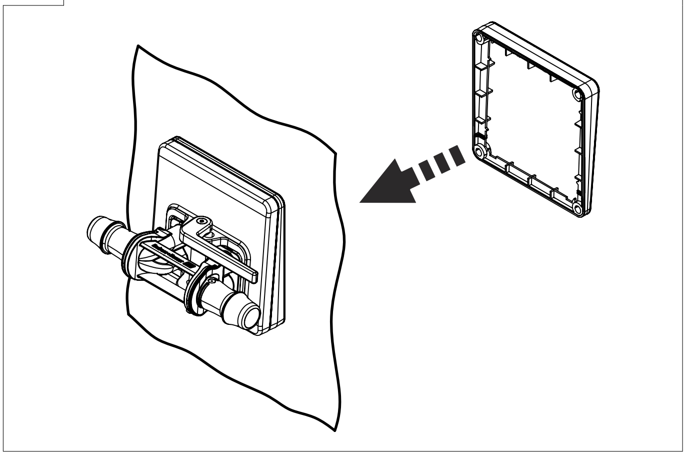
3 →



A0054239

▶ Push the sensor with the wedge (to the outside) into the prepared opening in the front panel.

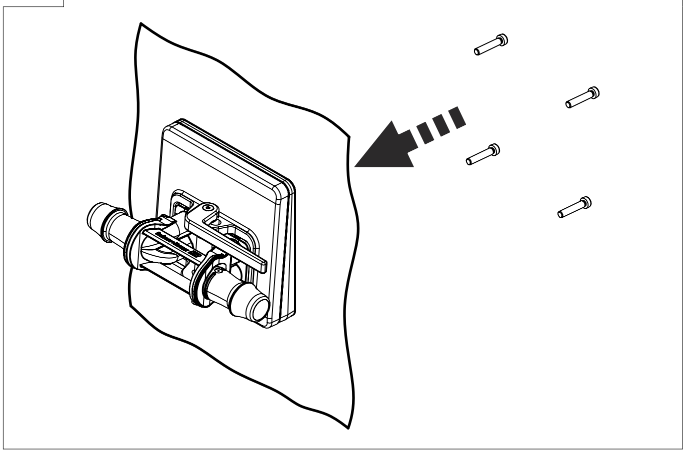
4 →



A0054240

▸ Slide the wedge over the sensor from the inside.

5



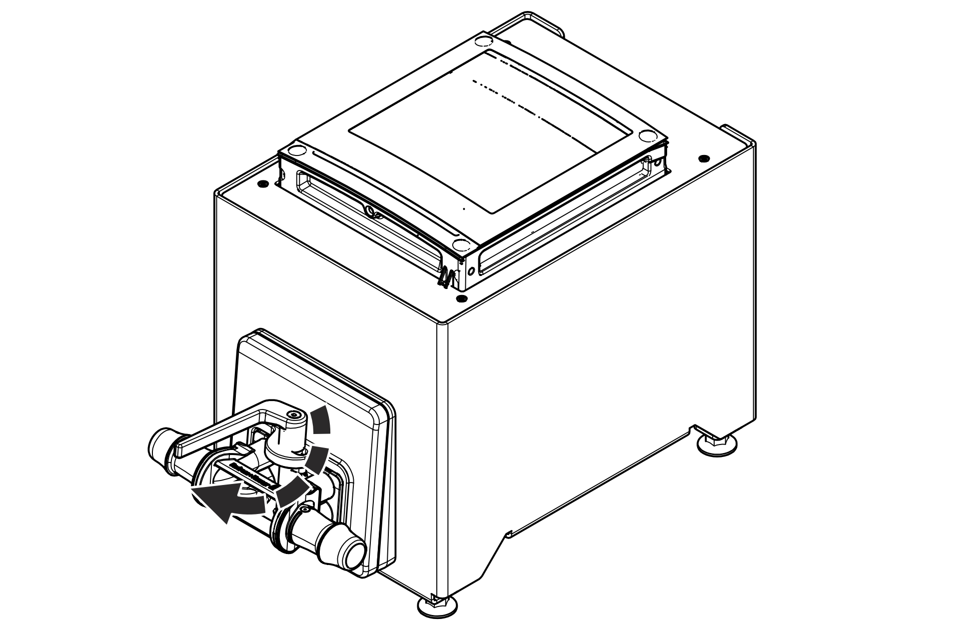
A0054241

▸ Screw the sensor to the wedges.

6.2.4 Replacing the disposable measuring tube

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

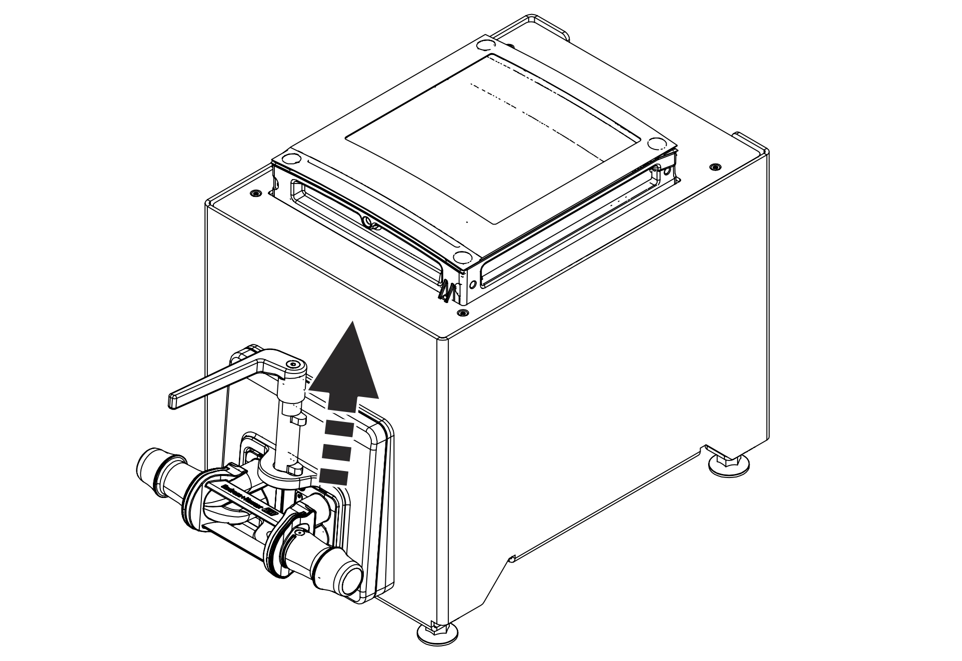
1 →



A0054164

- Open the lever.

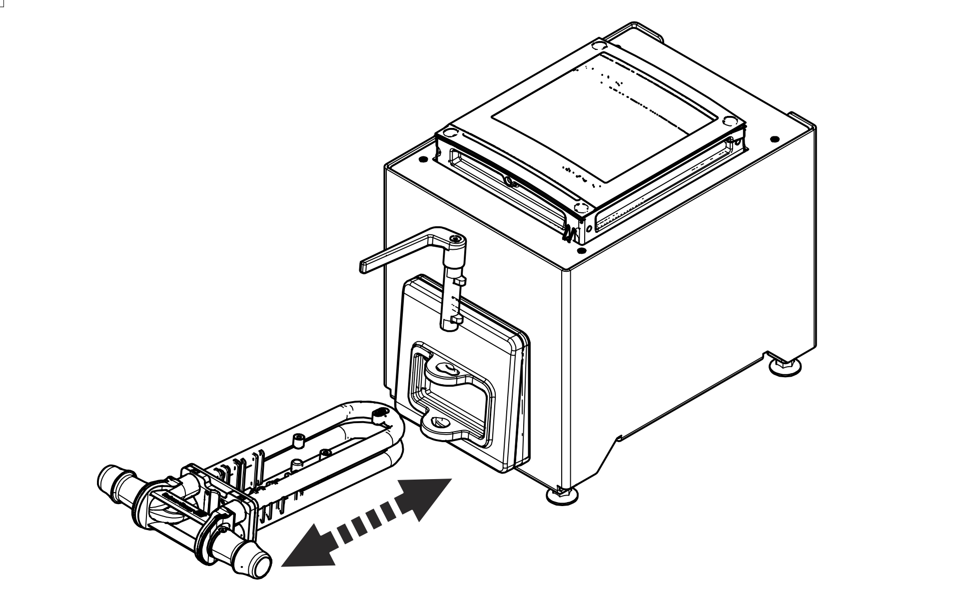
2 →



A0054165

- Pull up the lever.

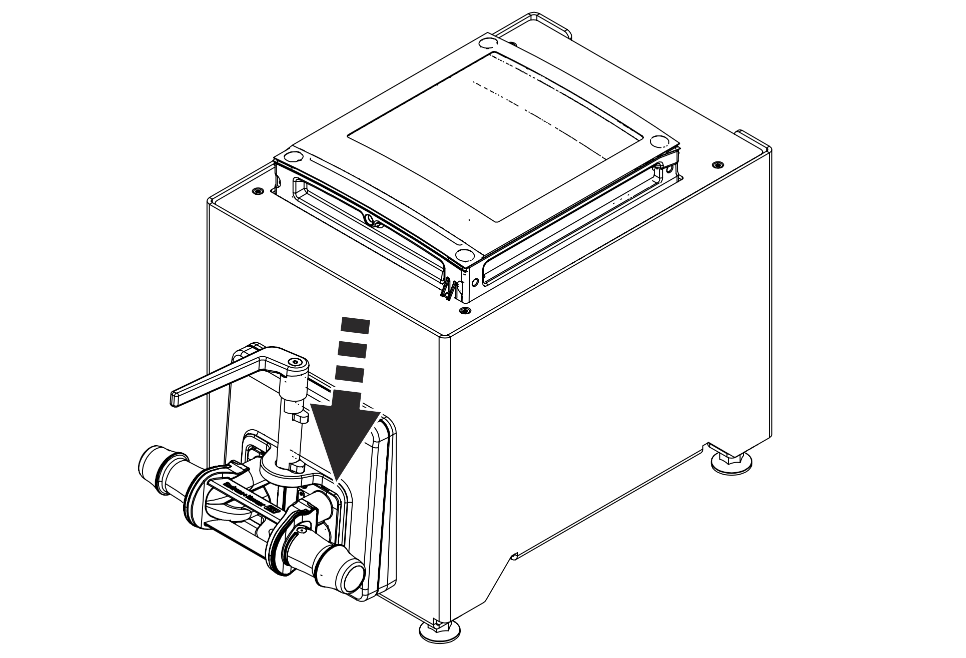
3 →



A0054166

- Replace the disposable measuring tube.
- After pulling out the disposable measuring tube, this status message appears on the display after 30 seconds at the latest: Sensor unknown.

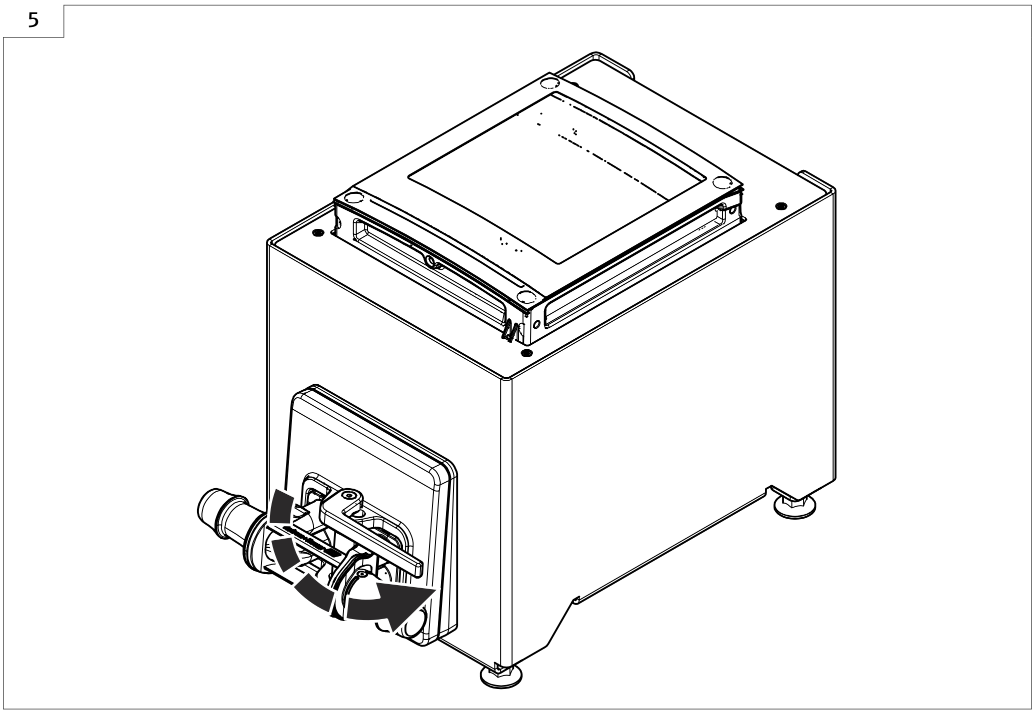
4 →



A0054685

- Lower the lever.

5



A0054163

- Turn the lever to the limit stop.
- After inserting the disposable measuring tube, this status message appears on the display after 30 seconds at the latest: Device initialization active.
- Heartbeat Verification and zero adjustment are performed automatically. This status message is displayed during this time: Device initialization active.
- The device is now operational.
- Fill the system with water.
- Perform commissioning again.
- Download Heartbeat Verification report.

6.2.5 Mounting the transmitter housing: Proline 500 – digital

CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- Do not exceed the permitted maximum ambient temperature.

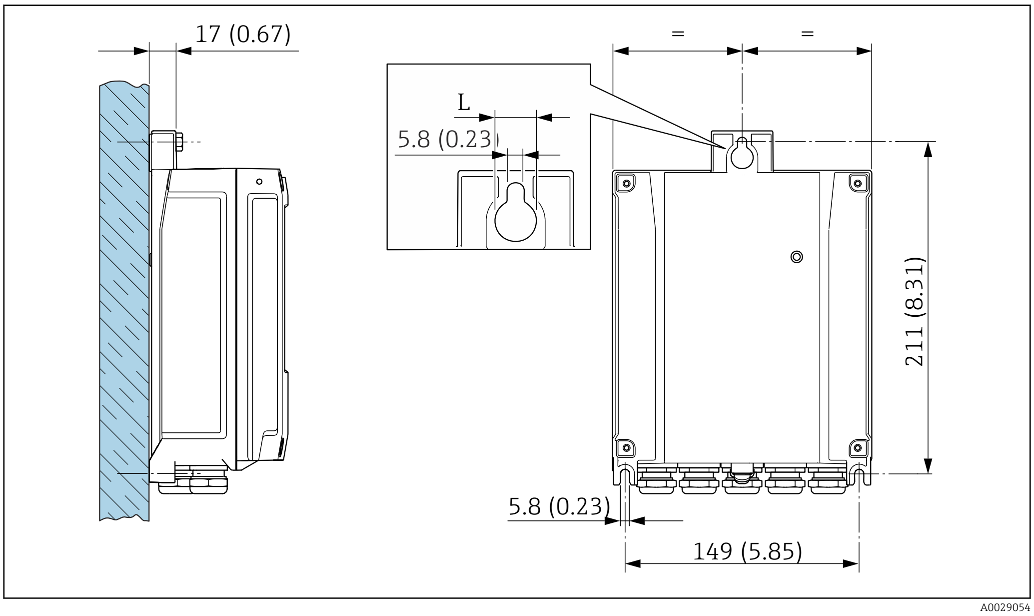
CAUTION

Excessive force can damage the housing!

- Avoid excessive mechanical stress.

Wall mounting

Required tools:
Drill with drill bit Ø 6.0 mm



5 Engineering 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 fixing screws slightly.
4. Fit the transmitter housing over the fixing screws and mount in place.
5. Tighten the fixing screws.

6.3 Post-mounting check

Is the device undamaged (visual inspection)?	☐
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature → 📖 307 ▪ Process 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?	☐
Are the measuring point identification 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 ≤ 3 mm (0.12 in)

7.2.2 Requirements for connecting cable

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

Protective grounding cable for the outer ground terminal

Conductor cross-section < 2.1 mm^2 (14 AWG)

The use of a cable lug enables the connection of larger cross-sections.

The grounding impedance must be less than 2 Ω.

Permitted temperature range

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

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

Standard installation cable is sufficient.

Signal cable

PROFINET with Ethernet-APL/SPE

The reference cable type for APL segments is fieldbus cable type A, MAU type 1 and 3 (specified in IEC 61158-2). This cable meets the requirements for intrinsically safe applications according to IEC TS 60079-47 and can also be used in non-intrinsically safe applications.

Cable type	A
Cable capacitance	45 to 200 nF/km
Loop resistance	15 to 150 Ω/km
Cable inductance	0.4 to 1 mH/km

Further details are provided in the Ethernet-APL/SPE Engineering Guideline (https://www.ethernet-apl.org).

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Pulse /frequency /switch output

Standard installation cable is sufficient.

Relay output

Standard installation cable is sufficient.

Current input 0/4 to 20 mA

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable ⌀ 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 mm^2 (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 mm² 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		Input/output 2		Input/output 3		Input/output 4	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (+)	23 (–)	20 (+)	21 (–)
		Device-specific terminal assignment: adhesive label in terminal cover.							

Transmitter and sensor connection housing: connecting cable

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

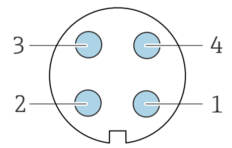
Terminal assignment and connection of the connecting cable:
Proline 500 – digital → 🗎 34

7.2.4 Available device plugs

Order code for "Input; output 1", option RB "PROFINET with Ethernet-APL/SPE"

Order code	Cable entry/connection	
"Electrical connection"	2	3
L, N, P, U	M12 plug × 1	–

7.2.5 /SPE Device plug pin assignment



Pin	Assignment	Coding	Plug/socket
1	APL signal -	A	Socket
2	APL signal +		
3	Cable shield[1]		
4	Not used		

	Metal plug housing	Cable shield		
	[1]If a cable shield is used			

7.2.6 Shielding and grounding

Optimal electromagnetic compatibility (EMC) of the fieldbus system can be guaranteed only if the system components and, in particular, the lines are shielded and the shield forms as complete a cover as possible.

- ▶ To ensure optimal EMC protection, connect the shield to the reference ground as often as possible.

To comply with both requirements, there are basically three different types of shielding in the fieldbus system:
- Shielding at both ends
- Shielding at one end on the feed side with capacitance termination at the field device
- Shielding at one end on the feed side

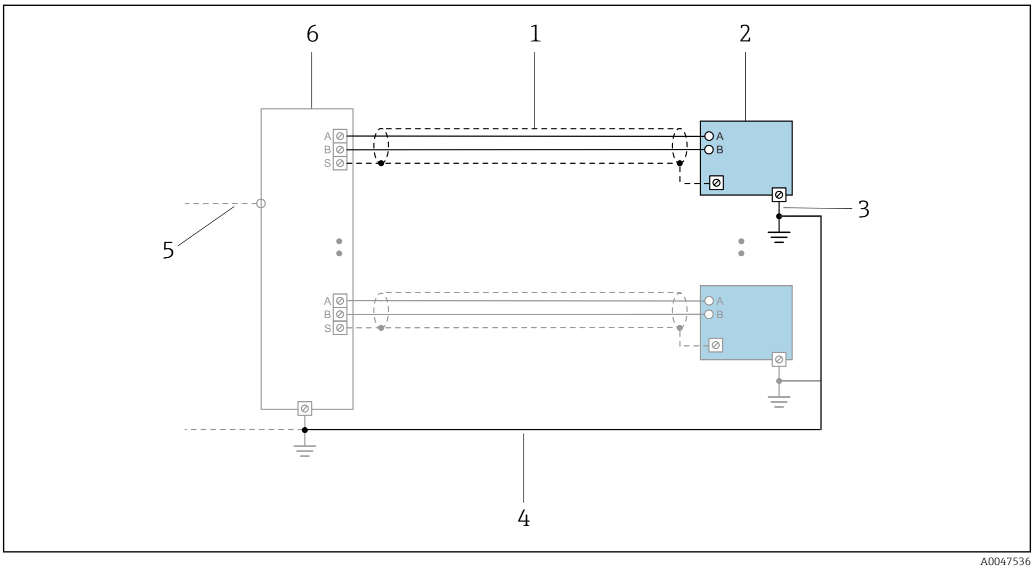
Experience shows that the best results with regard to EMC are achieved in most cases in installations with one-sided shielding on the feed side (without capacitance termination at the field device). Appropriate measures with regard to input wiring must be taken to allow unrestricted operation when EMC interference is present. These measures have been taken into account for this device. Operation in the event of disturbance variables as per NAMUR NE21 is thus guaranteed.

1. Observe national installation requirements and guidelines during installation.
2. Where there are large differences in potential between the individual grounding points,
   connect only one point of the shielding directly to the reference ground.
3. In systems without potential equalization,
   the cable shielding of fieldbus systems should be grounded on one side only, for example at the fieldbus supply unit or at safety barriers.

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.



6 *Connection example for PROFINET with Ethernet-APL*

1 *Cable shield*
2 *Measuring device*
3 *Local grounding*
4 *Potential equalization*
5 *Trunk or TCP*
6 *Field switch*

7.2.7 Preparing the measuring 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 device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 29.

7.3 Connecting the measuring device: Proline 500 – digital

NOTICE

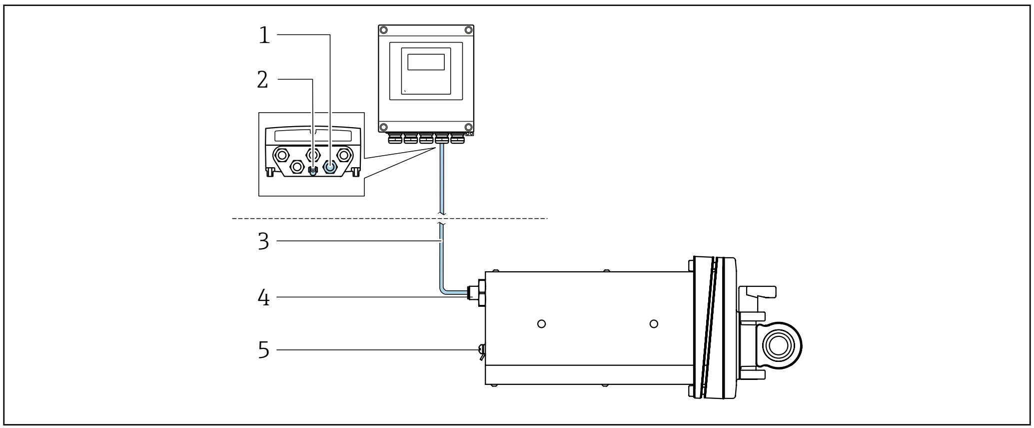
An incorrect connection compromises electrical safety!
- Only properly trained specialist staff may perform electrical connection work.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable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

7.3.1 Fitting the connecting cable

⚠ WARNING

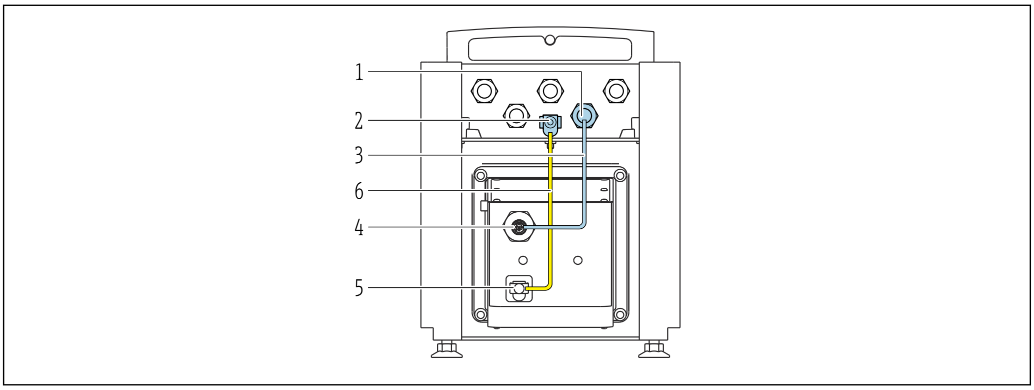
Risk of damaging electronic components!
- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.

Connection of connecting cable: Proline 500 – digital



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

1 *M12 socket for fitting the connecting cable to the transmitter housing*
2 *Terminal connection for potential equalization (PE)*
3 *Connecting cable with M12 plug and M12 socket*
4 *M12 plug for fitting the connecting cable to the sensor*
5 *Terminal connection for potential equalization (PE)*

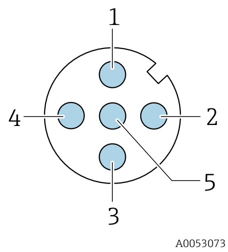


8 Order code for "Device version", option NE "Table version"

1 M12 socket for fitting the connecting cable to the transmitter housing
2 Terminal connection for potential equalization (PE)
3 Connecting cable with M12 plug and M12 socket
4 M12 plug for fitting the connecting cable to the sensor
5 Terminal connection for potential equalization (PE)
6 Fixed connection between the potential matching (PE)

Pin assignment, device plug

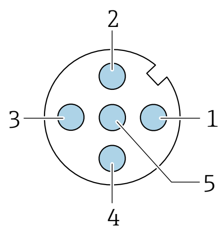
Connection at the transmitter



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

1) Cable colors of connecting cable

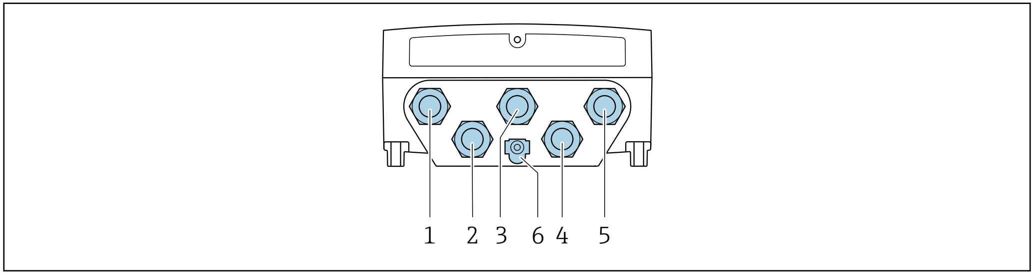
Connection at the sensor



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

1) Cable colors of connecting cable

7.3.2 Connecting the transmitter

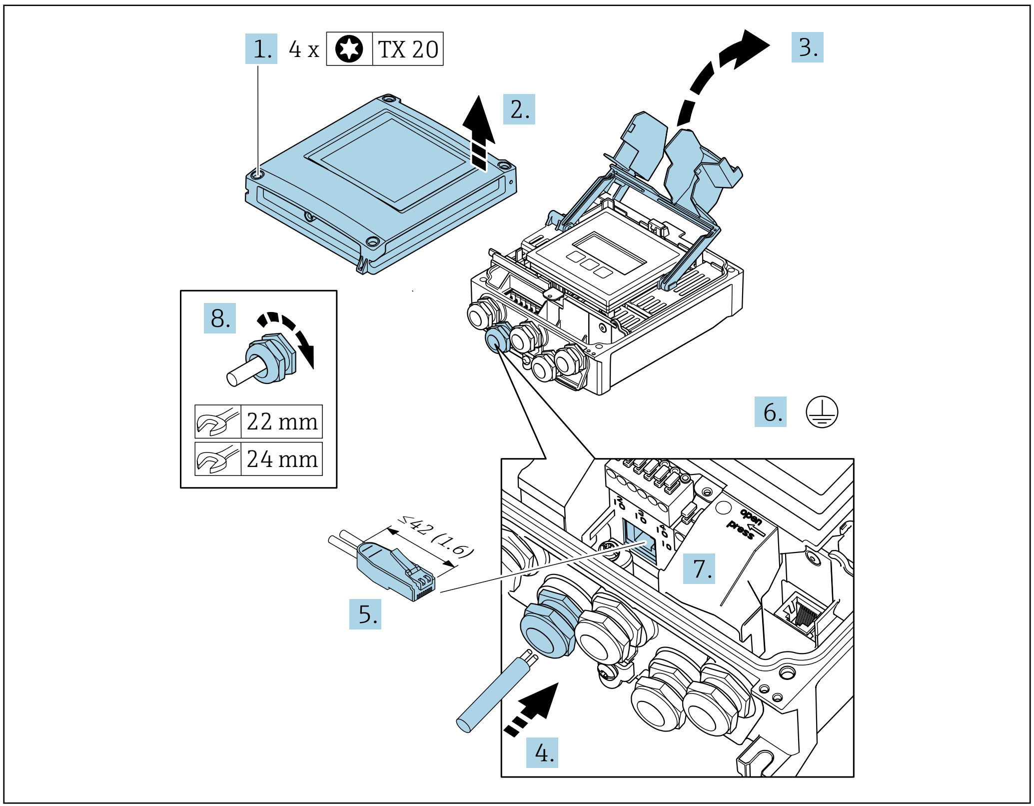


A0028200

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)

In addition to connecting the device via and the available input/outputs, additional connection options are also available:
Integrate into a network via the service interface (CDI-RJ45) → 🗎 39.

Connecting the plug

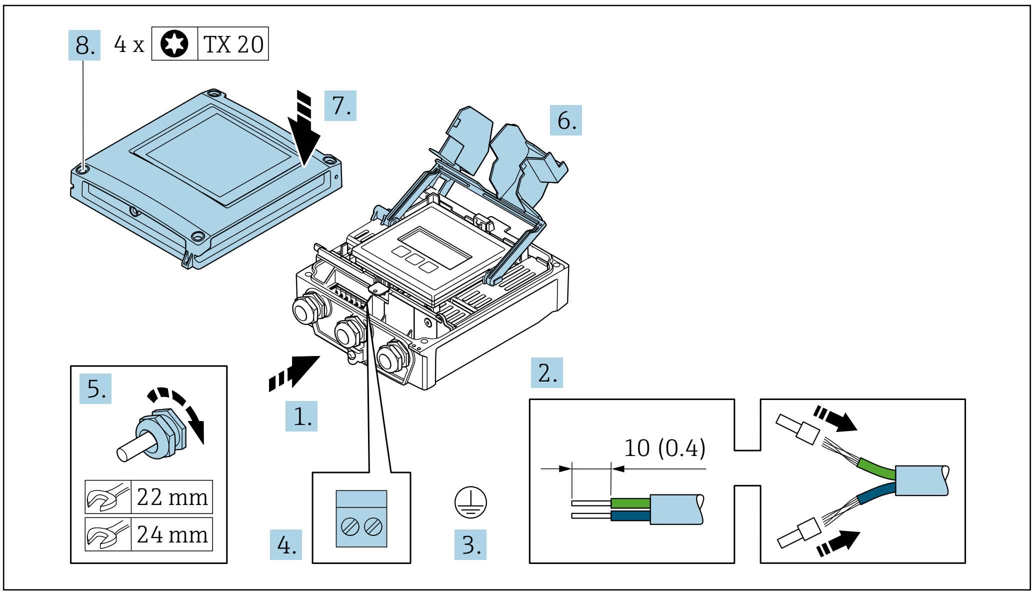


A0033987

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 and connect to the RJ45 connector.
6. Connect the protective ground.

7. Plug in the RJ45 connector.
8. Firmly tighten the cable glands.
   ↳ This concludes the connection process.

Connecting the supply voltage and additional inputs/outputs



A0033831

1. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
2. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
3. Connect the protective ground.
4. 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 → 📄 31.
5. Firmly tighten the cable glands.
   ↳ This concludes the cable connection process.
6. Close the terminal cover.
7. Close the housing cover.

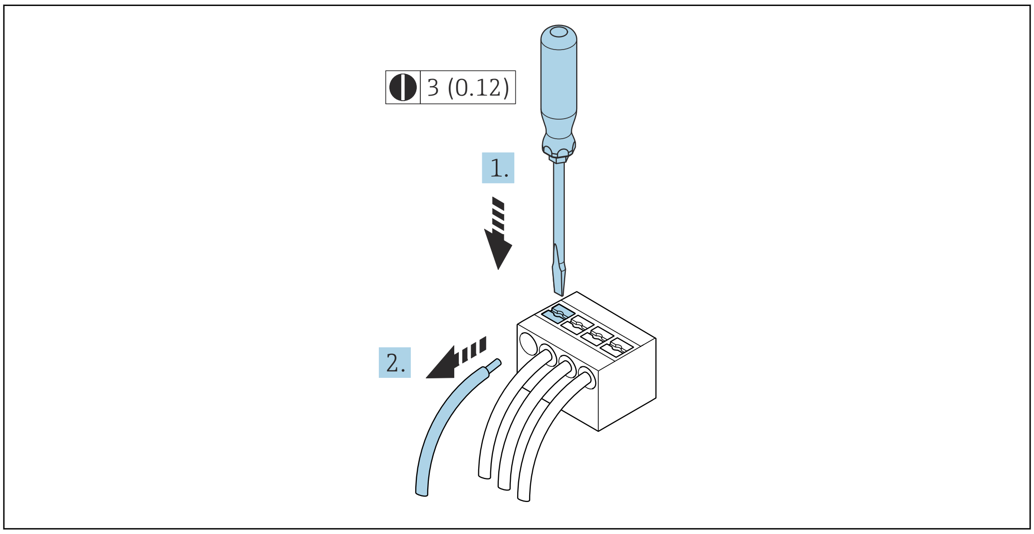
⚠ WARNING

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

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

Removing a cable

To remove a cable from the terminal:



9 *Engineering 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.

7.3.3 Integrating the transmitter into a network

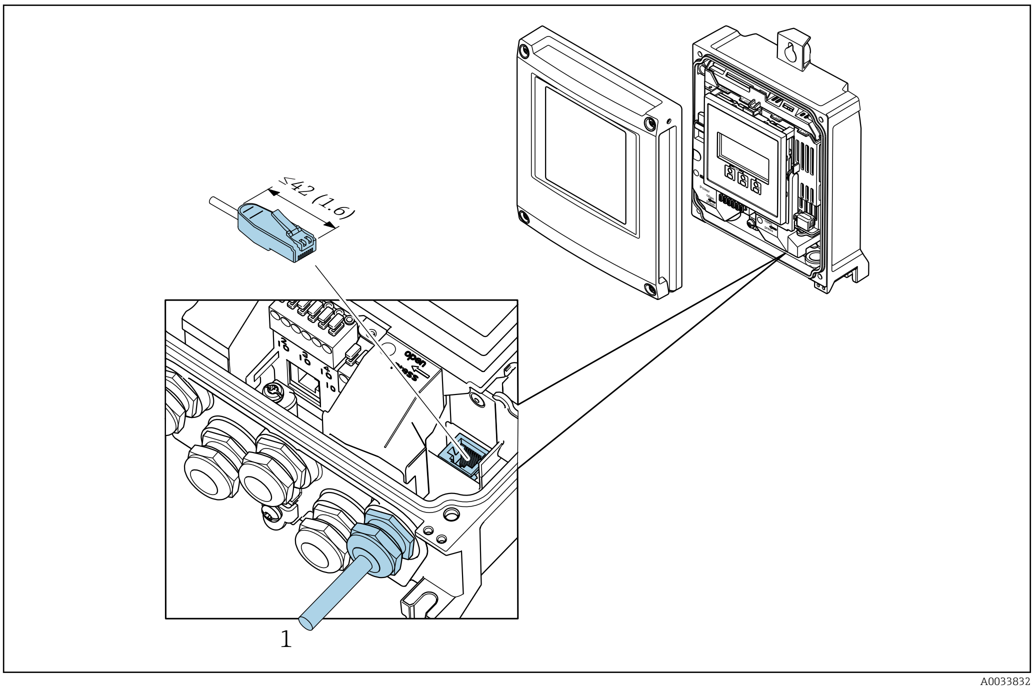
This section only presents the basic options for integrating the device into a network.

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

Integrating the device via the service interface

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

Note the following when connecting:
- Recommended cable: CAT5e, CAT6 or CAT7, with shielded connector (e.g. brand: YAMAICHI ; Part No Y-ConProfixPlug63 / Prod. ID: 82-006660)
- Maximum cable thickness: 6 mm
- Length of plug including anti-bend protection: 42 mm
- Bending radius: 5 x cable thickness



1 *Service interface (CDI-RJ45)*

Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

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

7.4 Potential equalization

7.4.1 Requirements

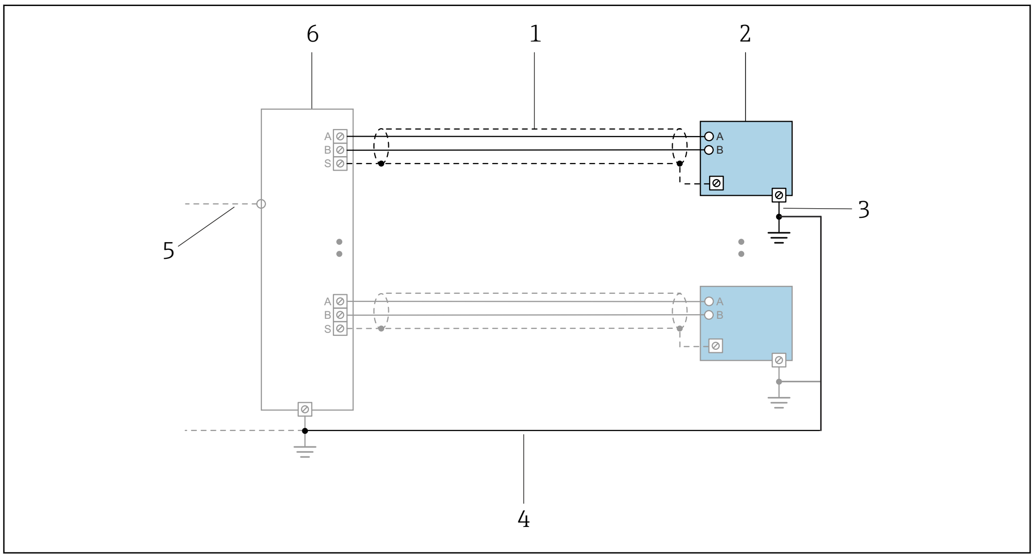
For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Medium, Connect the sensor and transmitter to the same electric potential [1)]
- Use a ground cable with a minimum cross-section of 6 mm^2 (10 AWG) and a cable lug for potential equalization connections

1) Order code for "Device version", option NE "Table version": Sensor and transmitter are wired internally.

7.5 Special connection instructions

7.5.1 Connection examples

PROFINET with Ethernet-APL/SPE

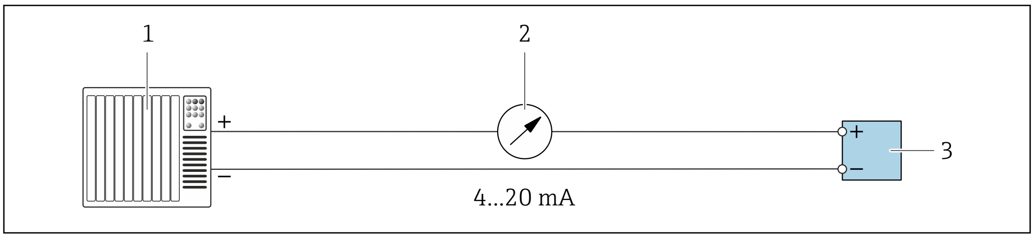


A0047536

10 *Connection example for PROFINET with Ethernet-APL*

1 *Cable shield*
2 *Measuring device*
3 *Local grounding*
4 *Potential equalization*
5 *Trunk or TCP*
6 *Field switch*

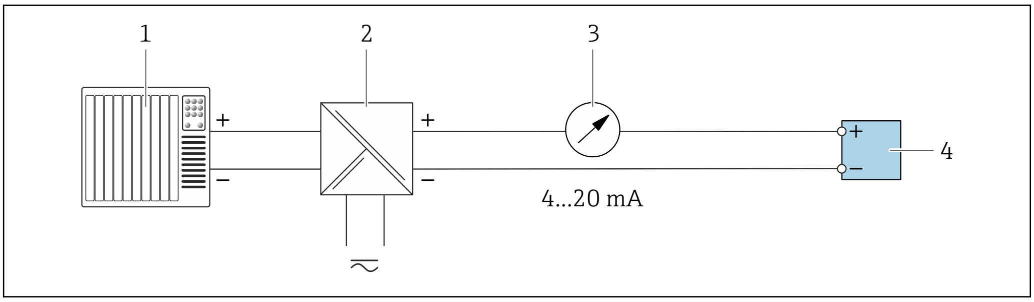
Current output 4-20 mA



A0028758

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

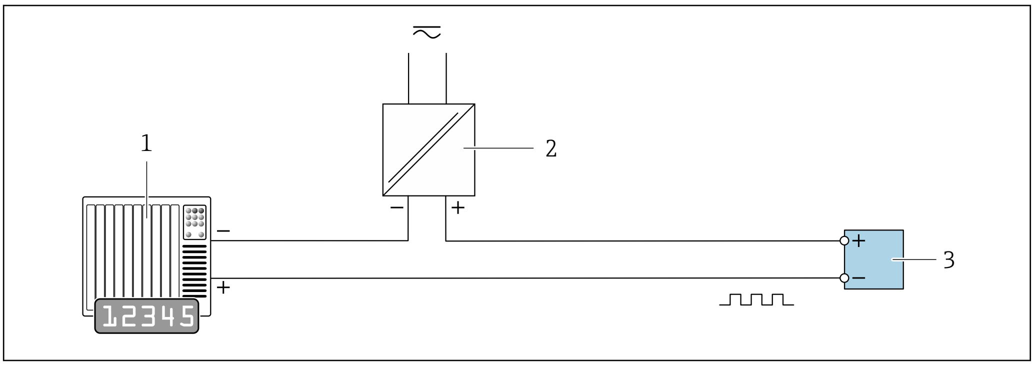
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load*
3 *Transmitter*



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

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

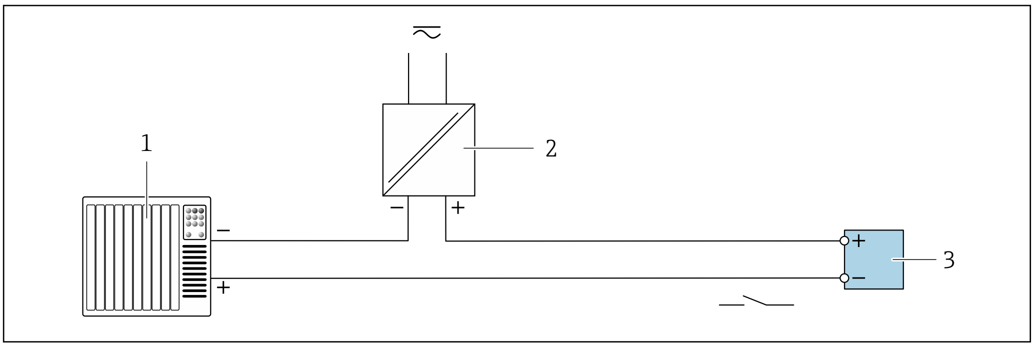
Pulse/frequency output



13 Connection example for pulse/frequency output (passive)

1 Automation system with pulse/frequency input (e.g. PLC with 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 298

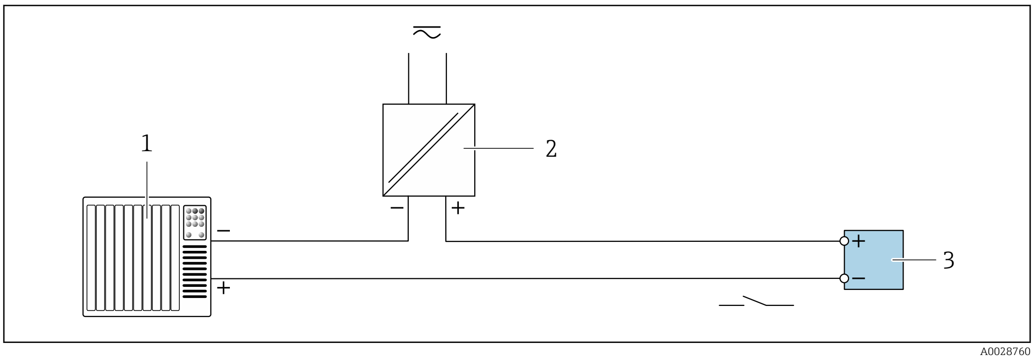
Switch output



14 Connection example for switch output (passive)

1 Automation system with switch input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 298

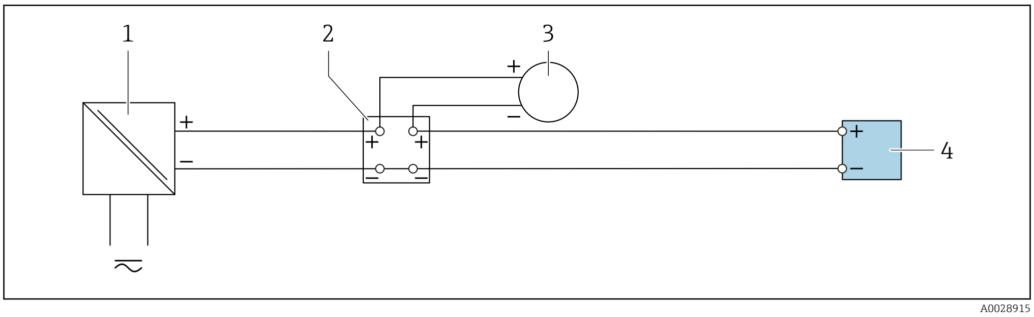
Relay output



15 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: observe input values → 299*

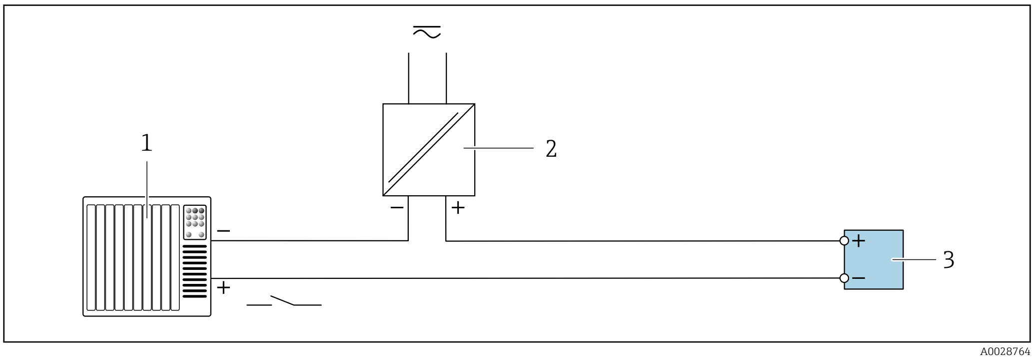
Current input



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

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

Status input



17 *Connection example for status input*

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

7.6 Hardware settings

7.6.1 Setting the device name

A measuring point can be quickly identified within a plant on the basis of the tag name. The factory-assigned device name can be changed using the DIP switches or the automation system.

EH	Endress+Hauser
500	Transmitter
XXXX	Serial number of the device

The device name currently used is displayed in Setup → Name of station .

Setting the device name using the DIP switches

The last part of the device name can be set using DIP switches 1-8. The address range is between 1 and 254 (factory setting: serial number of the device)

Overview of the DIP switches

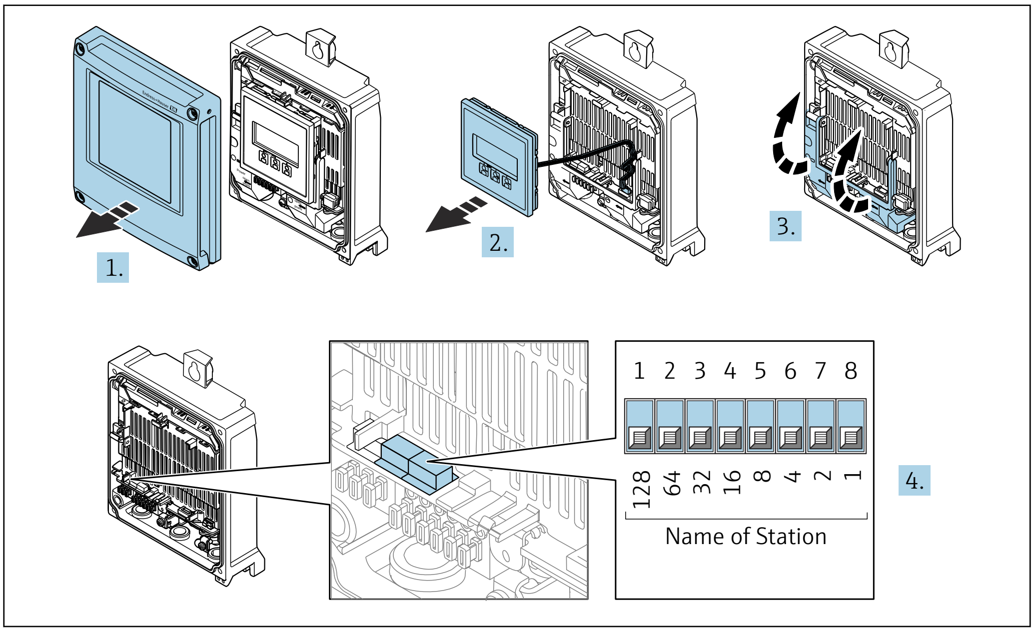
DIP switch	Bit	Description
1	128	Configurable part of the device name
2	64	
3	32	
4	16	
5	8	
6	4	
7	2	
8	1	

DIP switch	ON/OFF	Bit	Device name
1	OFF	–	
2	ON	64	
3...7	OFF	–	
8	ON	1	
	Serial number of the device:	065	

Setting the device name: Proline 500 - digital

Risk of electric shock when opening the transmitter housing.
- ▶ Before opening the transmitter housing:
- ▶ Disconnect the device from the power supply.

The default IP address may **not** be activated → 44.



1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Fold open the terminal cover.
4. Set the desired device name using the corresponding DIP switches on the I/O electronics module.
5. Reassemble the transmitter in the reverse order.
6. Reconnect the device to the power supply.
   ↳ The configured device address is used once the device is restarted.

Setting the device name via the automation system

DIP switches 1-8 must all be set to **OFF** (factory setting) or all be set to **ON** to be able to set the device name via the automation system.

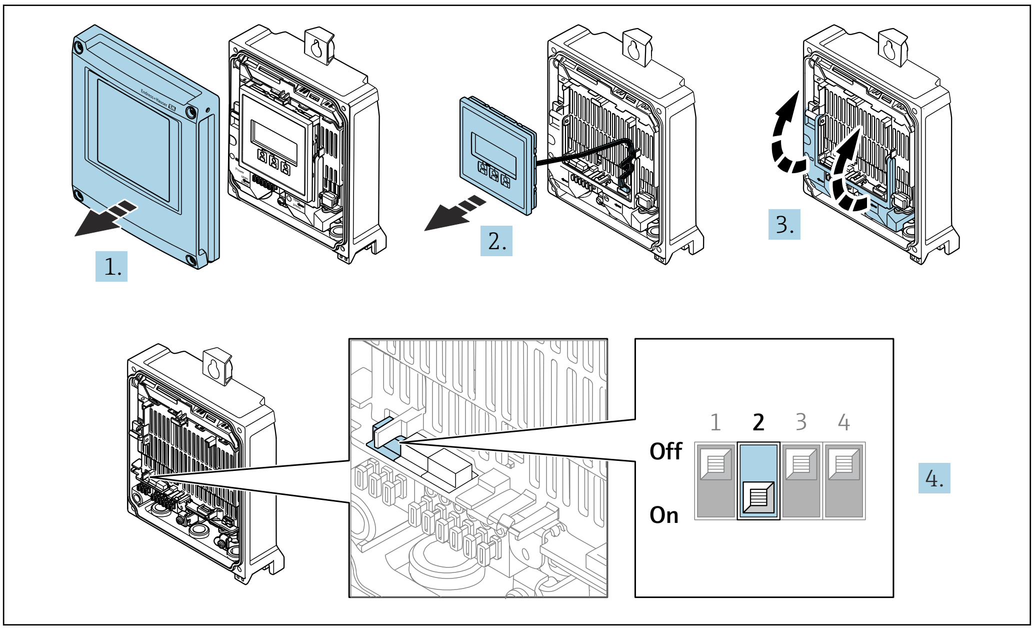
The complete device name (name of station) can be changed individually via the automation system.

- The serial number used as part of the device name in the factory setting is not saved. It is not possible to reset the device name to the factory setting with the serial number. The device name is empty following the reset.
- When assigning the device name via the automation system: assign the device name in lower case letters.

7.6.2 Activating the default IP address

Activating the default IP address by DIP switch: Proline 500 - digital

Risk of electric shock when opening the transmitter housing.
▶ Before opening the transmitter housing:
▶ Disconnect the device from the power supply.



A0034500

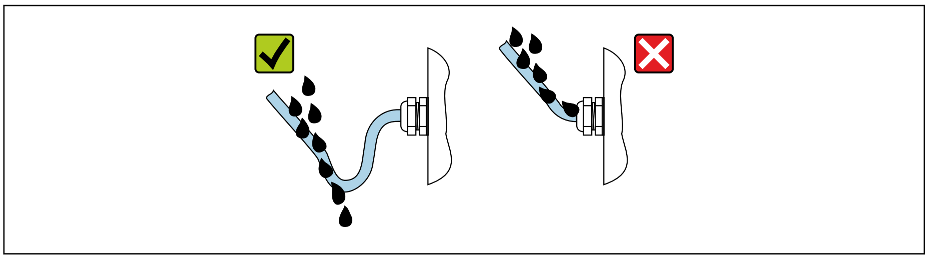
1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Fold open the terminal cover.
4. Set DIP switch no. 2 on the I/O electronics module from **OFF** → **ON**.
5. Reassemble the transmitter in the reverse order.
6. Reconnect the device to the power supply.
   ↳ The default IP address is used once the device is restarted.

7.7 Ensuring the degree of protection

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

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

1. Check that the housing seals are clean and fitted correctly.
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").
   ↳



A0029278

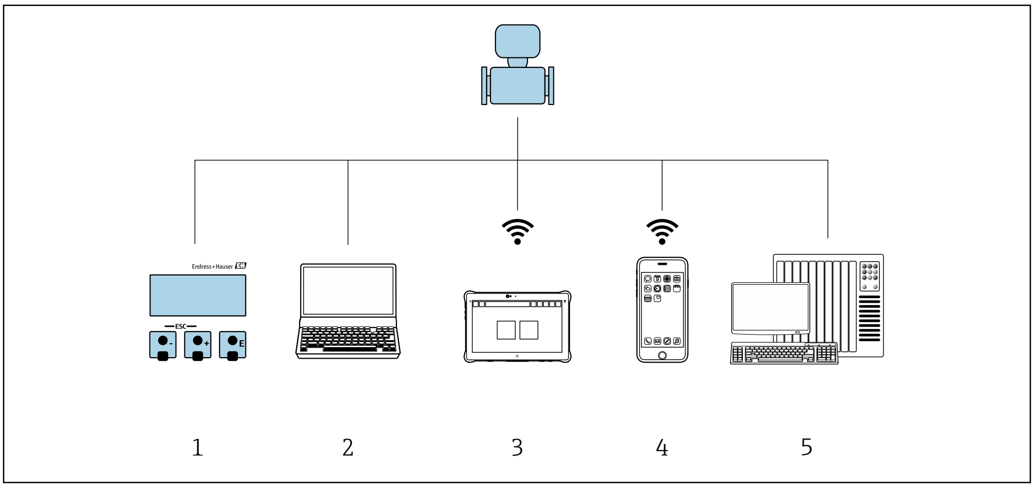
6. The cable glands supplied do not ensure housing protection when not in use. They must therefore be replaced by dummy plus corresponding to the housing protection.

7.8 Post-connection check

Are cables or the device undamaged (visual inspection)?	☐
Is the protective earthing established correctly?	☐
Do the cables used comply with the requirements ?	☐
Are the mounted cables relieved of tension?	☐
Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" → 🗎 45?	☐
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

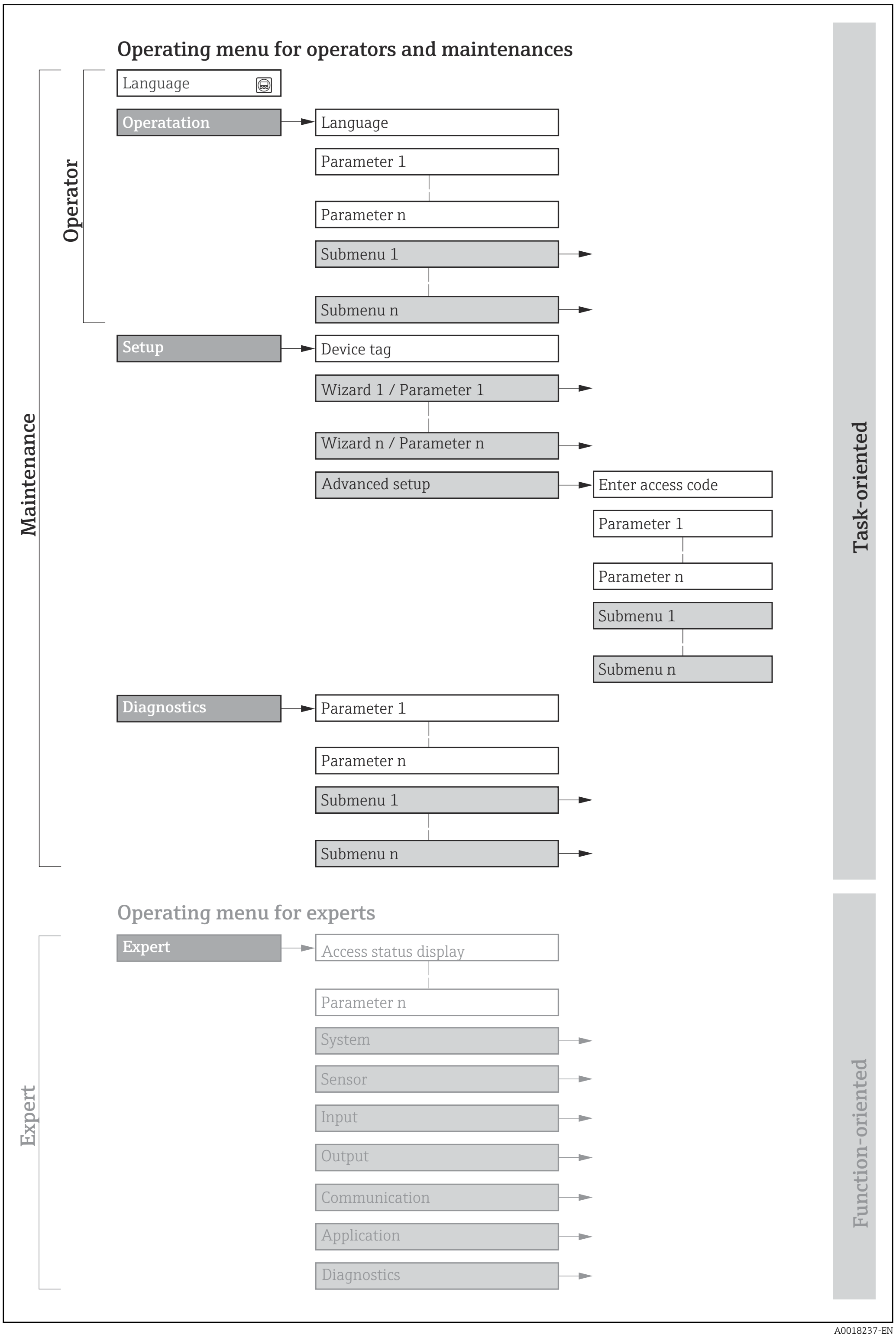


1 Local operation via display module
2 Computer with web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM)
3 Field Xpert SMT70
4 Mobile handheld terminal
5 Automation system (e.g. PLC)

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 → 314



18 *Schematic structure of the operating menu*

8.2.2 Operating philosophy

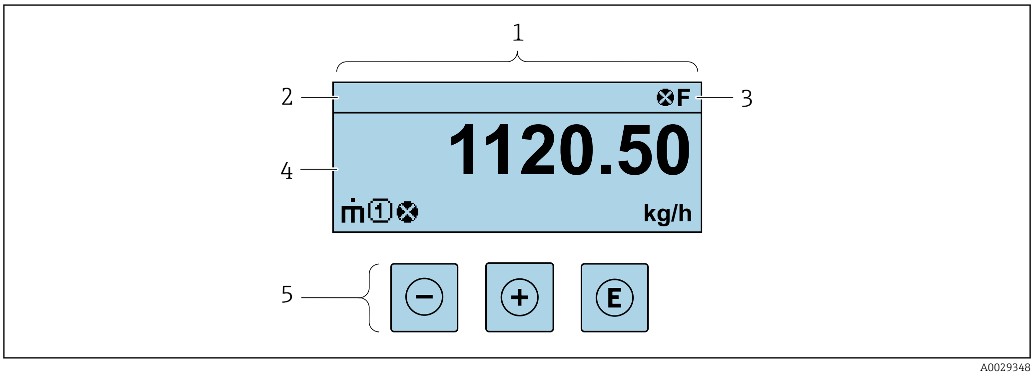
The individual parts of the operating menu are assigned to certain user roles (e.g. operator, maintenance etc.). Each user role contains typical tasks within the device life cycle.

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

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 of the device parameters and allows direct access to these by means of an access code. The structure of this menu is based on the function blocks of the device: ▪ System Contains all higher-level device parameters that do not affect measurement or measured value communication ▪ Sensor Configuration of the measurement. ▪ Input Configuration of the status input ▪ Output Configuration of the analog current outputs as well as the pulse/frequency and switch output ▪ Communication Configuration of the digital communication interface and the Web server ▪ Application Configuration of the functions that go beyond the actual measurement (e.g. totalizer) ▪ Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to operating menu via local display

8.3.1 Operational display



1 *Operational display*
2 *Device tag*
3 *Status area*
4 *Display range for measured values (up to 4 lines)*
5 *Operating elements → 🗎 56*

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 🗎 210
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 🗎 211
  - ⊗: Alarm
  - ⚠: Warning
- 🔒: Locking (the device is locked via the hardware)
- ⇆: Communication (communication via remote operation is active)

Display area

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

Measured variables

Symbol	Meaning
$\dot{m}$	Mass flow
$\dot{V}$	▪ Volume flow ▪ Corrected volume flow
ρ	▪ Density ▪ Reference density
🌡	Temperature

The number and display format of the measured variables can be configured via the **Format display** parameter (→ 121).

Totalizer

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

Input

Symbol	Meaning
⇥	Status input

Measurement channel numbers

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

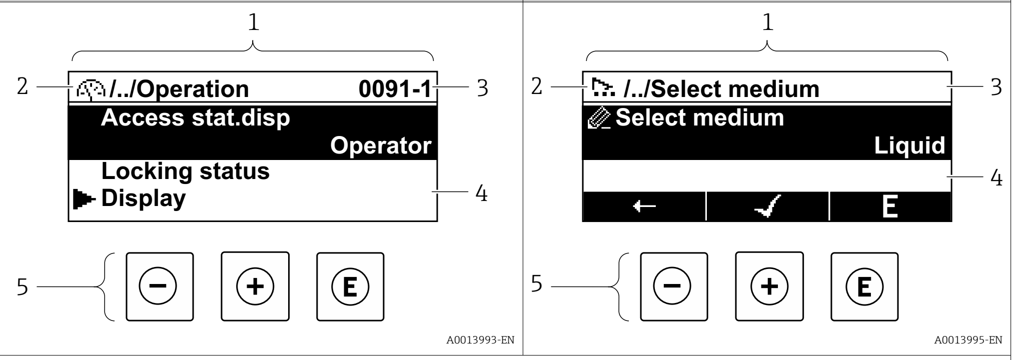
Diagnostic behavior

Symbol	Meaning
⊗	**Alarm** ▪ Measurement is interrupted. ▪ Signal outputs and totalizers assume the defined alarm condition. ▪ A diagnostic message is generated.
⚠	**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

In the submenu	In the wizard



1 *Navigation view*
2 *Navigation path to current position*
3 *Status area*
4 *Display area for navigation*
5 *Operating elements* → 📄 *56*

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 → 📄 52

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 → 📄 210
- For information on the function and entry of the direct access code → 📄 58

Display area

Menus

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

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

Submenus, wizards, parameters

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

Locking procedure

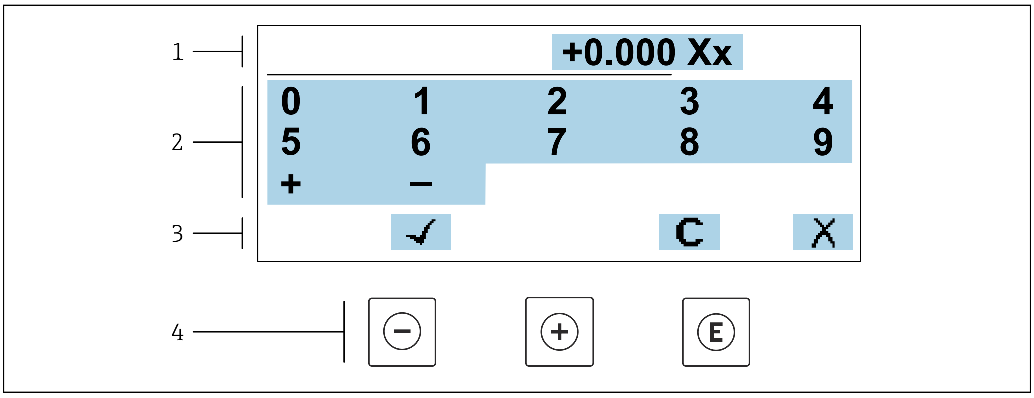
Symbol	Meaning
	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. ▪ By a user-specific access code ▪ By the hardware write protection switch

Wizards

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

8.3.3 Editing view

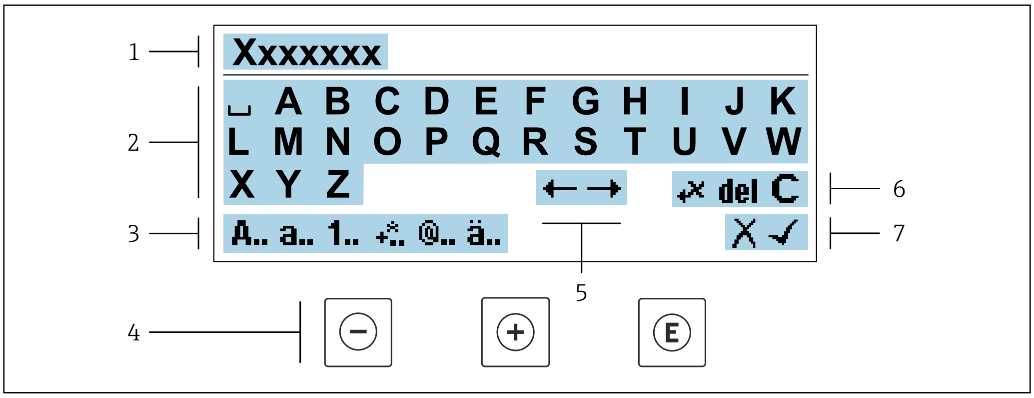
Numeric editor



19 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



20 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
E	**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 ° € $ £ ¥ § @ # / \ I ~ & _
ä..	Umlauts and accents

Controlling data entries

Symbol	Meaning
←→	Move entry position
X	Reject entry
✓	Confirm entry
←X	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** *In menu, submenu* Moves the selection bar upwards in a picklist *In wizards* Goes to previous parameter *In the text and numeric editor* Move the entry position to the left.
⊕	**Plus key** *In menu, submenu* Moves the selection bar downwards in a picklist *In wizards* Goes to the next parameter *In the text and numeric editor* Move the entry position to the right.

Ⓔ	**Enter key**
	In the operational display
	Pressing the key briefly opens the operating menu.
	In menu, submenu
	▪ Pressing the key briefly:
	  ▪ Opens the selected menu, submenu or parameter.
	  ▪ Starts the wizard.
	  ▪ If help text is open, closes the help text of the parameter.
	▪ Pressing the key for 2 s in a parameter:
	If present, opens the help text for the function of the parameter.
	In wizards
	Opens the editing view of the parameter and confirms the parameter value
	In the text and numeric editor
	▪ Pressing the key briefly confirms your selection.
	▪ Pressing the key for 2 s confirms your entry.

⊖ + ⊕	**Escape key combination (press keys simultaneously)**
	In menu, submenu
	▪ Pressing the key briefly:
	  ▪ Exits the current menu level and takes you to the next higher level.
	  ▪ If help text is open, closes the help text of the parameter.
	▪ Pressing the key for 2 s returns you to the operational display ("home position").
	In wizards
	Exits the wizard and takes you to the next higher level
	In the text and numeric editor
	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

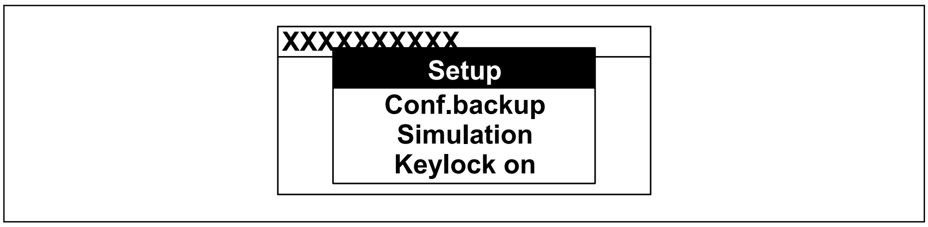
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- 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.



A0034608-EN

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

Calling up the menu via the context menu

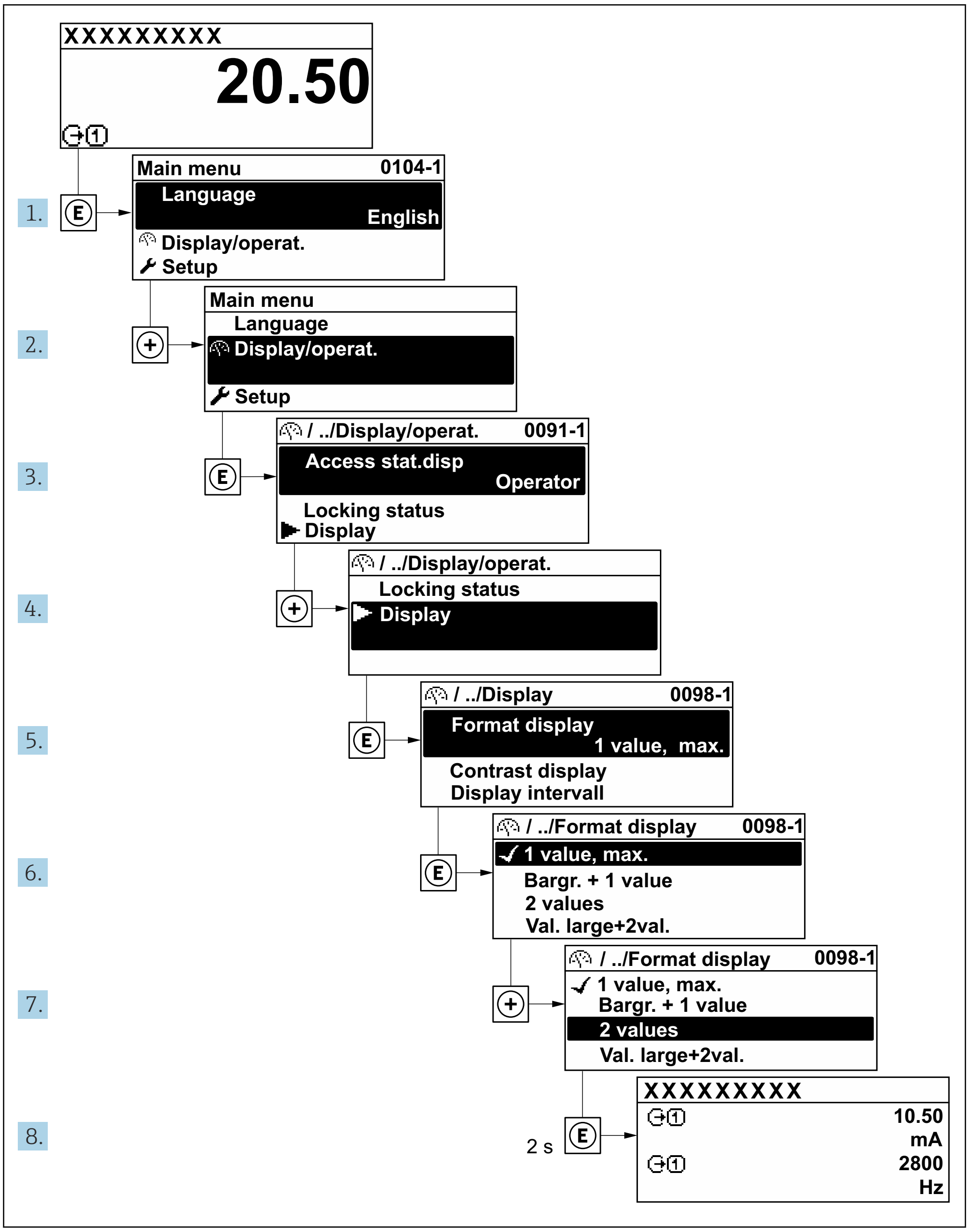
1. Open the context menu.
2. Press ⊞ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

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 → 52

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



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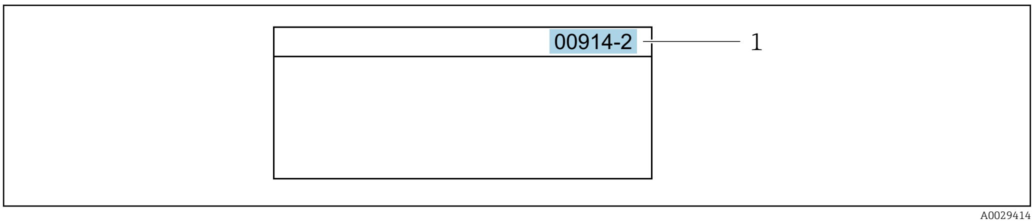
8.3.7 Calling the parameter directly

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

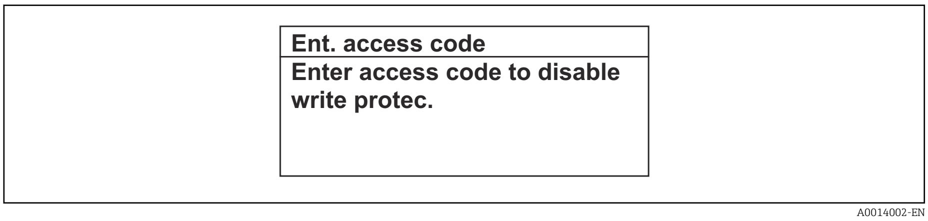
8.3.8 Calling up help text

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



21 *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

A0014049-EN

For a description of the editing view - consisting of the text editor and numeric editor - with symbols → 54, for a description of the operating elements → 56

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 → 154.

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 → 154

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 → 154.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 128) via the respective access option.

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

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

8.3.12 Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

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

To activate the keylock manually:

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

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

Switching off the keypad lock

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

8.4 Access to operating menu via web browser

8.4.1 Function range

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

Access to the network is required for the Ethernet-APL connection.

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. → 🗎 315

8.4.2 Requirements

Computer hardware

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

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

Computer software

Software	Interface	
	CDI-RJ45	WLAN

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

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

Computer settings

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

In the event of connection problems: → 207

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 → 📖 67

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 → 📖 67

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 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)

The IP address can be assigned to the measuring device in a variety of ways:
- Software addressing:
  The IP address is entered via the **IP address** parameter (→ 📖 92) .
- DIP switch for "Default IP address":
  To establish the network connection via the service interface (CDI-RJ45): the fixed IP address 192.168.1.212 is used .

To establish a network connection via the service interface (CDI-RJ45): set the "Default IP address" DIP switch to **ON**. The measuring device then has the fixed IP address: 192.168.1.212. The fixed IP address 192.168.1.212 can now be used to establish the connection to the network.

1. Via DIP switch 2, activate the default IP address 192.168.1.212: .
2. Switch on the measuring device.

3. Connect the computer to the RJ45 plug via the standard Ethernet cable → 📄 69.
4. 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.
5. Close any open Internet browsers.
6. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

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

Via WLAN interface

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

Note the following to avoid a network conflict:

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

Preparing the mobile terminal

▶ Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH__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.

ℹ The serial number can be found on the nameplate.

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

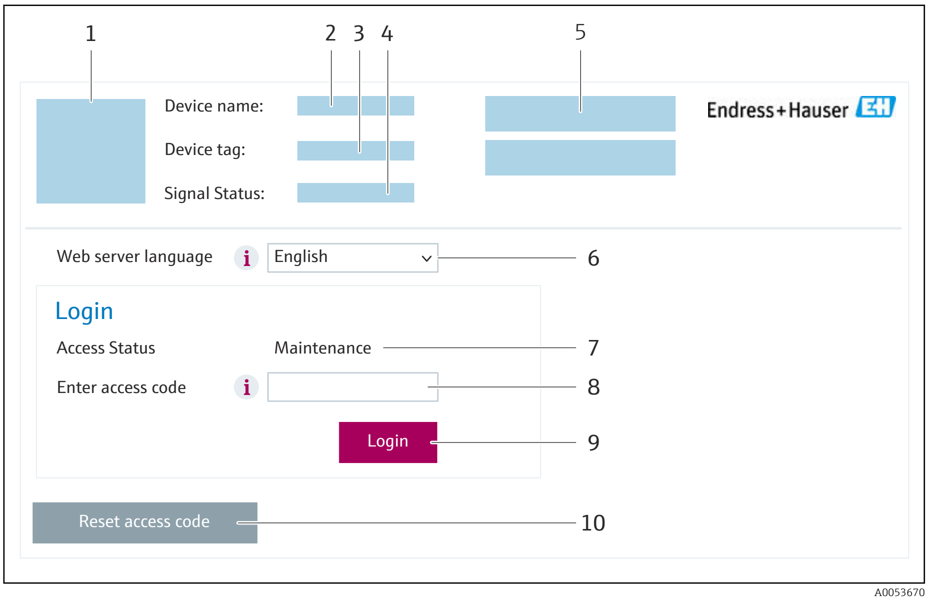
Terminating the WLAN connection

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

Starting the web browser

1. Start the web browser on the computer.

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



1 Picture of device
2 Device name
3 Device tag
4 Status signal
5 Current measured values
6 Operating language
7 User role
8 Access code
9 Login
10 Reset access code (→ 🗎 149)

If a login page does not appear, or if the page is incomplete → 🗎 207

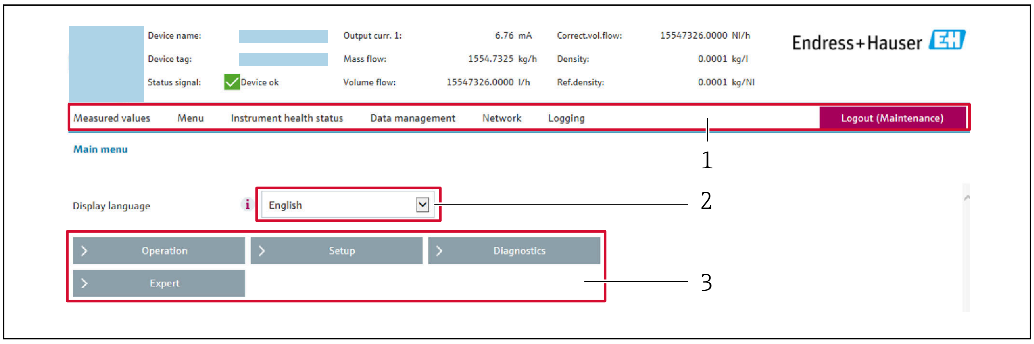
8.4.4 Logging on

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

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

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

8.4.5 User interface



A0029418

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

Header

The following information appears in the header:
- Device name
- Device tag
- Device status with status signal → 📄 213
- Current measured values

Function row

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

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

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

Navigation area

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

Working area

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

8.4.6 Disabling the Web server

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

Navigation
"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	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) → 🗎 63.

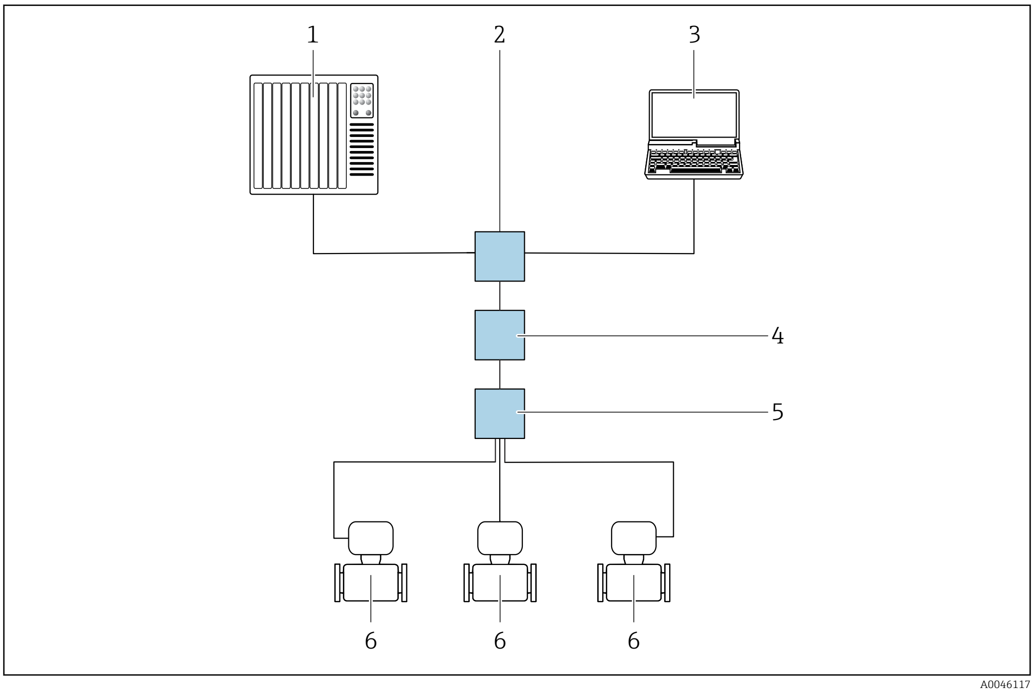
If communication with the web server was established via the default IP address 192.168.1.212, DIP switch no. 10 must be reset (from **ON** → **OFF**). Afterwards, the IP address of the device is active again for network communication.

8.5 Access to the operating menu via the operating tool

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

8.5.1 Connecting the operating tool

Via APL network



22 *Options for remote operation via APL network*

1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Ethernet switch, e.g. Scalance X204 (Siemens)*
3 *Computer with Web browser (e.g. Internet Explorer) for access to integrated Web server or computer with operating tool (e.g. FieldCare, DeviceCare with PROFINET COM DTM or SIMATIC PDM with FDI-Package)*
4 *APL power switch (optional)*
5 *APL field switch*
6 *Measuring device*

Service interface

Via service interface (CDI-RJ45)

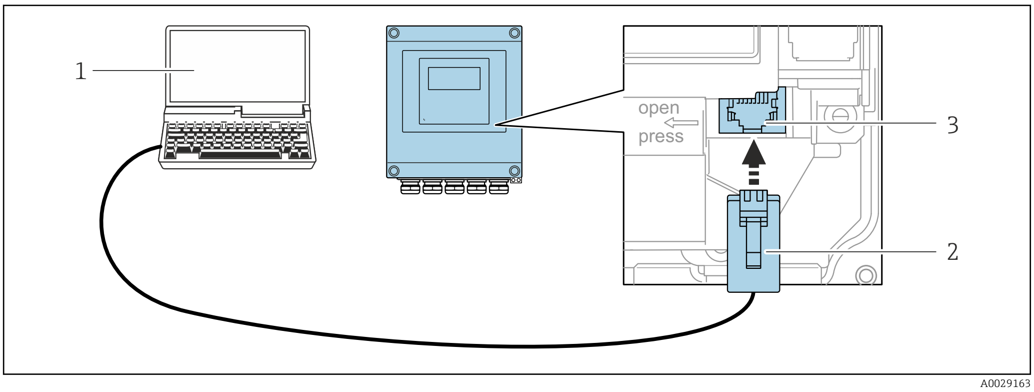
A point-to-point connection can be established to configure the device onsite. With the housing open, the connection is established directly via the service interface (CDI-RJ45) of the device.

An adapter for the RJ45 to the M12 plug 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 plug mounted in the cable entry. The connection to the service interface can be established via an M12 plug without opening the device.

Proline 500 – digital transmitter

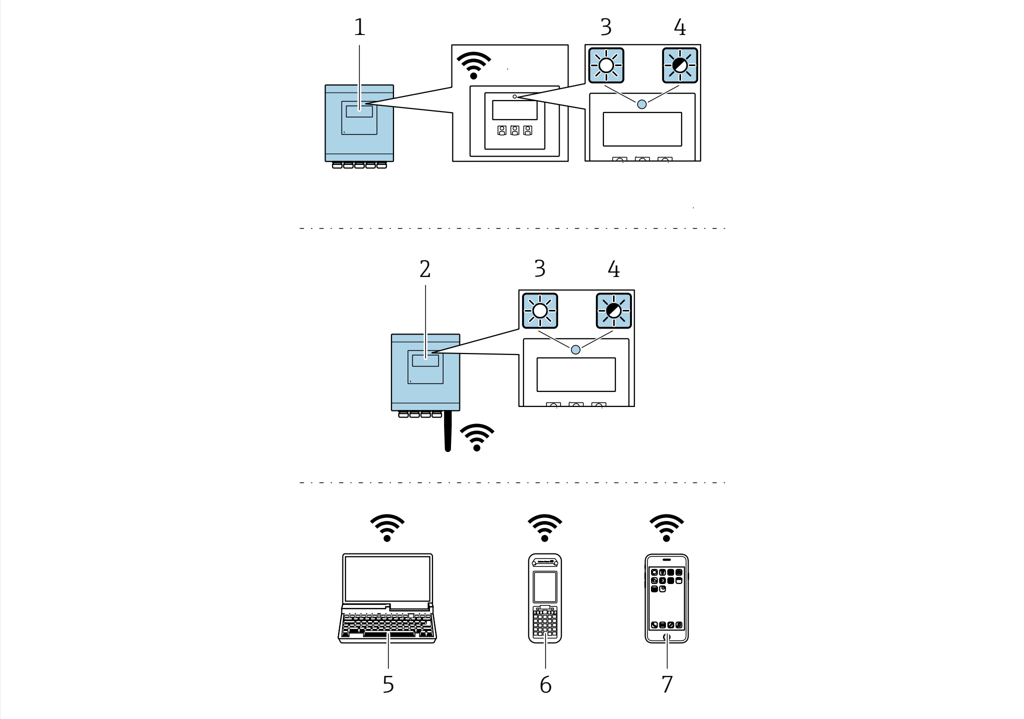


23 Connection via service interface (CDI-RJ45)

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

Via WLAN interface

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



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

Function	WLAN: IEEE 802.11 b/g (2.4 GHz)
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antennas	▪ Internal antenna ▪ External antenna (optional) In the event of poor transmission/reception conditions at the place of installation. Only 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 terminal

NOTICE

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

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

NOTICE

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

Preparing the mobile terminal

▶ Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH__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.

8.5.2 FieldCare

Function range

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

Access is via:
- CDI-RJ45 service interface → 📄 69
- WLAN interface → 📄 69

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 → 📄 74

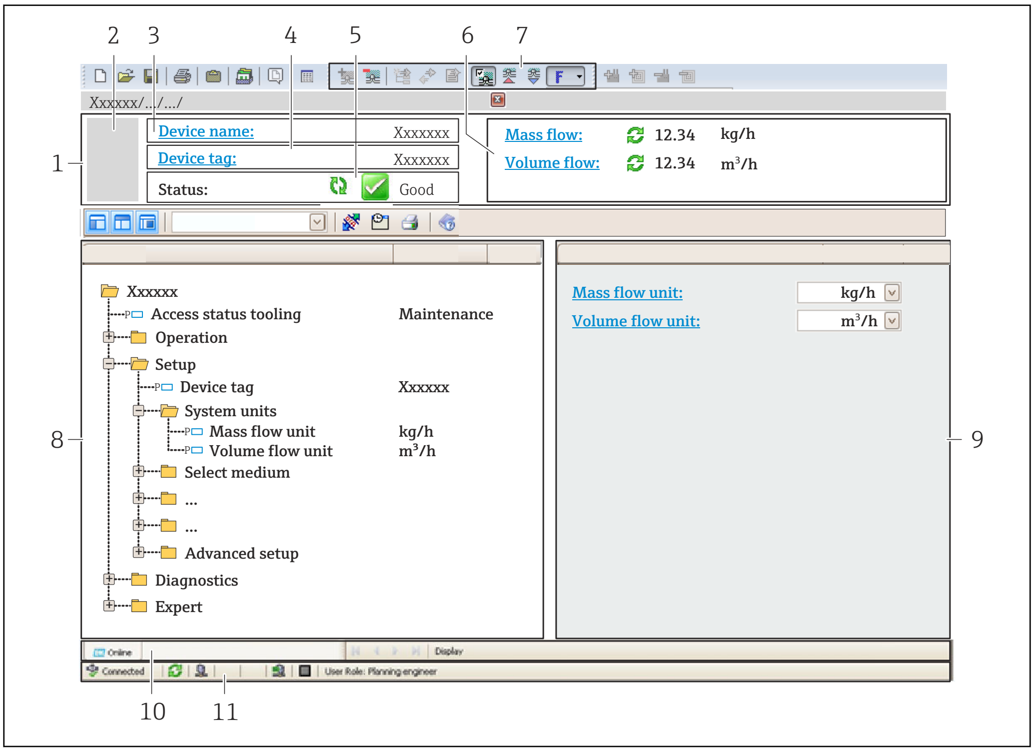
Establishing a connection

1. Start FieldCare and launch the project.

2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.
5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.
6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.
7. Establish the online connection to the device.

- Operating Instructions BA00027S
- Operating Instructions BA00059S

User interface



A0021051-EN

1 *Header*
2 *Picture of device*
3 *Device name*
4 *Device tag*
5 *Status area with status signal →* *213*
6 *Display area for current measured values*
7 *Editing toolbar with additional functions such as save/load, event list and create documentation*
8 *Navigation area with operating menu structure*
9 *Work area*
10 *Action area*
11 *Status area*

8.5.3 DeviceCare

Function range

Tool for connecting and configuring Endress+Hauser field devices.

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

Innovation brochure IN01047S

Source for device description files → 74

8.5.4 SIMATIC PDM

Function range

Standardized, vendor-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via the PROFINET protocol.

Source for device description files → 74

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.00.zz	▪ On the title page of the manual ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Manufacturer	17	Manufacturer Expert → Communication → Physical block → Manufacturer
Device ID	0xA43B	–
Device type ID	Promass 500	Device type Expert → Communication → Physical block → Device type
Device revision	1	–
PROFINET with Ethernet-APL version	2.43	Version of the PROFINET specification

For an overview of the various firmware versions for the device → 287

9.1.2 Operating tools

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

FieldCare	▪ www.endress.com → Downloads area ▪ USB stick (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	▪ www.endress.com → Downloads area ▪ CD–ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
SIMATIC PDM (Siemens)	www.endress.com → Downloads area

9.2 Device master file (GSD)

In order to integrate field devices into a bus system, PROFINET needs a description of the device parameters, such as output data, input data, data format and data volume.

These data are available in the device master file (GSD) which is provided to the automation system when the communication system is commissioned. In addition device bit maps, which appear as icons in the network structure, can also be integrated.

The device master file (GSD) is in XML format, and the file is created in the GSDML description markup language.

With the PA Profile 4.02 device master file (GSD) it is possible to exchange field devices made by different manufacturers without having to reconfigure.

The use of two different device master files (GSDs) is possible: the manufacturer-specific GSD and the PA-Profile GSD.

9.2.1 File name of the manufacturer-specific device master file (GSD)

Example of the name of a device master file:

GSDML	Description language
V2.43	Version of the PROFINET specification
EH	Endress+Hauser
300_500_APL	Transmitter
yyyymmdd	Date of issue (yyyy: year, mm: month, dd: day)
.xml	File name extension (XML file)

9.2.2 File name of the PA Profile device master file (GSD)

Example of the name of a PA Profile device master file:

GSDML-V2.43-PA_Profile_V4.02-B333-FLOW_CORIOLIS-yyyymmdd.xml

GSDML	Description language
V2.43	Version of the PROFINET specification
PA_Profile_V4.02	Version of the PA Profile specification
B333	PA Profile device identification
FLOW	Product family
CORIOLIS	Flow measuring principle
yyyymmdd	Date of issue (yyyy: year, mm: month, dd: day)
.xml	File name extension (XML file)

API	Supported modules	Input and output variables
0x9700	Analog input	Mass flow
	Analog input	Density
	Analog input	Temperature
	Totalizer	Totalizer value: mass/mass Totalizer control

Source for device master files (GSD):

Manufacturer-specific GSD:	www.endress.com → Download Area
PA Profile GSD:	https://www.profibus.com/products/gsd-files/gsd-library-profile-for-process-control-devices-version-40 → Download Area

9.3 Cyclic data transmission

9.3.1 Overview of the modules

The following graphic shows which modules are available to the device for cyclic data transfer. Cyclic data transfer is performed with an automation system.

Measuring device			Sub-slot	Direction Data flow	Control system
API	Modules	Slot			
0x9700	Analog Input 1 (Mass flow)	1	1	→	PROFINET
	Analog Input 2 (Density)	2	1	→	
	Analog Input 3 (Temperature)	3	1	→	
	Analog Input 4	20	1	→	
	Analog Input 5	21	1	→	
	Analog Input 6	22	1	→	
	Analog Input 7	23	1	→	
	Analog Input 8	24	1	→	
	Analog Input 9	25	1	→	
	Analog Input 10	26	1	→	
	Analog Input 11	27	1	→	
	Analog Input 12	28	1	→	
	Analog Input 13	29	1	→	
	Analog Input 14	30	1	→	
	Analog Input 15	31	1	→	
	Analog Input 16	32	1	→	
	Totalizer 1 (Mass)	4	1	→ ←	
	Totalizer 2	70	1	→ →	
	Totalizer 3	71	1	→ ←	
	Binary Input 1 (Heartbeat)	80	1	→	
	Binary Input 2	81	1	→	
	Analog Output 1 (Pressure)	160	1	←	
	Analog Output 2 (Temperature)	161	1	←	
	Analog Output 3 (Ref. density)	162	1	←	
	Analog Output 4 (% Sediment and water)	163	1	←	
	Analog Output 5 (Water cut percentage)	164	1	←	
	Analog Output 6 (Appl. Spec. out 0)	165	1	←	
	Analog Output 7 (Appl. Spec. out 1)	166	1	←	
	Binary Output 1 (Heartbeat)	210	1	→	
	Binary Output 2	211	1	←	
	Enumerated Output	240	1	←	

9.3.2 Description of the modules

The data structure is described from the perspective of the automation system:
- Input data: Are sent from the measuring device to the automation system.
- Output data: Are sent from the automation system to the measuring device.

Analog Input module

Transmit input variables from the measuring device to the automation system.

Analog Input modules cyclically transmit the selected input variables, including the status, from the measuring device to the automation system. The input variable is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Selection: input variable

Slot	Sub-slot	Input variables
1	1	Mass flow
2	1	Density
3	1	Temperature
20…32	1	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature ▪ Electronics temperature ▪ Oscillation frequency ▪ Frequency fluctuation ▪ Oscillation damping ▪ Tube damping fluctuation ▪ Signal asymmetry ▪ Exciter current ▪ Application-specific output 0 ▪ Application-specific output 1 ▪ Index inhomogeneous medium ▪ Index suspended bubbles ▪ Index sensor asymmetry ▪ Current output 1 ▪ Current output 2 ▪ Current output 3 **Additional input variables with the Heartbeat Verification application package** ▪ Carrier pipe temperature ▪ Oscillation damping 1 ▪ Oscillation frequency 1 ▪ Oscillation amplitude 0 ▪ Oscillation amplitude 1 ▪ Frequency fluctuation 1 ▪ Tube damping fluctuation 1 ▪ Exciter current 1 ▪ HBSI **Additional input variables with the Concentration Measurement application package** ▪ Concentration ▪ Target mass flow ▪ Carrier mass flow ▪ Target volume flow ▪ Carrier volume flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow

Data structure

Output data of Analog Output

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1]

1) Status coding → 🗎 85

Application-specific Input module

Transmit compensation values from the measuring device to the automation system.

The Application-specific Input module cyclically transmits compensation values, including the status, from the measuring device to the automation system. The compensation value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the compensation value.

Assigned compensation values

The configuration is performed via: Expert → Application → Application specific calculations → Process variables

Slot	Compensation value
20…32	Application-specific Input module 0
20…32	Application-specific Input module 1

Data structure

Input data of Application-specific Input module

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1]

1) Status coding → 🗎 85

Binary input module

Transmit binary input variables from the measuring device to the automation system.

Binary input variables are used by the measuring device to transmit the state of device functions to the automation system.

Binary Input modules cyclically transmit discrete input variables, including the status, from the measuring device to the automation system. The discrete input variable is depicted in the first byte. The second byte contains standardized status information pertaining to the input variable.

Selection: device function, binary input, slot 80

<table>
<tr><th>Slot</th><th>Sub-slot</th><th>Bit</th><th>Device function</th><th>Status (meaning)</th></tr>
<tr><td rowspan="5">80</td><td rowspan="5">1</td><td>0</td><td>Verification was not performed.</td><td rowspan="5">▪ 0 (device function not active)
▪ 1 (device function active)</td></tr>
<tr><td>1</td><td>The device has failed the verification.</td></tr>
<tr><td>2</td><td>Currently performing verification.</td></tr>
<tr><td>3</td><td>Verification ended.</td></tr>
<tr><td>4</td><td>The device has failed the verification.</td></tr>
</table>

Slot	Sub-slot	Bit	Device function	Status (meaning)
		5	Verification carried out successfully.	
		6	Verification was not performed.	
		7	Reserved	

Selection: device function, binary input, slot 81

Slot	Sub-slot	Bit	Device function	Status (meaning)
81	1	0	Partially filled pipe detection	▪ 0 (device function not active) ▪ 1 (device function active)
		1	Low flow cut off	
		2	Reserved	
		3	Reserved	
		4	Reserved	
		5	Reserved	
		6	Reserved	
		7	Reserved	

Data structure

Input data of Binary Input

Byte 1	Byte 2
Binary Input	Status [1]

1) Status coding → 📄 85

Mass module

Transmit mass counter value from the measuring device to the automation system.

The Mass module cyclically transmits the mass, including the status, from the measuring device to the automation system. The totalizer value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Selection: input variable

Slot	Sub-slot	Input variables
4	1	Mass

Data structure

Volume input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1]

1) Status coding → 📄 85

Mass Totalizer Control module

Transmit totalizer value from the measuring device to the automation system.

The Mass Totalizer Control module cyclically transmits a selected totalizer value, including the status, from the measuring device to the automation system. The totalizer value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Selection: input variable

Slot	Sub-slot	Input variable
4	1	Mass

Data structure

Mass Totalizer Control input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1]

1) Status coding → 85

Selection: output variable

Transmit the control value from the automation system to the measuring device.

Slot	Sub-slot	Value	Input variable
70…71	1	1	Reset to "0"
		2	Preset value
		3	Stop
		4	Totalize

Data structure

Mass Totalizer Control output data

Byte 1
Control variable

Totalizer module

Transmit totalizer value from the measuring device to the automation system.

The Totalizer module cyclically transmits a selected totalizer value, including the status, from the measuring device to the automation system. The totalizer value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Selection: input variable

Slot	Sub-slot	Input variable
70 to 71	1	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow [1)] ▪ Carrier mass flow ▪ Target volume flow ▪ Carrier volume flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ GSV flow alternative ▪ NSV flow ▪ NSV alternative flow ▪ S&W volume flow ▪ Oil mass flow ▪ Water mass flow ▪ Oil volume flow ▪ Water volume flow ▪ Oil corrected volume flow ▪ Raw value mass flow

1) Only available with the Concentration application package

Data structure

Totalizer input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1)]

1) Status coding → 🖹 85

Totalizer Control module

Transmit totalizer value from the measuring device to the automation system.

The Totalizer Control module cyclically transmits a selected totalizer value, including the status, from the measuring device to the automation system. The totalizer value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Selection: input variable

Slot	Sub-slot	Input variable
70 to 71	1	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow [1] ▪ Carrier mass flow ▪ Target volume flow ▪ Carrier volume flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ GSV flow [2] ▪ Alternative GSD flow [2] ▪ NSV flow [2] ▪ Alternative NSV flow [2] ▪ S&W volume flow [2] ▪ Oil mass flow [2] ▪ Water mass flow [2] ▪ Oil volume flow [2] ▪ Water volume flow [2] ▪ Oil corrected volume flow [2] ▪ Raw value mass flow [2]

1) Only available with the Concentration application package
2) Only available with the Petroleum application package

Data structure

Totalizer Control input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1]

1) Status coding → 📄 85

Selection: output variable

Transmit the control value from the automation system to the measuring device.

Slot	Sub-slot	Value	Input variable
70 to 71	1	1	Reset to "0"
		2	Preset value
		3	Stop
		4	Totalize

Data structure

Totalizer Control output data

Byte 1
Control variable

Analog Output module

Transmit a compensation value from the automation system to the measuring device.

Analog Output modules cyclically transmit compensation values, including the status and associated unit, from the automation system to the measuring device. The compensation value is depicted in the first four bytes in the form of a floating point number as per the

IEEE 754 standard. The fifth byte contains standardized status information pertaining to the compensation value.

Assigned compensation values

The selection is made via: Expert → Sensor → External compensation

Slot	Sub-slot	Compensation value
160	1	Pressure
161		Temperature
162		Reference density
163		External value for % S&W (sediment and water) [1]
164		External value for % Water cut [1]
165		Appl. Spec. Outp. 0
166		Appl. Spec. Outp. 1

1) Only available with the Petroleum application package.

Data structure

Output data of Analog Output

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status [1]

1) Status coding → 85

Failsafe mode

A failsafe mode can be defined for using the compensation values.

If the status is GOOD or UNCERTAIN, the compensation values transmitted by the automation system are used. If the status is BAD, the failsafe mode is activated for the use of the compensation values.

Parameters are available per compensation value to define the failsafe mode: Expert → Sensor → External compensation

Fail safe type parameter

- Fail safe value option: The value defined in the Fail safe value parameter is used.
- Fallback value option: The last valid value is used.
- Off option: The failsafe mode is disabled.

Fail safe value parameter

Use this parameter to enter the compensation value which is used if the Fail safe value option is selected in the Fail safe type parameter.

Binary output module

Transmit binary output values from the automation system to the measuring device.

Binary output values are used by the automation system to enable and disable device functions.

Binary output values cyclically transmit discrete output values, including the status, from the automation system to the measuring device. The discrete output values are transmitted in the first byte. The second byte contains standardised status information pertaining to the output value.

Selection: device function, binary output, slot 210

Slot	Sub-slot	Bit	Device function	Status (meaning)
210	1	0	Start the verification.	A change of status from 0 to 1 starts the Heartbeat Verification [1]
		1	Reserved	
		2	Reserved	
		3	Reserved	
		4	Reserved	
		5	Reserved	
		6	Reserved	
		7	Reserved	

1) Only available with the Heartbeat application package

Selection: device function, binary output, slot 211

Slot	Sub-slot	Bit	Device function	Status (meaning)
211	1	0	Flow override	▪ 0 (disable device function) ▪ 1 (enable device function)
		1	Zero adjust	
		2	Relay output	Relay output value: ▪ 0 ▪ 1
		3	Relay output	
		4	Relay output	
		5	Reserved	
		6	Reserved	
		7	Reserved	

Data structure

Binary Output input data

Byte 1	Byte 2
Binary Output	Status [1] [2]

1) Status coding → 📄 85
2) If the status is BAD, the control variable is not adopted.

Concentration module

ℹ Only available with the Concentration Measurement application package.

Assigned device functions

Slot	Input variables
240	Selection of the liquid type

Data structure

Concentration output data

Byte 1
Control variable

Liquid type	Enum code
Off	0
Sucrose in water	5
Glucose in water	2
Fructose in water	1
Invert sugar in water	6
Corn syrup HFCS42	15
Corn syrup HFCS55	16
Corn syrup HFCS90	17
Original wort	18
Ethanol in water	11
Methanol in water	12
Hydrogen peroxide in water	4
Hydrochloric acid	24
Sulfuric acid	25
Nitric acid	7
Phosphoric acid	8
Sodium hydroxide	10
Potassium hydroxide	9
Ammonium nitrate in water	13
Iron(III) chloride in water	14
% mass / % volume	19
User Profile Coef Set No. 1	21
User Profile Coef Set No. 2	22
User Profile Coef Set No. 3	23

9.3.3 Status coding

Status	Coding (hex)	Meaning
BAD - Maintenance alarm	0x24 to 0x27	A measured value is not available because a device error has occurred.
BAD - Process related	0x28 to 0x2B	A measured value is not available because the process conditions are not within the device's technical specification limits.
BAD - Function check	0x3C to 0x03F	A function check is active (e.g. cleaning or calibration)
UNCERTAIN - Initial value	0x4F to 0x4F	A predefined value is output until a correct measured value is available again or corrective measures have been performed that change this status.

Status	Coding (hex)	Meaning
UNCERTAIN - Maintenance demanded	0x68 to 0x6B	Signs of wear and tear have been detected on the measuring device. Short-term maintenance is needed to ensure that the measuring device remains operational. The measured value might be invalid. The use of the measured value depends on the application.
UNCERTAIN - Process related	0x78 to 0x7B	The process conditions are not within the device's technical specification limits. This could have a negative impact on the quality and accuracy of the measured value. The use of the measured value depends on the application.
GOOD - OK	0x80 to 0x83	No error has been diagnosed.
GOOD - Maintenance required	0xA4 to 0xA7	The measured value is valid. The device will require servicing in the near future.
GOOD - Maintenance demanded	0xA8 to 0xAB	The measured value is valid. It is highly advisable to service the device in the near future.
GOOD - Function check	0xBC to 0XBF	The measured value is valid. The measuring device is performing an internal function check. The function check does not have any noticeable effect on the process.

9.3.4 Factory setting

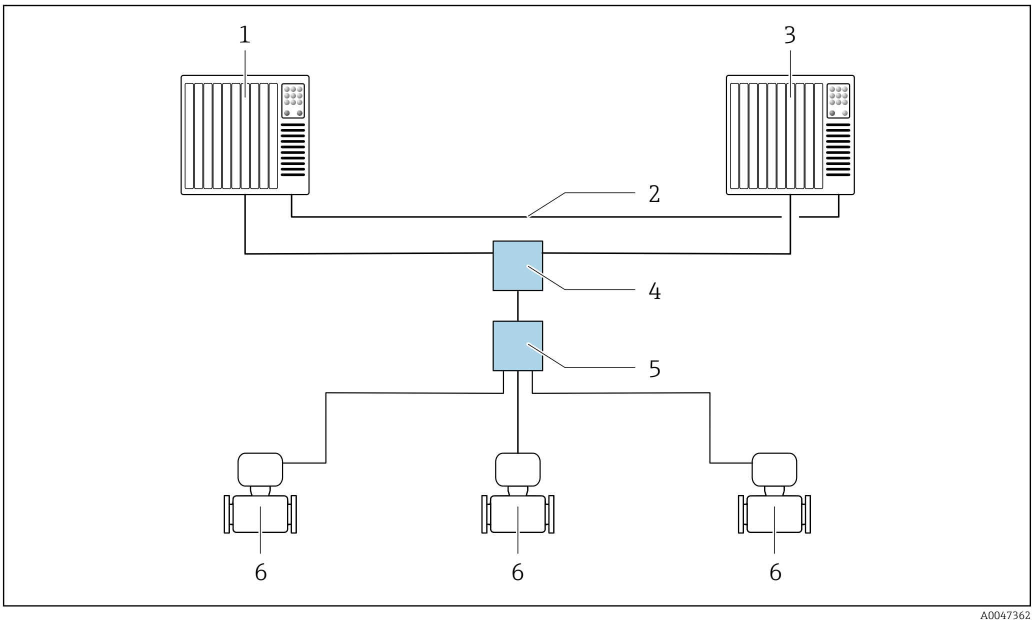
The slots are already assigned in the automation system for initial commissioning.

Assigned slots

Slot	Factory setting
1	Mass flow
2	Density
3	Temperature
4	Mass
20 to 32	–
70 to 71	–
80 to 81	–
160 to 166	–
210 to 211	–
240	–

9.4 System redundancy S2

A redundant layout with two automation systems is necessary for processes that are in continuous operation. If one system fails the second system guarantees continued, uninterrupted operation. The measuring device supports S2 system redundancy and can communicate with both automation systems simultaneously.



24 Example of the layout of a redundant system (S2): star topology

1 Automation system 1
2 Synchronization of automation systems
3 Automation system 2
4 Industrial Ethernet Managed Switch
5 APL field switch
6 Measuring device

All the devices in the network must support S2 system redundancy.

10 Commissioning

10.1 Post-mounting and post-connection check

Before commissioning the device:

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

- Checklist for "Post-mounting" check→ 📄 28
- Checklist for "Post-connection check" → 📄 46

10.2 Switching on the measuring device

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

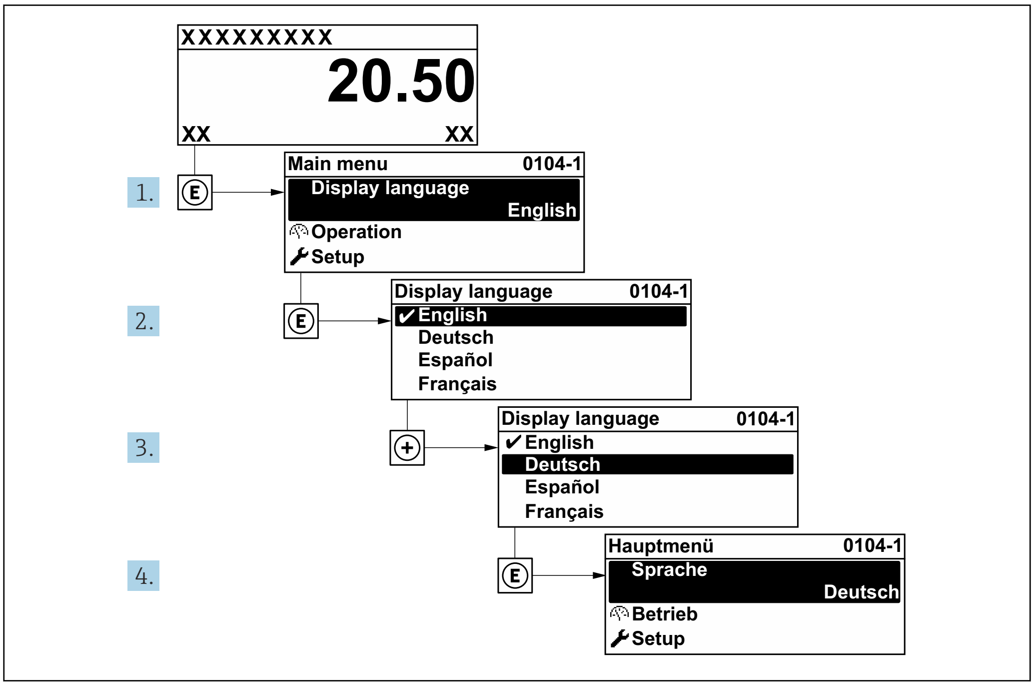
If nothing appears on the local display or if a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 📄 206.

10.3 Connecting via FieldCare

- For connecting FieldCare → 📄 69
- For connecting via FieldCare → 📄 71
- For user interface of FieldCare → 📄 72

10.4 Setting the operating language

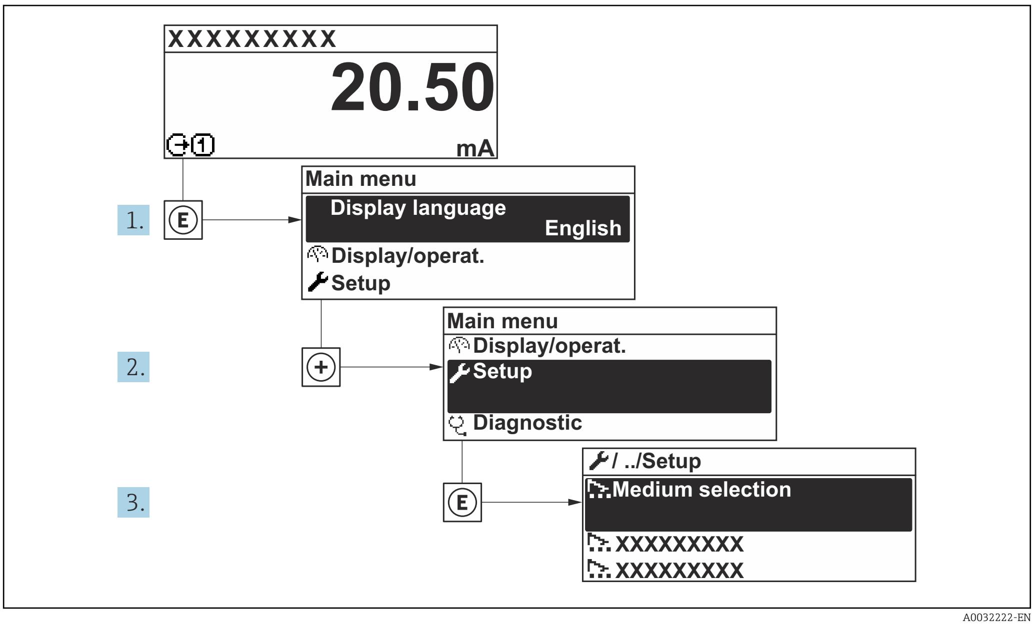
Factory setting: English or ordered local language



25 *Taking the example of the local display*

10.5 Configuring the measuring device

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



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

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

Setup	
PROFINET device name	→ 90
▶ **Communication**	→ 90
▶ **System units**	→ 92
▶ **Medium selection**	→ 95
▶ **Analog inputs**	→ 96
▶ **I/O configuration**	→ 99
▶ **Current input 1 to n**	→ 100
▶ **Status input 1 to n**	→ 101
▶ **Current output 1 to n**	→ 101
▶ **Pulse/frequency/switch output 1 to n**	→ 106

10.5.1 Defining the tag name

A measuring point can be quickly identified within a plant on the basis of the tag name. The tag name is equivalent to the device name (name of station) of the PROFINET specification (data length: 255 bytes)

The device name can be changed via DIP switches or the automation system .

The device name currently used is displayed in the **Name of station** parameter.

Navigation
"Setup" menu → PROFINET device name

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
PROFINET device name	Name of the measuring point.	Max. 32 characters such as letters and numbers.	EH-PROMASS500 serial number of the device

10.5.2 Displaying the communication interface

The **Communication** submenu shows all the current parameter settings for selecting and configuring the communication interface.

Navigation
"Setup" menu → Communication

"APL port" submenu

Navigation
"Setup" menu → Communication → APL port

▶ APL port	
IP address (7263)	→ 📄 91
Subnet mask (7265)	→ 📄 91
Default gateway (7264)	→ 📄 91
MAC address (7262)	→ 📄 91

Parameter overview with brief description

Parameter	Description	User entry / User interface	Factory setting
IP address	Enter the IP address of the measuring device.	Character string comprising numbers, letters and special characters (15)	0.0.0.0
Default gateway	Enter IP address for the default gateway of the measuring device.	Character string comprising numbers, letters and special characters (15)	0.0.0.0
Subnet mask	Enter subnet mask of the measuring device.	Character string comprising numbers, letters and special characters (15)	255.255.255.0
MAC address	Shows the MAC address of the measuring device.	Character string comprising numbers, letters and special characters	

"Service interface" submenu

Navigation
"Setup" menu → Communication → Service interface

▶ Service interface	
IP address (7209)	→ 📄 92
Subnet mask (7211)	→ 📄 92
Default gateway (7210)	→ 📄 92
MAC address (7214)	→ 📄 92

Parameter overview with brief description

Parameter	Description	User entry / User interface	Factory setting
IP address	Enter the IP address of the measuring device.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
Subnet mask	Displays the subnet mask.	4 octet: 0 to 255 (in the particular octet)	255.255.255.0
Default gateway	Displays the default gateway.	4 octet: 0 to 255 (in the particular octet)	0.0.0.0
MAC address	Displays the MAC address of the measuring device. MAC = Media Access Control	Unique 12-digit character string comprising letters and numbers, e.g.: 00:07:05:10:01:5F	Each measuring device is given an individual address.

"Network diagnostics" submenu

Navigation
"Setup" menu → Communication → Network diagnostics

▶ **Network diagnostics**	
Mean squared error (7258)	→ 92
Number of failed received packets (7257)	→ 92

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Mean squared error	Provides an indication of the link signal quality.	Signed floating-point number	0 dB
Number of failed received packets	Shows the number of failed received packets.	0 to 65535	0

10.5.3 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	→ 93
Mass unit	→ 93

Volume flow unit	→ 📄 93
Volume unit	→ 📄 93
Corrected volume flow unit	→ 📄 93
Corrected volume unit	→ 📄 93
Density unit	→ 📄 93
Reference density unit	→ 📄 94
Density 2 unit	→ 📄 94
Temperature unit	→ 📄 94
Pressure unit	→ 📄 94

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Mass flow unit	Select mass flow unit. *Result* The selected unit applies to: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	kg/h
Mass unit	Select mass unit.	Unit choose list	Country-specific: ▪ kg ▪ lb
Volume flow unit	Select volume flow unit. *Result* 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. *Result* The selected unit applies to: **Corrected volume flow** parameter (→ 📄 159)	Unit choose list	Nl/h
Corrected volume unit	Select corrected volume unit.	Unit choose list	Country-specific: ▪ Nl ▪ Sft^3
Density unit	Select density unit. *Result* The selected unit applies to: ▪ Output ▪ Simulation process variable ▪ Density adjustment (**Expert** menu)	Unit choose list	kg/l

Parameter	Description	Selection	Factory setting
Reference density unit	Select reference density unit.	Unit choose list	kg/Nl
Density 2 unit	Select second density unit.	Unit choose list	Depends on country: ▪ kg/l ▪ lb/ft³
Temperature unit	Select temperature unit. *Result* The selected unit applies to: ▪ **Electronic temperature** parameter (6053) ▪ **Maximum value** parameter (6051) ▪ **Minimum value** parameter (6052) ▪ **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. *Result* The unit is taken from: ▪ **Pressure value** parameter (→ 🗎 95) ▪ **External pressure** parameter (→ 🗎 95) ▪ Pressure value	Unit choose list	bar

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	→ 🗎 95
Pressure compensation	→ 🗎 95
Pressure value	→ 🗎 95
External pressure	→ 🗎 95

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	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 external process pressure value.		–

* Visibility depends on order options or device settings

10.5.5 Configuration of the Analog Inputs

The **Analog inputs** submenu guides the user systematically to the individual **Analog input 1 to n** submenu. From here you get to the parameters of the individual analog input.

Navigation
"Setup" menu → Analog inputs

▶ Analog inputs		
	▶ Mass flow	→ 📄 96

"Analog inputs" submenu

Navigation
"Setup" menu → Analog inputs → Mass flow

▶ Mass flow		
	Assign process variable (11074)	→ 📄 98
	Damping (11073)	→ 📄 99

Parameter overview with brief description

Parameter	Description	User interface / User entry	Factory setting
Parent class		0 to 255	70

Parameter	Description	User interface / User entry	Factory setting
Assign process variable	Select a process variable.	▪ Mass flow ▪ Volume flow ▪ Density ▪ Temperature ▪ Carrier pipe temperature ▪ Electronics temperature ▪ Oscillation frequency 0 ▪ Oscillation frequency 1 ▪ Oscillation amplitude 0 ▪ Oscillation amplitude 1 ▪ Frequency fluctuation 0 ▪ Frequency fluctuation 1 ▪ Oscillation damping 0 ▪ Oscillation damping 1 ▪ Oscillation damping fluctuation 0 ▪ Oscillation damping fluctuation 1 ▪ Signal asymmetry ▪ Torsion signal asymmetry * ▪ Exciter current 0 ▪ Exciter current 1 ▪ HBSI ▪ Current input 1 ▪ Current input 2 ▪ Current input 3 ▪ Application specific output 0 ▪ Application specific output 1 ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ Test point 0 ▪ Test point 1 ▪ Sensor index coil asymmetry ▪ Raw value mass flow ▪ Corrected volume flow ▪ Target mass flow ▪ Carrier mass flow ▪ Target volume flow ▪ Carrier volume flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ 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 ▪ Concentration ▪ Dynamic viscosity ▪ Kinematic viscosity ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity	Mass flow

Parameter	Description	User interface / User entry	Factory setting
Damping	Enter time constant for input damping (PT1 element). Damping reduces the effect of fluctuations in the measured value on the output signal.	Positive floating-point number	1.0 s

* Visibility depends on order options or device settings

10.5.6 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	→ 🗎 99
I/O module 1 to n information	→ 🗎 99
I/O module 1 to n type	→ 🗎 99
Apply I/O configuration	→ 🗎 99
I/O alteration code	→ 🗎 99

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 ▪ PROFINET	–
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

10.5.7 Configuring the current input

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

Navigation
"Setup" menu → Current input

▸ **Current input 1 to n**

Terminal number	→ 📖 100
0/4 mA value	→ 📖 100
20 mA value	→ 📖 100
Current span	→ 📖 100
Failure mode	→ 📖 100
Failure value	→ 📖 100

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / User entry / Selection	Factory setting
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 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
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)	Country-specific: ▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA)
Failure mode	–	Define input behavior in alarm condition.	▪ Alarm ▪ Last valid value ▪ Defined value	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

10.5.8 Configuring the status input

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

Navigation
"Setup" menu → Status input 1 to n

▶ Status input 1 to n	
Assign status input	→ 📄 101
Terminal number	→ 📄 101
Active level	→ 📄 101
Terminal number	→ 📄 101
Response time status input	→ 📄 101
Terminal number	→ 📄 101

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

10.5.9 Configuring the current output

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

Navigation
"Setup" menu → Current output

▶ **Current output 1 to n**	
Terminal number	→ 📄 102
Signal mode	→ 📄 102
Process variable current output	→ 📄 103
Current range output	→ 📄 104
Lower range value output	→ 📄 104
Upper range value output	→ 📄 104
Fixed current	→ 📄 104
Damping current output	→ 📄 105
Failure behavior current output	→ 📄 105
Failure current	→ 📄 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 current output module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 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 (→ 🗎 104), 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 (→ 🗎 104), 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 (→ 🗎 104).	Defines the fixed output current.	0 to 22.5 mA	22.5 mA

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Damping current output	A process variable is selected in the **Assign current output** parameter (→ 🗎 103) and one of the following options is selected in the **Current span** parameter (→ 🗎 104): ▪ 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)	Set reaction time for output signal to fluctuations in the measured value.	0.0 to 999.9 s	1.0 s
Failure behavior current output	A process variable is selected in the **Assign current output** parameter (→ 🗎 103) and one of the following options is selected in the **Current span** parameter (→ 🗎 104): ▪ 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)	Define output behavior in alarm condition.	▪ 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

10.5.10 Configuring the pulse/frequency/switch output

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

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

▶ **Pulse/frequency/switch output 1 to n**	
Operating mode	→ 📖 106

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	→ 📖 107
Terminal number	→ 📖 107
Signal mode	→ 📖 107
Assign pulse output	→ 📖 107
Pulse scaling	→ 📖 107
Pulse width	→ 📖 107
Failure mode	→ 📖 108
Invert output signal	→ 📖 108

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 (→ 🖹 106) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 107).	Enter quantity for measured value at which a pulse is output.	Positive floating point number	Depends on country and nominal diameter
Pulse width	The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 106) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 107).	Define time width of the output pulse.	0.05 to 2 000 ms	100 ms

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Failure mode	The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 106) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 107).	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	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	→ 🖹 109
Terminal number	→ 🖹 109
Signal mode	→ 🖹 109
Assign frequency output	→ 🖹 110
Minimum frequency value	→ 🖹 111
Maximum frequency value	→ 🖹 111
Measuring value at minimum frequency	→ 🖹 111
Measuring value at maximum frequency	→ 🖹 111
Failure mode	→ 🖹 112
Failure frequency	→ 🖹 112
Invert output signal	→ 🖹 112

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 (→ 📄 106).	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 (→ 🗎 106) and a process variable is selected in the **Assign frequency output** parameter (→ 🗎 110).	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 (→ 🗎 106) and a process variable is selected in the **Assign frequency output** parameter (→ 🗎 110).	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 (→ 🗎 106) and a process variable is selected in the **Assign frequency output** parameter (→ 🗎 110).	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 (→ 🗎 106) and a process variable is selected in the **Assign frequency output** parameter (→ 🗎 110).	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 (→ 🗎 106) and a process variable is selected in the **Assign frequency output** parameter (→ 🗎 110).	Define output behavior in alarm condition.	▪ Actual value ▪ Defined value ▪ 0 Hz	0 Hz
Failure frequency	In the **Operating mode** parameter (→ 🗎 106), the **Frequency** option is selected, in the **Assign frequency output** parameter (→ 🗎 110) 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	→ 🗎 113
Terminal number	→ 🗎 113
Signal mode	→ 🗎 113
Switch output function	→ 🗎 114
Assign diagnostic behavior	→ 🗎 114
Assign limit	→ 🗎 115
Assign flow direction check	→ 🗎 116
Assign status	→ 🗎 116
Switch-on value	→ 🗎 116
Switch-off value	→ 🗎 116
Switch-on delay	→ 🗎 116
Switch-off delay	→ 🗎 116
Failure mode	→ 🗎 116
Invert output signal	→ 🗎 116

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.	Select diagnostic behavior for switch output.	▪ 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 process variable for limit function.	▪ 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 device status for switch output.	▪ Partially filled pipe detection ▪ Low flow cut off ▪ Binary output * ▪ Binary output * ▪ Binary output *	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 measured value for the switch-on point.	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 measured value for the switch-off point.	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.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Switch-off delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

10.5.11 Configuring the relay output

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

Navigation

"Setup" menu → Relay output 1 to n

▶ **Relay output 1 to n**	
Terminal number	→ 🗎 117

Relay output function	→ 📄 117
Assign flow direction check	→ 📄 117
Assign limit	→ 📄 118
Assign diagnostic behavior	→ 📄 118
Assign status	→ 📄 119
Switch-off value	→ 📄 119
Switch-off delay	→ 📄 119
Switch-on value	→ 📄 119
Switch-on delay	→ 📄 119
Failure mode	→ 📄 119
Switch state	→ 📄 119
Powerless relay status	→ 📄 119

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 process variable for limit function.	▪ 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
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select device status for switch output.	▪ Partially filled pipe detection ▪ Low flow cut off ▪ Binary output * ▪ Binary output * ▪ Binary output *	Partially filled pipe detection
Switch-off value	The **Limit** option is selected in the **Relay output function** parameter.	Enter measured value for the switch-off point.	Signed floating-point number	Depends on country: ▪ 0 kg/h ▪ 0 lb/min
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-off of status output.	0.0 to 100.0 s	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.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open
Switch state	–	Shows the current relay switch status.	▪ Open ▪ Closed	–
Powerless relay status	–	Select quiescent state for relay.	▪ Open ▪ Closed	Open

* 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 configured for configuring the local display.

Navigation
"Setup" menu → Display

▶ Display	
Format display	→ 🗎 121
Value 1 display	→ 🗎 122
0% bargraph value 1	→ 🗎 123
100% bargraph value 1	→ 🗎 123
Value 2 display	→ 🗎 123
Value 3 display	→ 🗎 123
0% bargraph value 3	→ 🗎 123

100% bargraph value 3	→ 📄 124
Value 4 display	→ 📄 124
Value 5 display	→ 📄 124
Value 6 display	→ 📄 124
Value 7 display	→ 📄 124
Value 8 display	→ 📄 124

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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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	→ 🗎 125
On value low flow cutoff	→ 🗎 125
Off value low flow cutoff	→ 🗎 125
Pressure shock suppression	→ 🗎 125

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 (→ 🗎 125).	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 (→ 🗎 125).	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 (→ 🗎 125).	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 Configuring partially filled pipe detection

The **Partial 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	→ 🗎 126
Low value partial filled pipe detection	→ 🗎 126
High value partial filled pipe detection	→ 🗎 126
Response time part. filled pipe detect.	→ 🗎 126

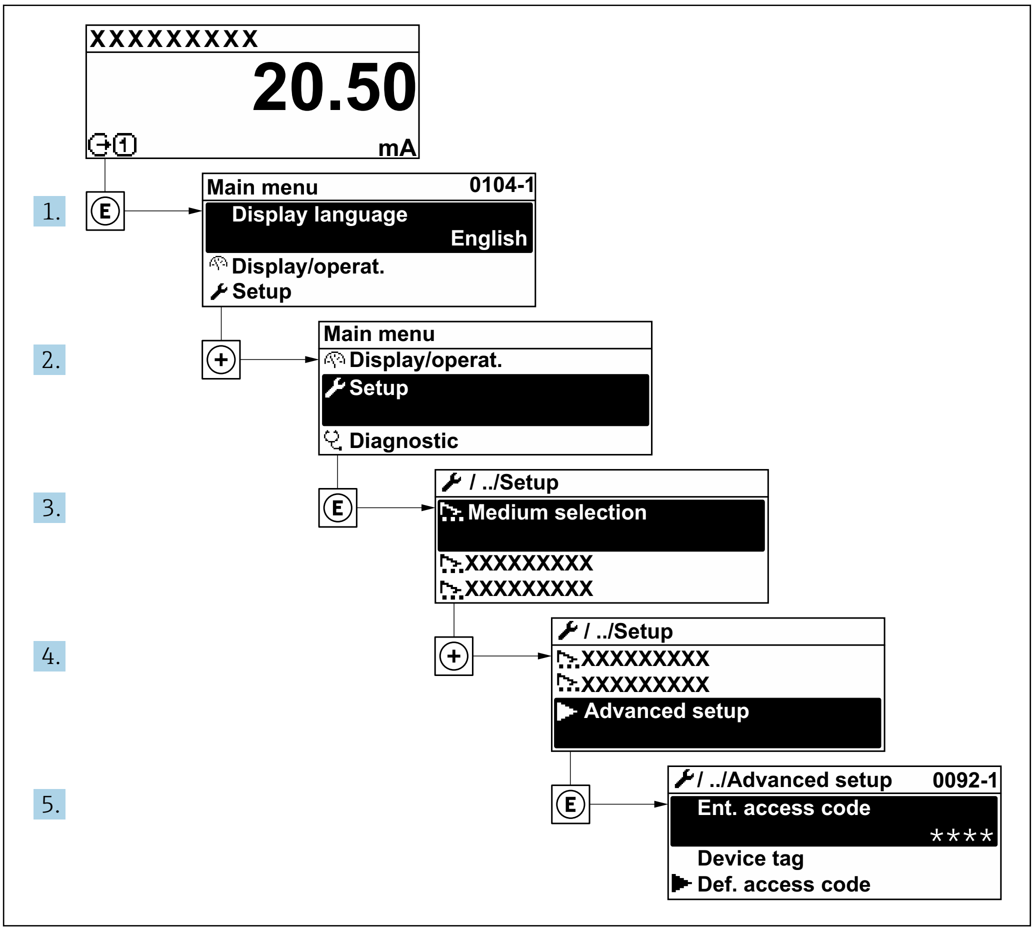
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for partially filled pipe detection.	▪ Off ▪ Density ▪ Calculated reference density	Off
Low value partial filled pipe detection	A process variable is selected in the **Assign process variable** parameter (→ 🗎 126).	Enter lower limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Depends on country: ▪ 200 kg/m^3 ▪ 12.5 lb/ft^3
High value partial filled pipe detection	A process variable is selected in the **Assign process variable** parameter (→ 🗎 126).	Enter upper limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Depends on country: ▪ 6 000 kg/m^3 ▪ 374.6 lb/ft^3
Response time part. filled pipe detect.	A process variable is selected in the **Assign process variable** parameter (→ 🗎 126).	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



A0032223-EN

The number of submenus can vary depending on the device version. Some submenus are not dealt with in the Operating Instructions. These submenus and the parameters they contain are explained in the Special Documentation for the device.

Navigation
"Setup" menu → Advanced setup

▶ **Advanced setup**	
Enter access code (0003)	→ 📄 128
▶ **Calculated values**	→ 📄 128
▶ **Sensor adjustment**	→ 📄 129
▶ **Totalizer 1 to n**	→ 📄 135
▶ **Display**	→ 📄 138

▶ WLAN settings	→ 📄 145
▶ Configuration backup	→ 📄 147
▶ Administration	→ 📄 148

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	→ 📄 128

"Corrected volume flow calculation" submenu

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

▶ Corrected volume flow calculation	
Select reference density (1812)	→ 📄 129
External reference density (6198)	→ 📄 129
Fixed reference density (1814)	→ 📄 129
Reference temperature (1816)	→ 📄 129
Linear expansion coefficient (1817)	→ 📄 129
Square expansion coefficient (1818)	→ 📄 129

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 ▪ External reference density ▪ Current input 1 * ▪ Current input 2 * ▪ Current input 3 *	Calculated reference density
External reference density	–	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 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 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 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 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/K²

* 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	→ 📖 130
▶ **Zero verification**	→ 📖 133
▶ **Zero adjustment**	→ 📖 134

Parameter overview with brief description

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

Density adjustment

With density adjustment, a high level of accuracy is achieved only at the point of adjustment and at the relevant density and temperature. However, the accuracy of a density adjustment is only ever as good as the quality of the reference measuring data provided. Therefore it is not a substitute for special density calibration.

Performing density adjustment

Note the following before performing the adjustment:
- A density adjustment only makes sense if there is little variation in the operating conditions and the density adjustment is performed under the operating conditions.
- The density adjustment scales the internally computed density value with a user-specific slope and offset.
- A 1-point or 2-point density adjustment can be performed.
- For a 2-point density adjustment, there must be a difference of at least 0.2 kg/l between the two target density values.
- The reference media must be gas-free or pressurized so that any gas they contain is compressed.
- The reference density measurements must be performed at the same medium temperature that prevails in the process, as otherwise the density adjustment will not be accurate.
- The correction resulting from the density adjustment can be deleted with the **Restore original** option.

"1 point adjustment" option

1. In the **Density adjustment mode** parameter, select the **1 point adjustment** option and confirm.
2. In the **Density setpoint 1** parameter, enter the density value and confirm.
   ↳ In the **Execute density adjustment** parameter the following options are now available:
   Ok
   Measure density 1 option
   Restore original
3. Select the **Measure density 1** option and confirm.
4. Select the **Calculate** option and confirm.

If the adjustment was completed successfully, the **Density adjustment factor** parameter and the **Density adjustment offset** parameter and the values calculated for them are shown on the display.

"2 point adjustment" option

1. In the **Density adjustment mode** parameter, select the **2 point adjustment** option and confirm.
2. In the **Density setpoint 1** parameter, enter the density value and confirm.

3. In the **Density setpoint 2** parameter, enter the density value and confirm.
   ↳ In the **Execute density adjustment** parameter the following options are now available:
   Ok
   Measure density 1
   Restore original
4. Select the **Measure density 1** option and confirm.
   ↳ In the **Execute density adjustment** parameter the following options are now available:
   Ok
   Measure density 2
   Restore original
5. Select the **Measure density 2** option and confirm.
   ↳ In the **Execute density adjustment** parameter the following options are now available:
   Ok
   Calculate
   Cancel
6. Select the **Calculate** option and confirm.

If the **Density adjust failure** option is displayed in the **Execute density adjustment** parameter, call up the options and select the **Cancel** option. The density adjustment is canceled and can be repeated.

Navigation
"Expert" menu → Sensor → Sensor adjustment → Density adjustment

▶ Density adjustment	
Density adjustment mode	→ 📖 132
Density setpoint 1	→ 📖 132
Density setpoint 2	→ 📖 132
Execute density adjustment	→ 📖 132
Progress	→ 📖 132
Density adjustment factor	→ 📖 132
Density adjustment offset	→ 📖 132

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Density adjustment mode	–	Select the method for field density adjustment to correct the factory setting.	▪ 1 point adjustment ▪ 2 point adjustment	1 point adjustment
Density setpoint 1	–	Enter density for the first reference media.	The entry depends on the unit selected in the **Density unit** parameter (0555).	1 kg/l
Density setpoint 2	In the **Density adjustment mode** parameter, the **2 point adjustment** option is selected.	Enter density for the second reference media.	The entry depends on the unit selected in the **Density unit** parameter (0555).	1 kg/l
Execute density adjustment	–	Select the next step to be performed for the density adjustment.	▪ Cancel * ▪ Busy * ▪ Ok * ▪ Density adjust failure * ▪ Measure density 1 * ▪ Measure density 2 * ▪ Calculate * ▪ Restore original *	Ok
Progress	–	Shows the progress of the process.	0 to 100 %	–
Density adjustment factor	–	Shows the calculated correction factor for the density.	Signed floating-point number	1
Density adjustment offset	–	Shows the calculated correction offset for the density.	Signed floating-point number	0

* Visibility depends on order options or device settings

Zero point verification and zero adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 🗎 303. Therefore, a zero adjustment in the field is generally not required.

Experience shows that zero adjustment is advisable only in special cases:
- To achieve maximum measuring accuracy even with low flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

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 point 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	→ 🗎 133
Progress	→ 🗎 133
Status	→ 🗎 134
Additional information	→ 🗎 134
Recommendation:	→ 🗎 134
Root cause	→ 🗎 134
Abort cause	→ 🗎 134
Zero point measured	→ 🗎 134
Zero point standard deviation	→ 🗎 134

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 %	–

Parameter	Description	Selection / User interface	Factory setting
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	→ 135
Progress	→ 135
Status	→ 135
Root cause	→ 135
Abort cause	→ 135
Root cause	→ 135
Reliability of measured zero point	→ 135
Additional information	→ 135
Reliability of measured zero point	→ 135

Zero point measured	→ 📄 135
Zero point standard deviation	→ 📄 135
Select action	→ 📄 135

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	–
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.	■ Restore ■ 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 (11104–1 to n)	→ 136
Process variable unit 1 to n (11107–1 to n)	→ 136
Totalizer 1 to n operation mode (11102–1 to n)	→ 136
Totalizer 1 to n control (11101–1 to n)	→ 137
Totalizer 1 to n failure behavior (11103–1 to n)	→ 137

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Assign process variable 1 to n	Select process variable for totalizer.	▪ 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	Select the unit for the process variable of the totalizer.	Unit choose list	kg
Totalizer 1 to n operation mode	Select totalizer operation mode, e.g. only totalize forward flow or only totalize reverse flow.	▪ Net ▪ Forward ▪ Reverse	Forward

Parameter	Description	Selection	Factory setting
Totalizer 1 to n control	Operate the totalizer.	▪ Reset + hold ▪ Preset + hold ▪ Hold ▪ Totalize	Totalize
Totalizer 1 to n failure behavior	Select totalizer behavior in the event of a device alarm.	▪ Hold ▪ Continue ▪ Last valid value + continue	Continue

* 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	→ 📖 140
Value 1 display	→ 📖 141
0% bargraph value 1	→ 📖 142
100% bargraph value 1	→ 📖 142
Decimal places 1	→ 📖 142
Value 2 display	→ 📖 142
Decimal places 2	→ 📖 143
Value 3 display	→ 📖 143
0% bargraph value 3	→ 📖 143
100% bargraph value 3	→ 📖 143
Decimal places 3	→ 📖 143
Value 4 display	→ 📖 143
Decimal places 4	→ 📖 143
Value 5 display	→ 📖 143
0% bargraph value 5	→ 📖 143
100% bargraph value 5	→ 📖 143
Decimal places 5	→ 📖 143
Value 6 display	→ 📖 143
Decimal places 6	→ 📖 144
Value 7 display	→ 📖 144

0% bargraph value 7	→ 📄 144
100% bargraph value 7	→ 📄 144
Decimal places 7	→ 📄 144
Value 8 display	→ 📄 144
Decimal places 8	→ 📄 144
Display language	→ 📄 144
Display interval	→ 📄 144
Display damping	→ 📄 144
Header	→ 📄 144
Header text	→ 📄 145
Separator	→ 📄 145
Backlight	→ 📄 145

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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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 (→ 🗎 122)	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	→ 🗎 146
WLAN mode	→ 🗎 146
SSID name	→ 🗎 146
Network security	→ 🗎 146
Security identification	→ 🗎 146
User name	→ 🗎 146
WLAN password	→ 🗎 146
WLAN IP address	→ 🗎 146
WLAN MAC address	→ 🗎 146
WLAN passphrase	→ 🗎 146
WLAN MAC address	→ 🗎 146
Assign SSID name	→ 🗎 146

SSID name	→ 📖 146
Connection state	→ 📖 147
Received signal strength	→ 📖 147

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
WLAN	–	Switch WLAN on and off.	▪ Disable ▪ Enable	Enable
WLAN mode	–	Select WLAN mode.	▪ WLAN access point ▪ WLAN Client	WLAN access point
SSID name	The client is activated.	Enter the user-defined SSID name (max. 32 characters).	–	–
Network security	–	Select the security type of the WLAN network.	▪ Unsecured ▪ WPA2-PSK ▪ EAP-PEAP with MSCHAPv2 * ▪ EAP-PEAP MSCHAPv2 no server authentic. * ▪ EAP-TLS *	WPA2-PSK
Security identification	–	Select security settings and download these settings via menu Data management > Security > WLAN.	▪ Trusted issuer certificate ▪ Device certificate ▪ Device private key	–
User name	–	Enter user name.	–	–
WLAN password	–	Enter WLAN password.	–	–
WLAN IP address	–	Enter IP address of the WLAN interface of the device.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
WLAN MAC address	–	Enter MAC address of the WLAN interface of the device.	Unique 12-digit character string comprising letters and numbers	Each measuring device is given an individual address.
WLAN passphrase	The **WPA2-PSK** option is selected in the **Security type** parameter.	Enter the network key (8 to 32 characters). ℹ 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). ℹ 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	

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Connection state	–	Displays the connection status.	▪ Connected ▪ Not connected	Not connected
Received signal strength	–	Shows the received signal strength.	▪ Low ▪ Medium ▪ High	High

* Visibility depends on order options or device settings

10.6.7 Configuration management

After commissioning, you can save the current device configurationor 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	→ 📄 147
Last backup	→ 📄 147
Configuration management	→ 📄 147
Backup state	→ 📄 148
Comparison result	→ 📄 148

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

Parameter	Description	User interface / Selection	Factory setting
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 scope of the "Configuration management" parameter

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

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

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

10.6.8 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**	→ 149
▶ **Reset access code**	→ 149
Device reset	→ 150

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	→ 🗎 149
	Confirm access code	→ 🗎 149

Parameter overview with brief description

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

Using the parameter to reset the access code

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

▶ Reset access code		
	Operating time	→ 🗎 149
	Reset access code	→ 🗎 149

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	Reset access code to factory settings. ℹ 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	→ 📄 152
Process variable value	→ 📄 152
Current input 1 to n simulation	→ 📄 153
Value current input 1 to n	→ 📄 153
Status input 1 to n simulation	→ 📄 153
Input signal level 1 to n	→ 📄 153
Current output 1 to n simulation	→ 📄 152
Current output value	→ 📄 152
Frequency output 1 to n simulation	→ 📄 153
Frequency output 1 to n value	→ 📄 153
Pulse output simulation 1 to n	→ 📄 153
Pulse value 1 to n	→ 📄 153
Switch output simulation 1 to n	→ 📄 153
Switch state 1 to n	→ 📄 153
Relay output 1 to n simulation	→ 📄 153

Switch state 1 to n	→ 📖 153
Device alarm simulation	→ 📖 153
Diagnostic event category	→ 📖 153
Diagnostic event simulation	→ 📖 153

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 (→ 🗎 152).	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 (→ 107) 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
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
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 → 📄 154
- Protect access to local operation via key locking → 📄 61
- Protect access to measuring device via write protection switch → 📄 155

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 (→ 📄 149).
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 (→ 📄 149) to confirm.
   ↳ The 🔒 symbol appears in front of all write-protected parameters.

- Disabling parameter write protection via access code → 📄 60.
- If the access code is lost: Resetting the access code → 📄 155.
- 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 → 📄 60

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

Parameters which can always be modified via the local display

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

Parameters for configuring the language	Parameters for configuring the local display	Parameters for configuring the totalizer
↓	↓	↓
Display language	Format display	Control Totalizer
	Contrast display	Preset value
	Display interval	Reset all totalizers

Defining the access code via the web browser

1. Navigate to the **Define access code** parameter (→ 📄 149).

2. Define a 16-digit (max.) numeric code as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 📄 149) to confirm.
   ↳ The web browser switches to the login page.

- Disabling parameter write protection via access code → 📄 60.
- If the access code is lost: Resetting the access code → 📄 155.
- 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 → 📄 60

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 (→ 📄 149).
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 📄 154.

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.

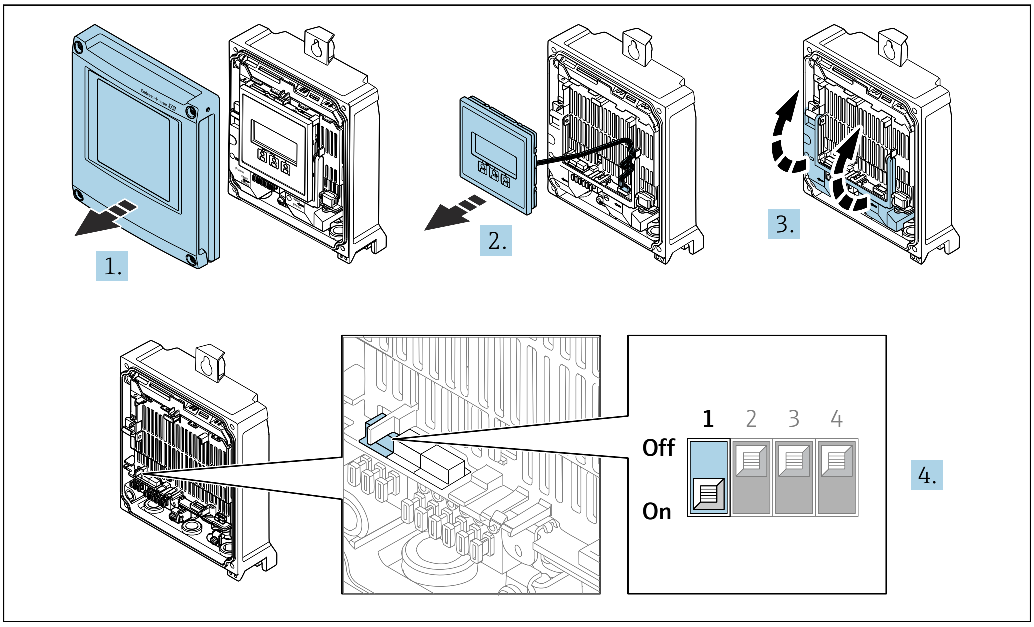
10.8.2 Write protection via write protection switch

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 PROFINET protocol

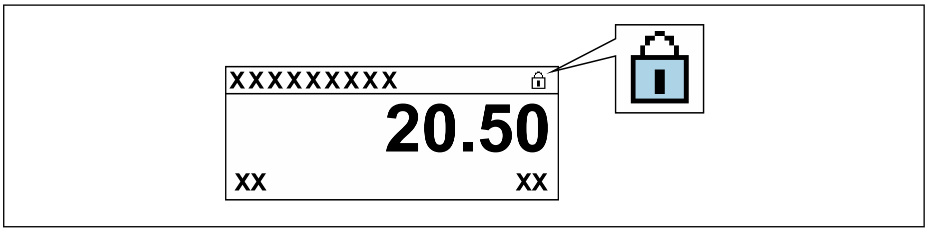
Proline 500 – digital

Enable/disable write protection



A0029673

1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.
4. **Enable or disable write protection:**
   Move the write protection switch on the main electronics module into position: **ON** hardware write protection enabled/**OFF** (factory setting) hardware write protection disabled.
   ↳ In the **Locking status** parameter, the **Hardware locked** option is displayed → 🗎 157. In addition, the 🔒 symbol appears on the local display in front of the parameters in the header of the operational display and in the navigation view when hardware write protection is enabled.



A0029425

5. Inserting 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 securing screws.

11 Operation

11.1 Reading off the device locking status

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

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access authorization displayed in the **Access status** parameter applies → 📄 60. 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) → 📄 155.
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset, etc.). Once the internal processing has been completed, the parameters can be changed once again.

11.2 Adjusting the operating language

Detailed information:
- To configure the operating language → 📄 88
- For information on the operating languages supported by the measuring device → 📄 308

11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 📄 119
- On the advanced settings for the local display → 📄 138

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**	→ 📄 158
▶ **Totalizer**	→ 📄 160
▶ **Input values**	→ 📄 161
▶ **Output values**	→ 📄 162

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	→ 📄 158
Volume flow	→ 📄 158
Corrected volume flow	→ 📄 159
Density	→ 📄 159
Reference density	→ 📄 159
Temperature	→ 📄 159
Pressure	→ 📄 159
Concentration	→ 📄 159
Target mass flow	→ 📄 159
Carrier mass flow	→ 📄 159
Target corrected volume flow	→ 📄 159
Carrier corrected volume flow	→ 📄 160
Target volume flow	→ 📄 160
Carrier volume flow	→ 📄 160

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Mass flow	–	Displays the mass flow that is currently measured. *Dependency* The unit is taken from: **Mass flow unit** parameter (→ 📄 93)	Signed floating-point number
Volume flow	–	Displays the volume flow that is currently calculated. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 📄 93).	Signed floating-point number

Parameter	Prerequisite	Description	User interface
Corrected volume flow	–	Displays the corrected volume flow that is currently calculated. *Dependency* The unit is taken from: **Corrected volume flow unit** parameter (→ 🗎 93)	Signed floating-point number
Density	–	Shows the density currently measured. *Dependency* The unit is taken from the **Density unit** parameter (→ 🗎 93).	Signed floating-point number
Reference density	–	Displays the reference density that is currently calculated. *Dependency* The unit is taken from: **Reference density unit** parameter (→ 🗎 94)	Signed floating-point number
Temperature	–	Shows the medium temperature currently measured. *Dependency* The unit is taken from: **Temperature unit** parameter (→ 🗎 94)	Signed floating-point number
Pressure	–	Displays either a fixed or external pressure value. *Dependency* The unit is taken from the **Pressure unit** parameter (→ 🗎 94).	Signed floating-point number
Concentration	For the following order code: Order code for "Application package", option **ED** "Concentration" ℹ The software options currently enabled are displayed in the **Software option overview** parameter.	Displays the concentration that is currently calculated. *Dependency* 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" ℹ 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. *Dependency* The unit is taken from: **Mass flow unit** parameter (→ 🗎 93)	Signed floating-point number
Carrier mass flow	With the following conditions: Order code for "Application package", option **ED** "Concentration" ℹ 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. *Dependency* The unit is taken from: **Mass flow unit** parameter (→ 🗎 93)	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. ℹ 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. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 🗎 93).	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. ℹ The software options currently enabled are displayed in the **Software option overview** parameter.	Displays the corrected volume flow currently measured for the carrier fluid. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 🗎 93).	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. ℹ The software options currently enabled are displayed in the **Software option overview** parameter.	Displays the volume flow currently measured for the target medium. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 🗎 93).	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. ℹ The software options currently enabled are displayed in the **Software option overview** parameter.	Displays the volume flow currently measured for the carrier medium. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 🗎 93).	Signed floating-point number

11.4.2 Totalizer

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

Navigation
"Diagnostics" menu → Measured values → Totalizer

▶ **Totalizer**	
Assign process variable 1 to n	→ 🗎 161
Totalizer 1 to n value	→ 🗎 161
Totalizer 1 to n status	→ 🗎 161
Totalizer 1 to n status (Hex)	→ 🗎 161

Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Assign process variable 1 to n	Select process variable for totalizer.	▪ 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
Totalizer 1 to n value	Shows the totalizer value reported to the controller for further processing.	Signed floating-point number	0 kg
Totalizer 1 to n status	Shows the status of the totalizer value reported to the controller for further processing ('Good', 'Uncertain', 'Bad').	▪ Good ▪ Uncertain ▪ Bad	Good
Totalizer 1 to n status (Hex)	Shows the status of the totalizer value reported to the controller for further processing (Hex).	0 to 255	128

* Visibility depends on order options or device settings

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** → 🖹 161
- ▶ **Status input 1 to n** → 🖹 162

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	→ 📖 162
Measured current 1 to n	→ 📖 162

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	→ 📖 162

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	→ 📖 163

▶ Pulse/frequency/switch output 1 to n	→ 📖 163
▶ Relay output 1 to n	→ 📖 164

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	→ 📖 163
	Measured current	→ 📖 163

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	→ 📖 164
	Pulse output 1 to n	→ 📖 164
	Switch state	→ 📖 164

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 1 to n	The **Pulse** option is selected in the **Operating mode** parameter parameter.	Displays the pulse frequency currently output.	Positive floating-point number
Switch 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	→ 📖 164
Switch cycles	→ 📖 164
Max. switch cycles number	→ 📖 164

Parameter overview with brief description

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

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 📖 89)
- Advanced settings using the**Advanced setup** submenu (→ 📖 127)

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**	
Totalizer 1 to n control (11101–1 to n)	→ 165
Preset value 1 to n (11108–1 to n)	→ 165
Reset all totalizers (2806)	→ 165

Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Totalizer 1 to n control	Operate the totalizer.	▪ Reset + hold ▪ Preset + hold ▪ Hold ▪ Totalize	Totalize
Preset value 1 to n	Specify start value for totalizer.	Signed floating-point number	0 kg
Reset all totalizers	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	Cancel

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

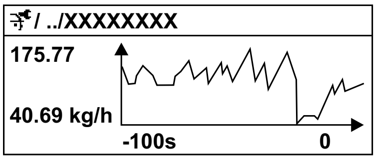
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the previously aggregated flow values.

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 → 📄 71.
- Web browser

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



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	→ 📄 168
Assign channel 2	→ 📄 169
Assign channel 3	→ 📄 169
Assign channel 4	→ 📄 169
Logging interval	→ 📄 170
Clear logging data	→ 📄 170
Data logging	→ 📄 170
Logging delay	→ 📄 170
Data logging control	→ 📄 170

Data logging status	→ 📄 170
Entire logging duration	→ 📄 170

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. ℹ 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 (→ 🗎 168)	Off
Assign channel 3	The **Extended HistoROM** application package is available. ℹ 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 (→ 🗎 168)	Off
Assign channel 4	The **Extended HistoROM** application package is available. ℹ 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 (→ 🗎 168)	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 distributed 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 → 📖 315

11.8.1 "Measurement mode" submenu

Navigation
"Expert" menu → Sensor → Measurement mode

▶ Measurement mode	
Gas Fraction Handler (6377)	→ 🗎 171

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
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)	→ 🗎 171
Cut off inhomogeneous wet gas (6375)	→ 🗎 171
Cut off inhomogeneous liquid (6374)	→ 🗎 171
Suspended bubbles index (6376)	→ 🗎 172
Cut off suspended bubbles (6370)	→ 🗎 172

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

Parameter	Prerequisite	Description	User interface / User entry	Factory setting
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 devices in the application.

The test scope achieved using these diagnostic and verification tests is expressed as the **total test coverage** (TTC). The TTC 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

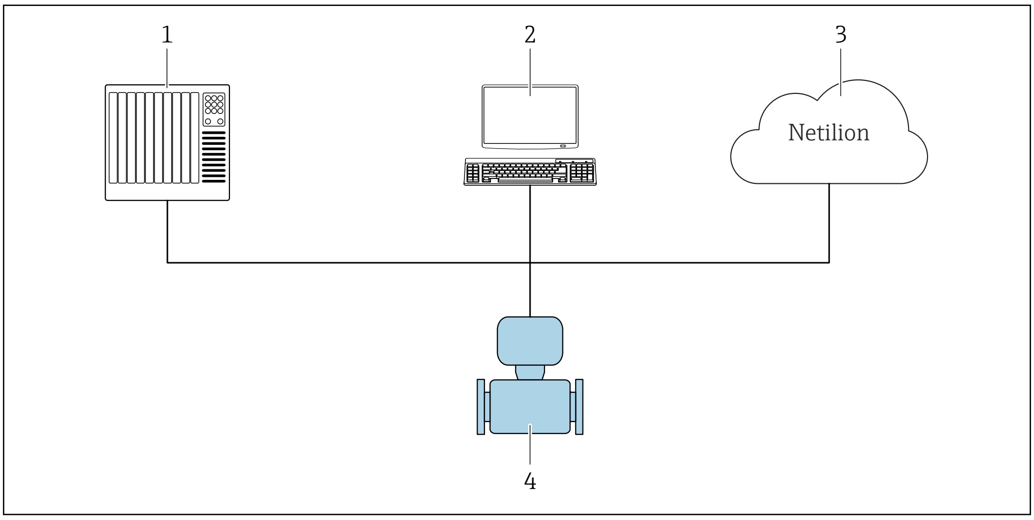
Only the dangerous undetected failures that are not captured by the device diagnostics can falsify the measured value that is output or interrupt the output of measured values.

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

The current value for the TTC depends on the configuration and integration of the measuring device. 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** features are available via the local display module and 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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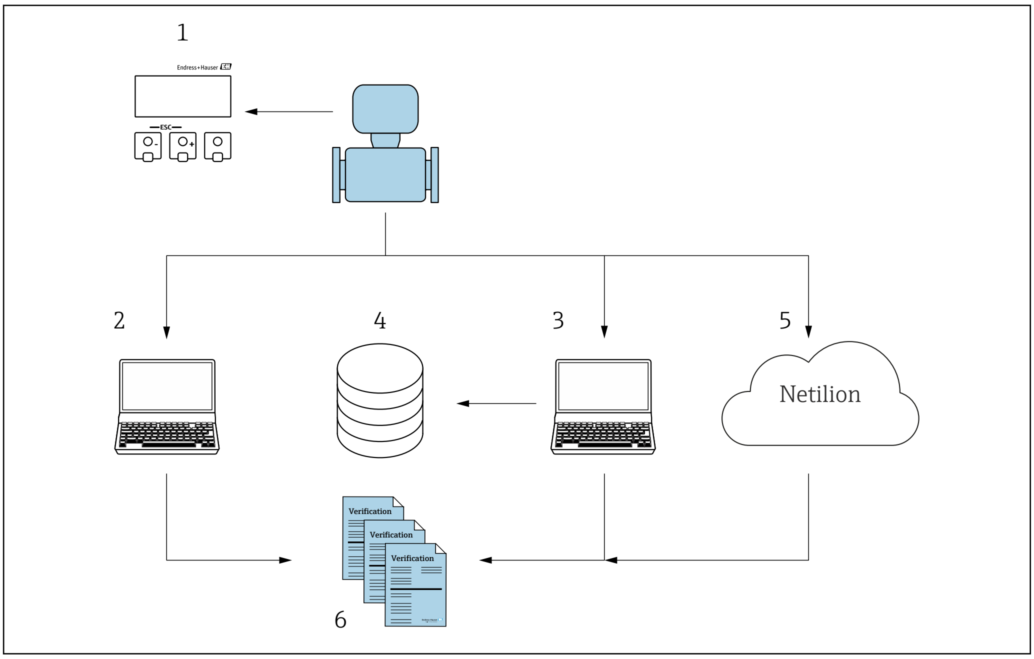
28 *General screen layout*

1 *PLC*
2 *Asset management system*
3 *Netilion cloud platform*
4 *Measuring device*

For more information on Netilion: www.endress.com → Downloads

Performing the verification and creating a verification report



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1 *Local display*
2 *Web browser*
3 *FieldCare*
4 *Data archive (via Flow Verification DTM)*
5 *Netilion cloud platform*
6 *Verification report*

Run **Heartbeat Verification** via one of the following interfaces:
- System integration interface of a higher-level system
- Local display
- WLAN interface
- CDI-RJ45 service interface (CDI: Common Data Interface)

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

The detailed results of the verification (8 data records) 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 .

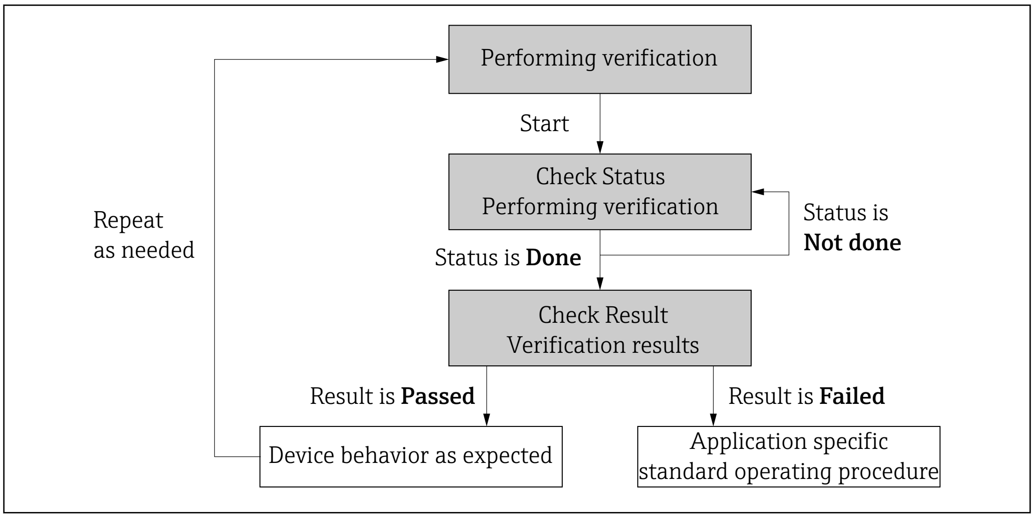
Data exchange can take place automatically or be triggered by a user.

Integration in the PLC system

The verification function integrated in the measuring device 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 Monitoring
The user can read the monitoring measured variables in the operating menu.

Heartbeat Verification
- Start verification.
- Read out the last verification result.

Asset management system

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

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.

PLC system

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

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

Netilion cloud platform

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

Heartbeat Verification
- Start verification.
- Read out, archive and document the verification results including detailed results using the Heartbeat Technology verification report.

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 [2] 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.

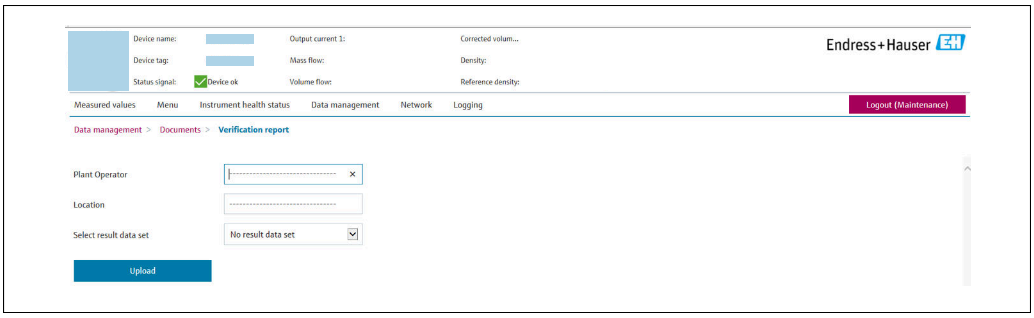
2) First In – First Out

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.

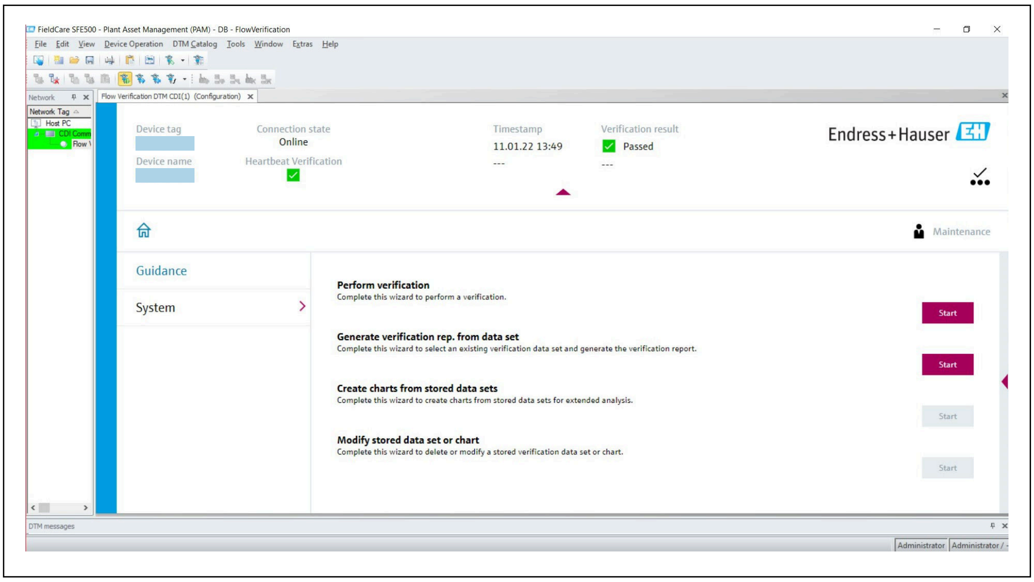
Data management via device DTM

Thanks to the device DTM the device can be operated and a **Heartbeat Verification** performed. The results of the verification can be displayed and a verification report can be created.

Data management via Flow Verification DTM

The Flow Verification DTM allows you to perform a **Heartbeat Verification**. The results of the verification can be displayed and a verification report can be created.

The Flow Verification DTM offers advanced capabilities for managing and visualizing the results.



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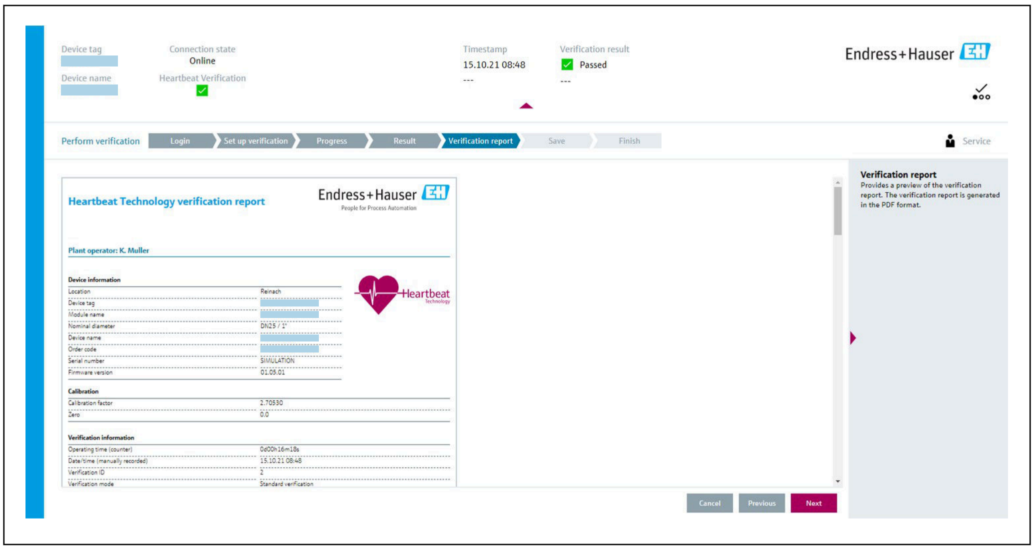
29 "Flow Verification DTM" home page in FieldCare SFE500

A wizard guides the user through four different processes step by step with help text.

Entry point	Process description
Perform verification *Online connection to the device required.*	Perform verification and generate a verification report.
Generate verification report using a verification data set ▪ from the device (online) ▪ from archive (offline)	Select the existing verification data set and create the verification report.
Create charts for selected diagnostic parameters from stored verification data sets	Create charts for selected diagnostic parameters from archived verification data sets for the purpose of advanced analysis and trending.
Maintain stored verification data sets or chart templates	Delete or modify archived verification data sets or chart templates.

Perform verification



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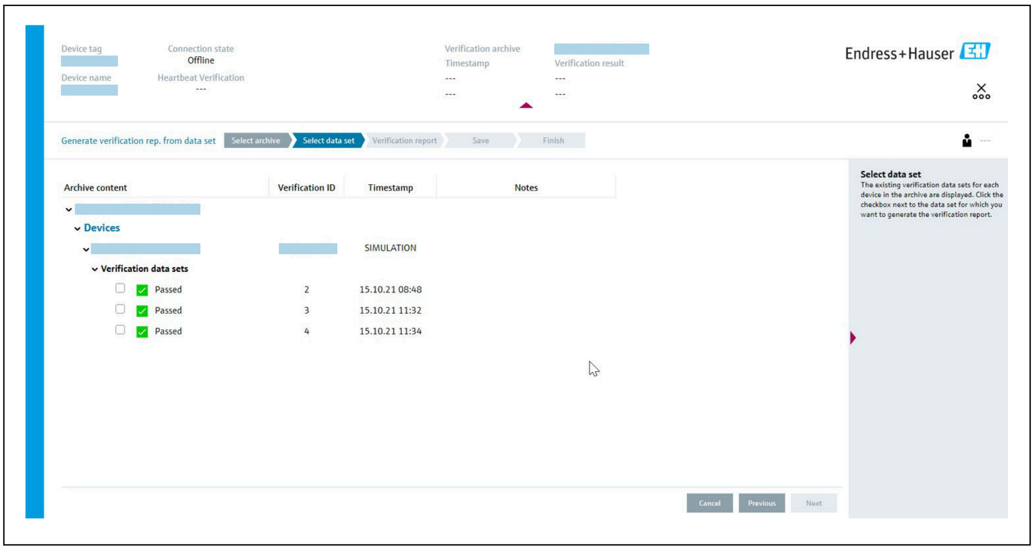
30 *Example: Verification report displayed after verification has been performed*

Online connection to the device required.

Generate verification report using a verification data set



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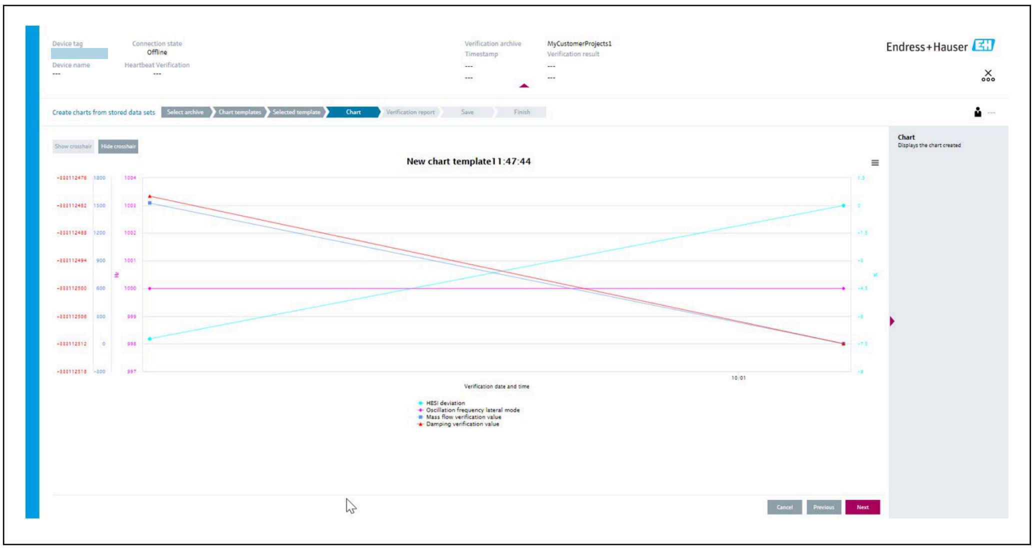
31 *Example: Generating verification report using a verification data set*

Read the verification data set from
- Device: Online connection to device required.
- Archive: Offline operation sufficient.

Creating charts for selected diagnostic parameters from stored verification data sets



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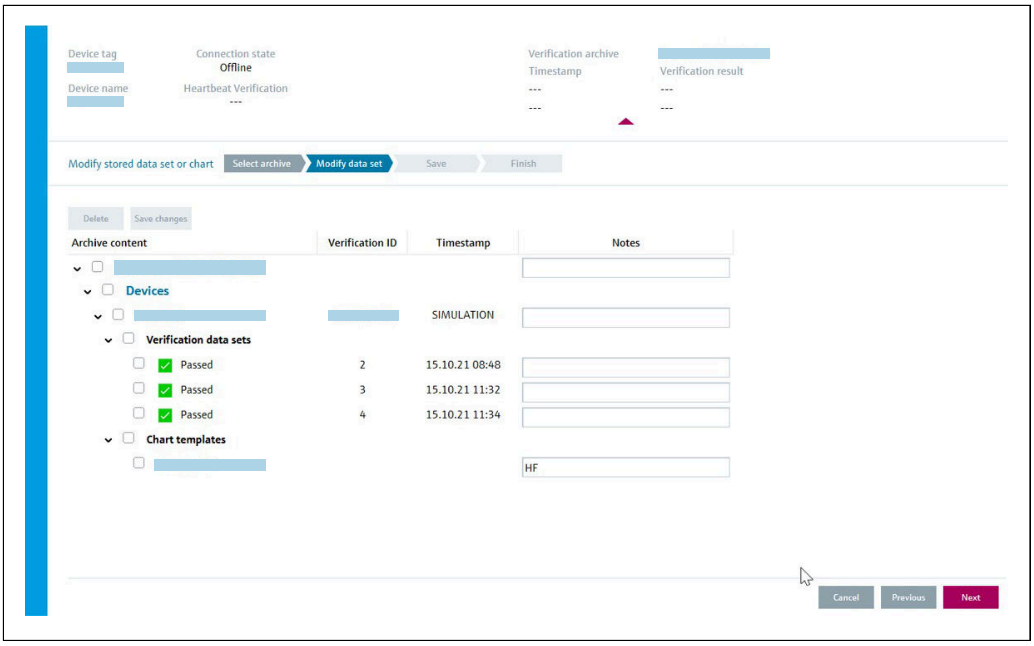
32 *Example: Create charts you have edited yourself for selected diagnostic parameters from stored verification data sets*

You can create your own templates.

Maintaining stored verification data sets or chart templates



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33 *Example: Deleting or modifying stored verification data sets or chart templates*

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 performing Heartbeat Verification:
- standard verification → 182
  Verification is performed by the device without manual checking of external measured variables.
- Extended verification → 185
  Verification includes the entry of external measured variables.

Performance characteristics

Heartbeat Verification is performed on demand and supplements permanent self-monitoring with additional checks .

The standard verification also checks the following analog 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
- Relay output

The extended verification supports a check of the following output modules by means of simulation and measurement using external measuring equipment:
- 4 to 20 mA current output, active and passive
- Pulse/frequency output, active and passive

The test is based on reference values that are incorporated in the measuring device, traceable from the factory and redundant in the device. **Heartbeat Verification** confirms on demand the device function with the total test coverage (TTC).

Assessed by an independent body: **Heartbeat Technology** meets the requirements for traceable verification according to 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.

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: During the process of commissioning the measuring device, an initial verification (and all additional verifications during the life cycle) is performed under process or reference conditions → 175.

The results are saved as an initial situation in the measuring device life cycle up until the 8th verification. From the 9th verification onwards, a printout of the verification reports or an upload of the data using the Flow Verification DTM is recommended to avoid losing the data from the previous verifications.

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.

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

Navigation
"Expert" menu → Diagnostics → Heartbeat Technology → Heartbeat base settings

▶ Heartbeat base settings	
Plant operator	→ 📄 181
Location	→ 📄 181

Parameter overview with brief description

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

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 → 📄 182
- Extended verification → 📄 185

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 (→ 📄 185):
- 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) → 📄 181.

The result of the verification is displayed in the **Overall result** parameter (→ 📄 185):
- 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 → 📄 181.

- 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 → 📄 196.
- 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 → 📄 181.

"Performing verification" submenu

Navigation
"Diagnostics" menu → Heartbeat Technology → Performing verification

▶ Performing verification	
Year	→ 📄 184
Month	→ 📄 184
Day	→ 📄 184
Hour	→ 📄 184
AM/PM	→ 📄 184
Minute	→ 📄 184
Verification mode	→ 📄 184
External device information	→ 📄 191
Start verification	→ 📄 184

Progress	→ 185
Measured values	→ 192
Output values	→ 192
Status	→ 185
Overall result	→ 185

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	10
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: → 194	▪ Not supported ▪ Passed ▪ Not done ▪ Failed	Not done

Extended verification

The extended verification supplements the standard verification with the output of various measured variables. During the verification process, these measured variables are recorded manually with the help of external measuring equipment, for example, and entered in the measuring device → 190. The value entered is checked and verified by the measuring device 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

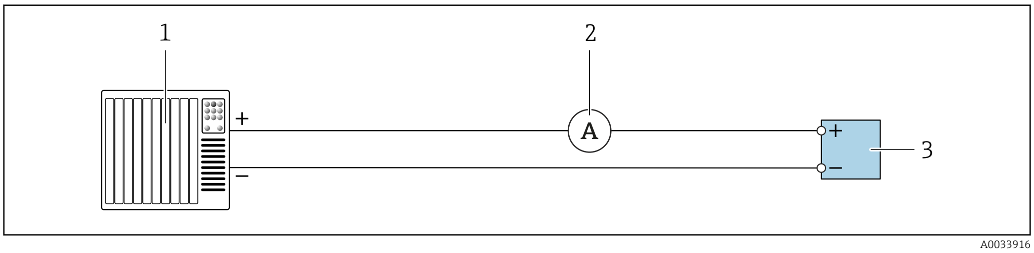
Determining the terminal assignment for the outputs

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



34 Extended verification of the active current output

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

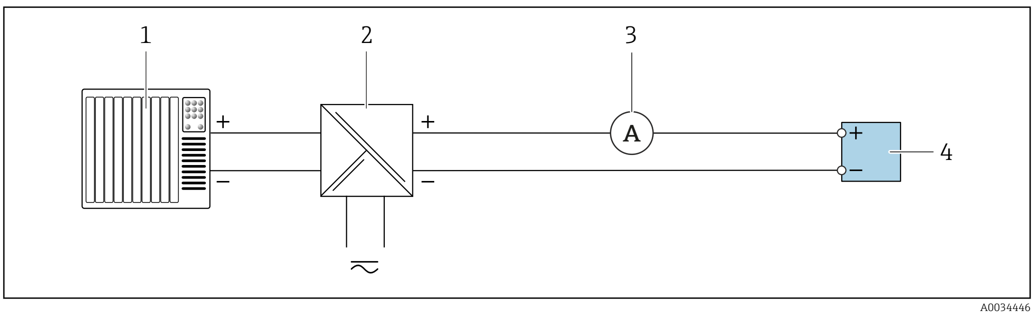
Extended verification of the active current output

▶ 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



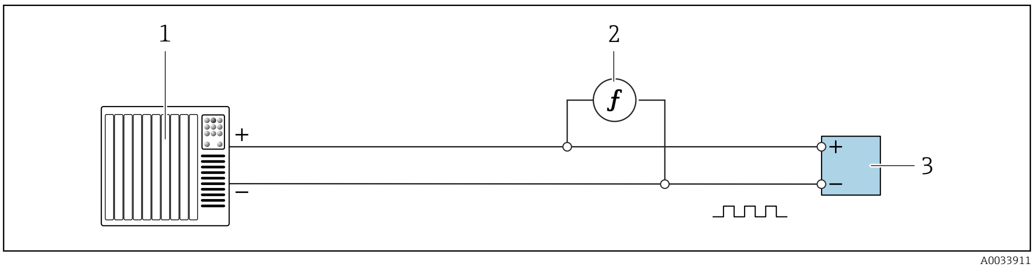
35 Extended verification of the passive current output

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



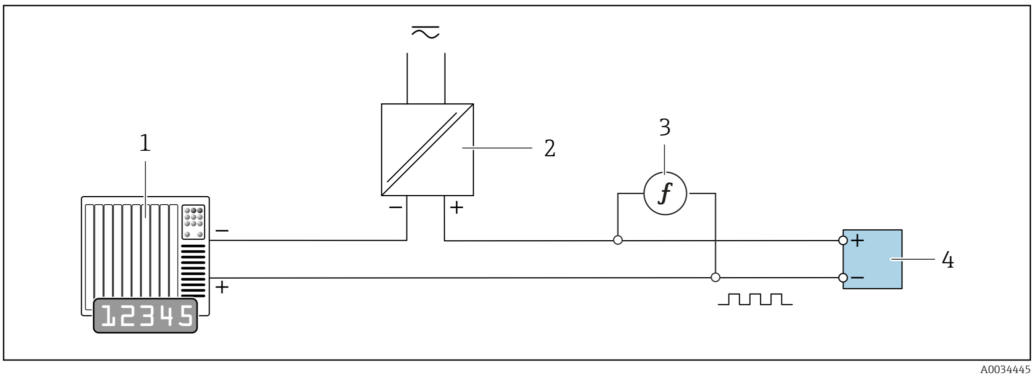
36 Extended verification of the active pulse/frequency output

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



37 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 (→ 192) shows the value simulated by the device at the selected output → 186

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 (→ 185):
- 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) → 181.

The result of the verification is displayed in the **Overall result** parameter (→ 185):
- 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 → 181.

- 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 → 196.
- 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 → 181.

"Performing verification" submenu

Navigation
"Diagnostics" menu → Heartbeat Technology → Performing verification

▶ Performing verification

Year	→ 191
Month	→ 191
Day	→ 191
Hour	→ 191
AM/PM	→ 191
Minute	→ 191
Verification mode	→ 191
External device information	→ 191
Start verification	→ 192
Progress	→ 192
Measured values	→ 192
Output values	→ 192
Status	→ 192
Verification result	→ 192

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	10
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 (→ 🗎 184): ▪ Output 1 low value ▪ Output 1 high value ▪ Output 2 low value ▪ Output 2 high value ▪ Frequency output 1 ▪ Pulse output 1	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	-
Status	–	Displays the current status of the verification.	▪ Done ▪ Busy ▪ Failed ▪ Not done	–
Verification result	–	Displays the overall result of the verification. ℹ Detailed description of the classification of the results: → 🗎 194	▪ 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	→ 🗎 193
Verification ID	→ 🗎 193
Operating time	→ 🗎 193
Overall result	→ 🗎 193
Sensor	→ 🗎 193
Sensor electronic module (ISEM)	→ 🗎 194
I/O module	→ 🗎 194
System status	→ 🗎 194

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. ℹ Detailed description of the classification of the results: → 🗎 194	▪ 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. ℹ Detailed description of the classification of the results: → 🗎 194	▪ Not supported ▪ Passed ▪ Not done ▪ Failed	Not done

Parameter	Prerequisite	Description	User interface	Factory setting
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: → 194	▪ 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: → 194	▪ 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: → 194	▪ 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 → 🖹 196.

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	± (100 µA (offset) + 1 % of reading)	▪ Lower value 4 mA: ±1 % ▪ Upper value 20 mA: ±0.5 %
Pulse/frequency/switch output, active and passive	±0.05 %, with a 120 s cycle	▪ Pulse: ±0.3 % ▪ Frequency: ±0.3 %
Current input 4 to 20 mA, active and passive	▪ −20 %: 24 V − 20 % = 19.2 V ▪ Read back the supply voltage: >24 V − 20 % − 5 % = 18 V (min. 18 V applied)	–
Double pulse output, active and passive	±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

Partial results by test groups and detailled 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 pipe damping
Process temperature verification value	Current measured value for medium temperature
Electronics 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 ▪ Passed ▪ Failed	▶ 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 ▪ Passed ▪ Failed	▶ 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 ▪ Passed ▪ Failed	▶ 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 ▪ Passed ▪ Failed	▶ 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 ▪ Passed ▪ Failed	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 ▪ Passed ▪ Failed	▶ 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 ▪ Passed ▪ Failed	▶ 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.

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 ▪ Passed ▪ Failed	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 ▪ Passed ▪ Failed	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 ▪ Passed ▪ Failed	Sensor electronics module (ISEM) defective ▶ Replace sensor electronics module (ISEM)
Reference temperature	Temperature measurement monitoring	No value range ▪ Passed ▪ Failed	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 measures
Output 1 to n	Check of all the input and output modules installed at the measuring device	No value range ▪ Passed ▪ Failed ▪ Not done ℹ Limit values → 🗎 195	**Causes** ▪ Output values out of specification ▪ I/O modules defective **Measures** ▶ Check cabling. ▶ Check connections. ▶ Check load (current output). ▶ Replace the I/O module.

Verification report

The verification results can be documented via the web server, DeviceCare or FieldCare operating tools in the form of a verification report → 📄 175. 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 → 📄 196
  - 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, an Endress+Hauser service technician or a service provider authorized by Endress+Hauser can be tasked with performing the verification.

Individual test groups and description of individual tests: → 196

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 → 🖹 196.

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 in an external Condition Monitoring system so that changes to the measuring device and in the process can be detected at an early stage. The measured variables can be interpreted in a Condition Monitoring system. The information obtained in this way helps users to control measures concerning maintenance or process optimization. Possible applications of Condition Monitoring include the detection of the formation of build-up or wear as a result of 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 generally available continuously.

Enabling or disabling Heartbeat Monitoring
The output of the HBSI diagnostic parameter are switched on or off in the operating menu:
→ 🗎 201

Description of the monitoring parameters

The following diagnostic parameters can be assigned to the various outputs of the measuring device .

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/s	1)
Oscillation damping fluctuation 0	Fluctuation of the mechanical damping of the measuring tube/s	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 → 🗎 203.

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	→ 📄 202
HBSI cycle time	→ 📄 202

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.	Time-controlled 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 4320 h	12 h

Displaying the monitoring results

The current value of the **HBSI** parameter is continuously displayed in the Expert menu.

In the case of measuring devices with a local display, the value can also be configured as a display value.

Navigation
"Diagnostics" submenu → Heartbeat → Monitoring results

▶ Monitoring results	
HBSI value reliability (6380)	→ 📄 202

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
HBSI	Displays 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 pick-ups, excitation system, cables etc.), in % of the reference value.	−100.0 to 100.0 %	–
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 → 📄 201 . 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 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 measuring 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 that also bring about a gradual change in the measuring performance (e.g. abrasion, corrosion or buildup in the sensor). These influences also affect the integrity of the device on the long term.

Devices with **Heartbeat Monitoring** offer a range of parameters that are particularly suitable for monitoring specific, application-related influences:
- 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 it emerges that the process causes coating/build-up in the measuring tubes of the measuring device, **Heartbeat Monitoring** can be used for 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
  In the case of Promass I, the **HBSI** parameter 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 device, **Heartbeat Monitoring** can be used for this application.

Relevant monitoring parameters:
- HBSI
  An increase in the **HBSI** parameter is a clear indication of increased wear of the sensor due to corrosion or abrasion.
- Sensor asymmetry
  Corrosion or abrasion is rarely constant over the entire length of the measuring tube. Abrasion often occurs at the inlet, i.e. in areas of higher fluid velocity. Corrosion attacks the weak points of a measuring system and occurs at welds (flow splitters etc.). Changes to the sensor asymmetry can be caused by corrosion and 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.

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Error	Possible causes	Remedial action
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display dark and no output signals	Supply voltage does not match the voltage specified on the nameplate.	Apply the correct supply voltage .
Local display dark and no output signals	Supply voltage has incorrect polarity.	Reverse polarity of supply voltage.
Local display dark and no output signals	No contact between connecting cables and terminals.	Ensure electrical contact between the cable and the terminal.
Local display dark and no output signals	▪ Terminals are not plugged into the I/O electronics module correctly. ▪ 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 → 🗎 289.
Local display dark and no output signals	The connector between the main electronics module and display module is not plugged in correctly.	Check the connection and correct if necessary.
Local display cannot be read, but signal output is within the valid range	Display is set too bright or too dark.	▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 🗎 289.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures → 🗎 216
Text on local display appears in a language that cannot be understood.	The selected operating language cannot be understood.	1. Press ⊟ + ⊞ for 2 s ("home position"). 2. Press Ⓔ. 3. Configure the required language in the **Display language** parameter (→ 🗎 144).
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 → 🗎 289.

For output signals

Error	Possible causes	Remedial action
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 🗎 289.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Parameter configuration error	Check and adjust parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

Error	Possible causes	Remedial action
Write access to parameter not possible.	Hardware write protection is enabled.	Set the write protection switch on the main electronics module to the **OF**F position → 🗎 155.
Write access to parameter not possible.	Current user role has limited access authorization.	1. Check user role → 🗎 60. 2. Enter correct customer-specific access code → 🗎 60.
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 → 🗎 67.
	The Ethernet interface is incorrectly configured on the PC.	▶ Check the properties of the Internet protocol (TCP/IP) → 🗎 63. ▶ Check the network settings with the IT manager.
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 for the device and operating device → 🗎 63.
	WLAN communication is disabled.	–
It is not possible to connect to the web server, FieldCare or DeviceCare.	WLAN network is not available.	▪ Check whether WLAN reception is available: LED on the display module lights up in blue. ▪ Check if the WLAN connection is enabled: LED on display module flashes blue. ▪ Switch on instrument function.
No network connection or unstable network connection.	WLAN network is weak.	▪ Operating device outside of receiving range: Check the network status on the operating device. ▪ 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 no further operation possible.	Data transfer is active.	Wait until data transfer or current action is finished.
	Connection lost	▶ Check cable connection and power supply. ▶ Refresh web browser and restart if necessary.
The web browser contents are difficult to read or incomplete.	The web browser version used is not the best option.	▶ Use correct web browser version → 🗎 62. ▶ Empty the web browser cache. ▶ Restart the web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No contents displayed in the web browser or contents incomplete.	▪ JavaScript is not enabled. ▪ JavaScript cannot be enabled.	▶ Enable JavaScript. ▶ Enter http://XXX.XXX.X.X.XX/servlet/basic.html as the IP address.
Operation with FieldCare or DeviceCare not possible via CDI-RJ45 service interface (port 8000).	Firewall of the PC or network prevents communication.	Depending on the settings of the firewall used on the PC or in the network, the firewall must be disabled or adjusted for FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare not possible via CDI-RJ45 service interface (port 8000 or TFTP ports).	Firewall of the PC or network prevents communication.	Depending on the settings of the firewall used on the PC or in the network, the firewall must be disabled or adjusted for FieldCare/DeviceCare access.

For system integration

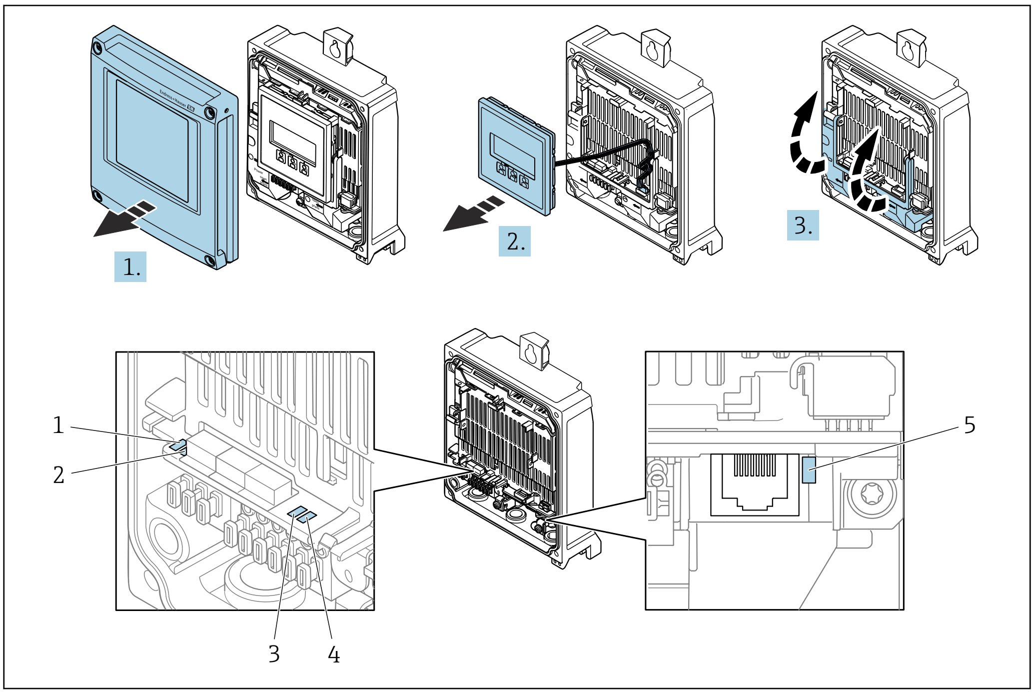
Error	Possible causes	Remedy
The PROFINET device name is not displayed correctly and contains coding.	A device name containing one or more underscores has been specified via the automation system.	Specify a correct device name (without underscores) via the automation system.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

Proline 500 – digital

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



A0029689

1 Supply voltage
2 Device status
3 Flashing/network status
4 Port 1 active: PROFINET with Ethernet-APL
5 Port 2 active: service interface (CDI)

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/module status (normal operation)	Off	Firmware error
		Green	Device status is OK.
		Flashing green	Device is not configured.

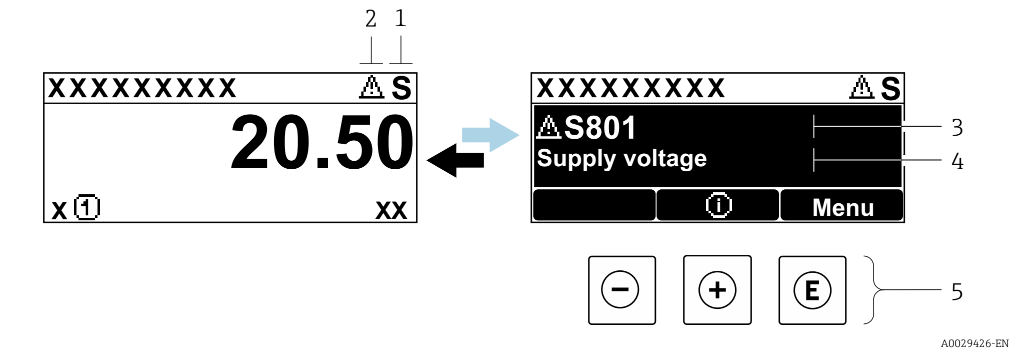
LED		Color	Meaning
		Flashing red	A diagnostic event with "Warning" diagnostic behavior has occurred.
		Red	A diagnostic event with "Alarm" diagnostic behavior has occurred.
		Flashing red/green	The device restarts/self-test.
3	Flashing/network status	Green	Cyclic data exchange is active.
		Flashing green	Following request from automation system: Flash frequency: 1 Hz (flash functionality: 500 ms on, 500 ms off) Cyclic data exchange is not active, no IP address is available: Flash frequency: 4 Hz
		Red	IP address is available but there is no connection to the automation system
		Flashing red	Cyclic data exchange was active but the connection was disconnected: Flash frequency: 3 Hz
4	Port 1 active: PROFINET with Ethernet-APL	Off	Not connected or no connection established.
		Green	Connection available, no active communication
		Flashing green	Connection with active communication
5	Port 2 active: Service interface (CDI)	Off	Not connected or no connection established.
		Orange	Connection available but no activity.
		Flashing orange	Activity present.

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

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

Operational display in alarm condition	Diagnostic message



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

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

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter → 281
- Via submenus → 282

Status signals

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

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

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

Diagnostic behavior

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

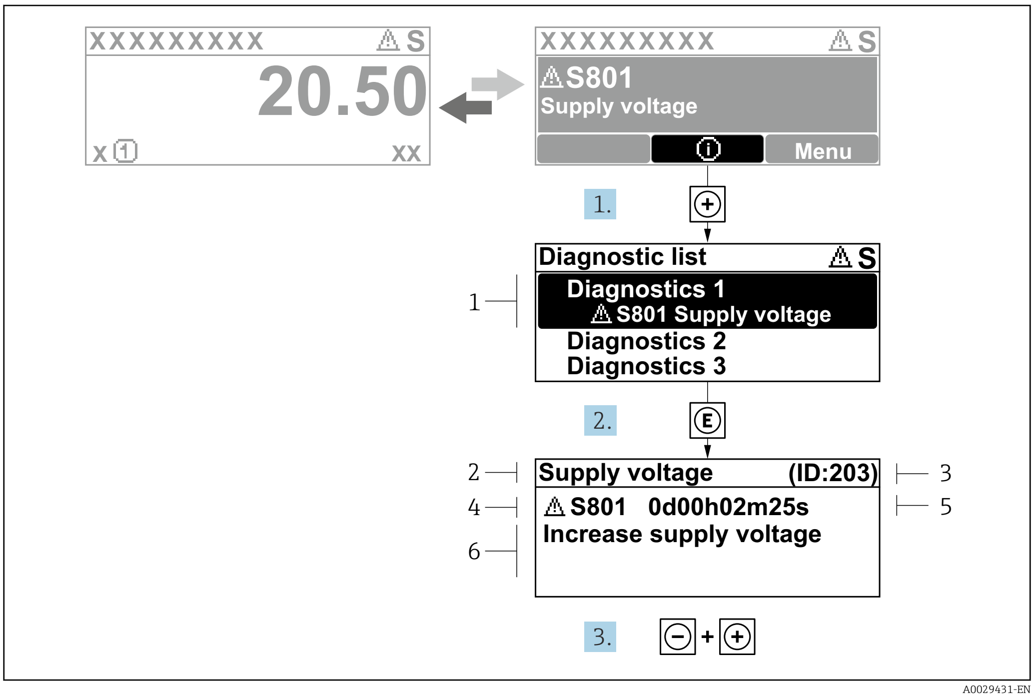
Diagnostic information

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

Operating elements

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

12.3.2 Calling up remedial measures



38 *Message for remedial measures*

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

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

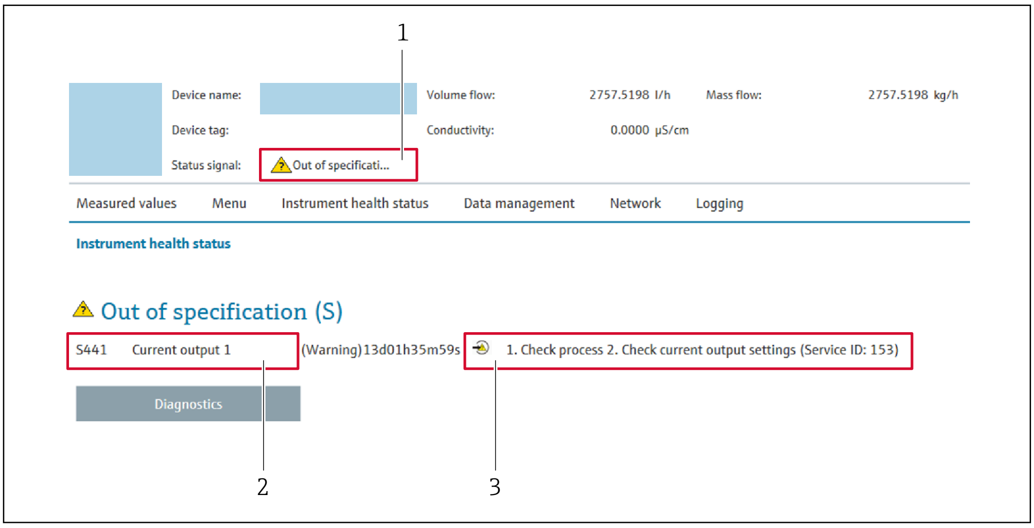
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

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

12.4 Diagnostic information in the web browser

12.4.1 Diagnostic options

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



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

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 281
- Via submenu → 282

Status signals

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

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

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

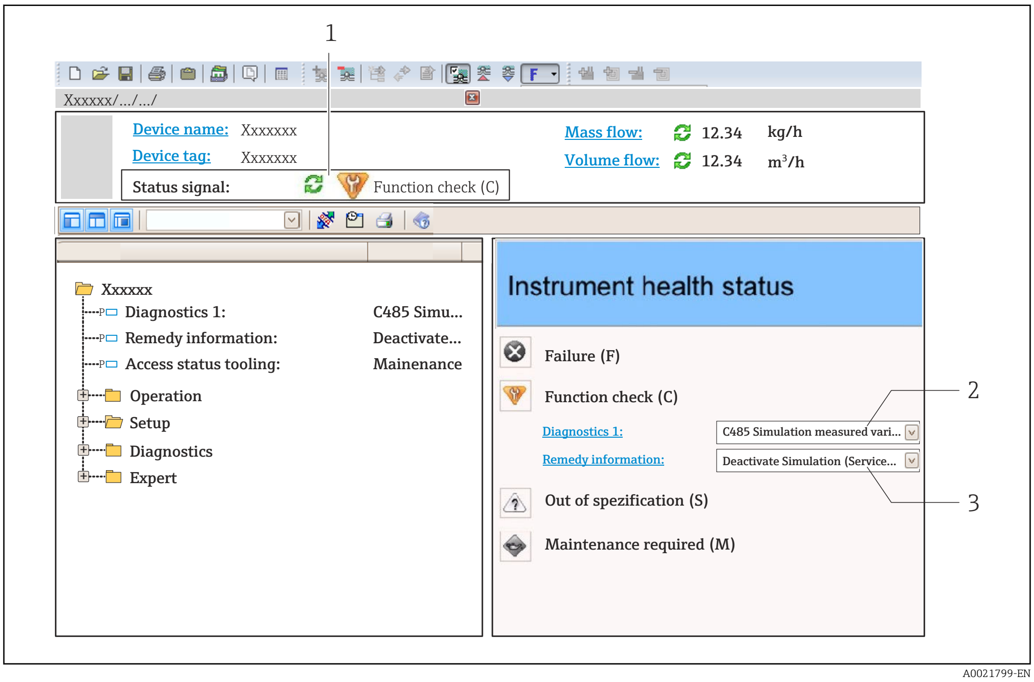
12.4.2 Calling up remedy information

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

12.5 Diagnostic information in FieldCare or DeviceCare

12.5.1 Diagnostic options

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



1 Status area with status signal → 📄 210
2 Diagnostic information → 📄 211
3 Remedial measures with service ID

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 📄 281
- Via submenu → 📄 282

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 Adapting the diagnostic information

12.6.1 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

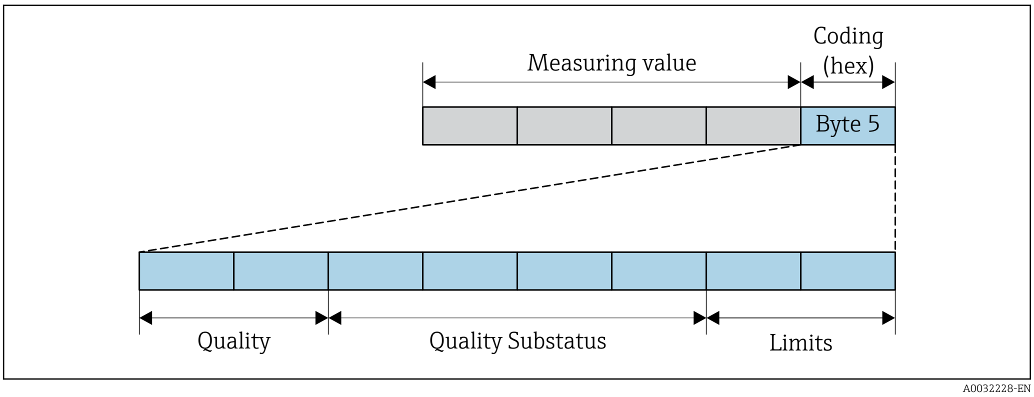
Available diagnostic behaviors

The following diagnostic behaviors can be assigned:

Diagnostic behavior	Description
Alarm	The device stops measurement. The totalizers assume the defined alarm condition. A diagnostic message is generated.
Warning	The device continues to measure. Measured value output via PROFINET and totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is only displayed in the **Event logbook** submenu (**Event list** submenu) and is not displayed in alternating sequence with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

Displaying the measured value status

If modules with input data (e.g. Analog Input module, Discrete Input module, Totalizer module, Heartbeat module) are configured for cyclic data transmission, the measured value status is coded as per PROFINET PA Profile 4 Specification and transmitted along with the measured value to the PROFINET Controller via the status byte. The status byte is split into three segments: Quality, Quality Substatus and Limits.



39 *Structure of the status byte*

The content of the status byte depends on the configured failure mode in the individual function block. Depending on which failure mode has been configured, status information in accordance with PROFINET PA Profile Specification 4 is transmitted to the the PROFINET with Ethernet-APL controller via the status byte status information. The two bits for the limits always have the value 0.

Supported status information

Status	Coding (hex)
BAD - Maintenance alarm	0x24 to 0x27
BAD - Process related	0x28 to 0x2B
BAD - Function check	0x3C to 0x3F
UNCERTAIN - Initial value	0x4C to 0x4F
UNCERTAIN - Maintenance demanded	0x68 to 0x6B
UNCERTAIN - Process related	0x78 to 0x7B
GOOD - OK	0x80 to 0x83
GOOD - Maintenance required	0xA4 to 0xA7
GOOD - Maintenance demanded	0xA8 to 0xAB
GOOD - Function check	0xBC to 0xBF

12.7 Overview of diagnostic information

In the case of some items of diagnostic information, the diagnostic behavior can be changed. Adapting the diagnostic information → 215

12.7.1 Diagnostic of sensor

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">002</td><td colspan="2">Sensor unknown</td><td rowspan="7">1. Check if the correct sensor is mounted
2. Check if the 2-D matrix code on the sensor is undamaged</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Measured values
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

<table>
<tr><th colspan="3">Diagnostic information</th><th>Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th><th></th></tr>
<tr><td rowspan="8">022</td><td colspan="2">Temperature sensor defective</td><td rowspan="6">1. If available: Check connection cable between sensor and transmitter
2. Check or replace sensor electronic module (ISEM)
3. Replace sensor</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td><td></td></tr>
<tr><td colspan="3">Influenced measured variables
▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">046</td><td colspan="2">Sensor limit exceeded</td><td rowspan="7">1. Check process conditions
2. Check sensor</td></tr>
<tr><td colspan="2">Measured variable status [from the factory] 1)</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>S</td></tr>
<tr><td>Diagnostic behavior</td><td>Warning</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">
- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut
</td></tr>
</table>

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">062</td><td colspan="2">Sensor connection faulty</td><td rowspan="7">1. If available: Check connection cable between sensor and transmitter
2. Check or replace sensor electronic module (ISEM)
3. Replace sensor</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

Diagnostic information			Remedy instructions
No.	Short text		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="8">082</td><td colspan="2">Data storage inconsistent</td><td rowspan="7">Check module connections</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables
▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
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▪ Carrier mass flow
▪ Carrier pipe temperature
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▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Measured values
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▪ Oscillation damping 2
▪ Density
▪ Oil density
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▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="8">083</td><td colspan="2">Memory content inconsistent</td><td rowspan="7">1. Restart device
2. Restore S-DAT data
3. Replace S-DAT</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables
▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Measured values
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">119</td><td colspan="2">Sensor initialization active</td><td rowspan="7">Sensor initialization in progress, please wait</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>C</td></tr>
<tr><td>Diagnostic behavior</td><td>Warning</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">■ Oscillation amplitude 1
■ Oscillation amplitude 2
■ Application specific output
■ Application specific output
■ Signal asymmetry
■ Carrier mass flow
■ Carrier pipe temperature
■ Target corrected volume flow
■ Carrier corrected volume flow
■ Sensor index coil asymmetry
■ Concentration
■ Measured values
■ Oscillation damping 1
■ Oscillation damping 2
■ Density
■ Oil density
■ Water density
■ Test point
■ Test point
■ Dynamic viscosity
■ Sensor electronics temperature (ISEM)
■ GSV flow
■ GSV flow alternative
■ Kinematic viscosity
■ Mass flow
■ Oil mass flow
■ Water mass flow
■ Inhomogeneous medium index
■ Suspended bubbles index
■ HBSI
■ NSV flow
■ NSV flow alternative
■ External pressure
■ Exciter current 1
■ Exciter current 2
■ Oscillation frequency 1
■ Oscillation frequency 2
■ Raw value mass flow
■ S&W volume flow
■ Torsion signal asymmetry
■ Reference density
■ Reference density alternative
■ Corrected volume flow
■ Oil corrected volume flow
■ Water corrected volume flow
■ Oscillation damping fluctuation 1
■ Oscillation damping fluctuation 2
■ Frequency fluctuation 1
■ Frequency fluctuation 2
■ Target mass flow
■ Carrier volume flow
■ Target volume flow
■ Temp. compensated dynamic viscosity
■ Temp. compensated kinematic viscosity
■ Temperature
■ Volume flow
■ Oil volume flow
■ Water volume flow
■ Water cut</td></tr>
</table>

Diagnostic information			Remedy instructions
No.	**Short text**		
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
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Alarm	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">141</td><td colspan="2">Zero adjustment failed</td><td rowspan="7">1. Check process conditions
2. Repeat commissioning procedure
3. Check sensor</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Measured values
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
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▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">142</td><td colspan="2">Sensor index coil asymmetry too high</td><td rowspan="7">Check sensor</td></tr>
<tr><td colspan="2">Measured variable status [from the factory] [1]</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>S</td></tr>
<tr><td>Diagnostic behavior</td><td>Warning</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">Oscillation amplitude 1
Oscillation amplitude 2
Application specific output
Application specific output
Signal asymmetry
Carrier mass flow
Carrier pipe temperature
Target corrected volume flow
Carrier corrected volume flow
Sensor index coil asymmetry
Concentration
Measured values
Oscillation damping 1
Oscillation damping 2
Density
Oil density
Water density
Test point
Test point
Dynamic viscosity
Sensor electronics temperature (ISEM)
GSV flow
GSV flow alternative
Kinematic viscosity
Mass flow
Oil mass flow
Water mass flow
Inhomogeneous medium index
Suspended bubbles index
HBSI
NSV flow
NSV flow alternative
External pressure
Exciter current 1
Exciter current 2
Oscillation frequency 1
Oscillation frequency 2
Raw value mass flow
S&W volume flow
Torsion signal asymmetry
Reference density
Reference density alternative
Corrected volume flow
Oil corrected volume flow
Water corrected volume flow
Oscillation damping fluctuation 1
Oscillation damping fluctuation 2
Frequency fluctuation 1
Frequency fluctuation 2
Target mass flow
Carrier volume flow
Target volume flow
Temp. compensated dynamic viscosity
Temp. compensated kinematic viscosity
Temperature
Volume flow
Oil volume flow
Water volume flow
Water cut</td></tr>
</table>

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
144	Measurement error too high		1. Check process conditions 2. Check or change sensor
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

12.7.2 Diagnostic of electronic

Diagnostic information			Remedy instructions
No.	Short text		
201	Electronics faulty		1. Restart device 2. Replace electronics
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
242	Firmware incompatible		1. Check firmware version 2. Flash or replace electronic module
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
252	Module incompatible		1. Check electronic modules 2. Check if correct modules are available (e.g. NEx, Ex) 3. Replace electronic modules
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">270</td><td colspan="2">Main electronics defective</td><td rowspan="7">1. Restart device
2. Replace main electronic module</td></tr>
<tr><th colspan="2">Measured variable status</th></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><th colspan="3">Influenced measured variables</th></tr>
<tr><td colspan="3">
- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut
</td></tr>
</table>

Diagnostic information			Remedy instructions
No.	**Short text**		
271	Main electronics faulty		1. Restart device 2. Replace main electronic module
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">272</td><td colspan="2">Main electronics faulty</td><td rowspan="7">Restart device</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Measured values
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
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▪ Reference density
▪ Reference density alternative
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▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

Diagnostic information			Remedy instructions
No.	Short text		
273	Main electronics defective		1. Pay attention to display emergency operation 2. Replace main electronics
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">275</td><td colspan="2">I/O module defective</td><td rowspan="7">Change I/O module</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

</td></tr>
</table>

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">276</td><td colspan="2">I/O module faulty</td><td rowspan="7">1. Restart device
2. Change I/O module</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">
■ Oscillation amplitude 1
■ Oscillation amplitude 2
■ Application specific output
■ Application specific output
■ Signal asymmetry
■ Carrier mass flow
■ Carrier pipe temperature
■ Target corrected volume flow
■ Carrier corrected volume flow
■ Sensor index coil asymmetry
■ Concentration
■ Measured values
■ Oscillation damping 1
■ Oscillation damping 2
■ Density
■ Oil density
■ Water density
■ Test point
■ Test point
■ Dynamic viscosity
■ Sensor electronics temperature (ISEM)
■ GSV flow
■ GSV flow alternative
■ Kinematic viscosity
■ Mass flow
■ Oil mass flow
■ Water mass flow
■ Inhomogeneous medium index
■ Suspended bubbles index
■ HBSI
■ NSV flow
■ NSV flow alternative
■ External pressure
■ Exciter current 1
■ Exciter current 2
■ Oscillation frequency 1
■ Oscillation frequency 2
■ Raw value mass flow
■ S&W volume flow
■ Torsion signal asymmetry
■ Reference density
■ Reference density alternative
■ Corrected volume flow
■ Oil corrected volume flow
■ Water corrected volume flow
■ Oscillation damping fluctuation 1
■ Oscillation damping fluctuation 2
■ Frequency fluctuation 1
■ Frequency fluctuation 2
■ Target mass flow
■ Carrier volume flow
■ Target volume flow
■ Temp. compensated dynamic viscosity
■ Temp. compensated kinematic viscosity
■ Temperature
■ Volume flow
■ Oil volume flow
■ Water volume flow
■ Water cut
</td></tr>
</table>

Diagnostic information			Remedy instructions
No.	**Short text**		
283	Memory content inconsistent		Restart device
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	Short text		
302	Device verification active		Device verification active, please wait.
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Function check	
	Coding (hex)	0xBC to 0xBF	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	M	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
304	Device verification failed		1. Check verification report 2. Repeat commissioning procedure 3. Check sensor
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
311	Sensor electronics (ISEM) faulty		Maintenance required! Do not reset device
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	M	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
330	Flash file invalid		1. Update firmware of device 2. Restart device
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	M	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
331	Firmware update failed		1. Update firmware of device 2. Restart device
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
332	Writing in HistoROM backup failed		1. Replace user interface board 2. Ex d/XP: replace transmitter
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
361	I/O module 1 to n faulty		1. Restart device 2. Check electronic modules 3. Change I/O module or main electronics
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
369	Matrix code scanner defective		Replace matrix code scanner
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
371	Temperature sensor defective		Contact service
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	M	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	Short text		
372	Sensor electronics (ISEM) faulty		1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
373	Sensor electronics (ISEM) faulty		Transfer data or reset device
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
374	Sensor electronics (ISEM) faulty		1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
375	I/O- 1 to n communication failed		1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
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)
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
382	Data storage		1. Insert T-DAT 2. Replace T-DAT
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Measured values
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	Short text		
383	Memory content		Reset device
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	Oscillation amplitude 1 Oscillation amplitude 2 Application specific output Application specific output Signal asymmetry Carrier mass flow Carrier pipe temperature Target corrected volume flow Carrier corrected volume flow Sensor index coil asymmetry Concentration Measured values Oscillation damping 1 Oscillation damping 2 Density Oil density Water density Test point Test point Dynamic viscosity	Sensor electronics temperature (ISEM) GSV flow GSV flow alternative Kinematic viscosity Mass flow Oil mass flow Water mass flow Inhomogeneous medium index Suspended bubbles index HBSI NSV flow NSV flow alternative External pressure Exciter current 1 Exciter current 2 Oscillation frequency 1 Oscillation frequency 2 Raw value mass flow S&W volume flow Torsion signal asymmetry	Reference density Reference density alternative Corrected volume flow Oil corrected volume flow Water corrected volume flow Oscillation damping fluctuation 1 Oscillation damping fluctuation 2 Frequency fluctuation 1 Frequency fluctuation 2 Target mass flow Carrier volume flow Target volume flow Temp. compensated dynamic viscosity Temp. compensated kinematic viscosity Temperature Volume flow Oil volume flow Water volume flow Water cut

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">387</td><td colspan="2">HistoROM data faulty</td><td rowspan="7">Contact service organization</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>F</td></tr>
<tr><td>Diagnostic behavior</td><td>Alarm</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oscillation amplitude 1
▪ Oscillation amplitude 2
▪ Application specific output
▪ Application specific output
▪ Signal asymmetry
▪ Carrier mass flow
▪ Carrier pipe temperature
▪ Target corrected volume flow
▪ Carrier corrected volume flow
▪ Sensor index coil asymmetry
▪ Concentration
▪ Measured values
▪ Oscillation damping 1
▪ Oscillation damping 2
▪ Density
▪ Oil density
▪ Water density
▪ Test point
▪ Test point
▪ Dynamic viscosity
▪ Sensor electronics temperature (ISEM)
▪ GSV flow
▪ GSV flow alternative
▪ Kinematic viscosity
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ Inhomogeneous medium index
▪ Suspended bubbles index
▪ HBSI
▪ NSV flow
▪ NSV flow alternative
▪ External pressure
▪ Exciter current 1
▪ Exciter current 2
▪ Oscillation frequency 1
▪ Oscillation frequency 2
▪ Raw value mass flow
▪ S&W volume flow
▪ Torsion signal asymmetry
▪ Reference density
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oscillation damping fluctuation 1
▪ Oscillation damping fluctuation 2
▪ Frequency fluctuation 1
▪ Frequency fluctuation 2
▪ Target mass flow
▪ Carrier volume flow
▪ Target volume flow
▪ Temp. compensated dynamic viscosity
▪ Temp. compensated kinematic viscosity
▪ Temperature
▪ Volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

12.7.3 Diagnostic of configuration

Diagnostic information			Remedy instructions
No.	Short text		
410	Data transfer failed		1. Retry data transfer 2. Check connection
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
412	Processing download		Download active, please wait
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
431	Trim 1 to n required		Carry out trim
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
437	Configuration incompatible		1. Update firmware 2. Execute factory reset
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
438	Dataset different		1. Check dataset file 2. Check device parameterization 3. Download new device parameterization
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	M	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
441	Current output 1 to n saturated		1. Check current output settings 2. Check process
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
442	Frequency output 1 saturated		1. Check frequency output settings 2. Check process
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
443	Pulse output 1 saturated		1. Check pulse output settings 2. Check process
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
444	Current input 1 to n saturated		1. Check current input settings 2. Check connected device 3. Check process
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	Measured values		

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">453</td><td colspan="2">Flow override active</td><td rowspan="7">Deactivate flow override</td></tr>
<tr><td colspan="2">Measured variable status</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>C</td></tr>
<tr><td>Diagnostic behavior</td><td>Warning</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">
- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut
</td></tr>
</table>

Diagnostic information			Remedy instructions
No.	Short text		
484	Failure mode simulation active		Deactivate simulation
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Alarm	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
485	Process variable simulation active		Deactivate simulation
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	**Short text**		
486	Current input 1 to n simulation active		Deactivate simulation
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	Measured values		

Diagnostic information			Remedy instructions
No.	Short text		
491	Current output 1 to n simulation active		Deactivate simulation
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
492	Frequency output 1 to n simulation active		Deactivate simulation frequency output
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
493	Pulse output simulation active		Deactivate simulation pulse output
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
494	Switch output 1 to n simulation active		Deactivate simulation switch output
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
495	Diagnostic event simulation active		Deactivate simulation
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
496	Status input 1 to n simulation active		Deactivate simulation status input
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Carrier mass flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Concentration	▪ Density ▪ Mass flow ▪ Target mass flow ▪ Carrier volume flow	▪ Target volume flow ▪ Volume flow

Diagnostic information			Remedy instructions
No.	**Short text**		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Carrier mass flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Concentration	▪ Density ▪ Mass flow ▪ Target mass flow ▪ Carrier volume flow	▪ Target volume flow ▪ Volume flow

Diagnostic information			Remedy instructions
No.	Short text		
537	Configuration		1. Check IP addresses in network 2. Change IP address
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
594	Relay output 1 to n simulation active		Deactivate simulation switch output
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	C	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	–		

12.7.4 Diagnostic of process

Diagnostic information			Remedy instructions
No.	Short text		
803	Loop current 1 faulty		1. Check wiring 2. Change I/O module
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	**Short text**		
830	Ambient temperature too high		Reduce ambient temp. around the sensor housing
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
831	Ambient temperature too low		Increase ambient temp. around the sensor housing
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
832	Electronics temperature too high		Reduce ambient temperature
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
833	Electronics temperature too low		Increase ambient temperature
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
834	Process temperature too high		Reduce process temperature
	Measured variable status [from the factory] [1)]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
835	Process temperature too low		Increase process temperature
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
842	Process value below limit		1. Decrease process value 2. Check application 3. Check sensor
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
862	Partly filled pipe		1. Check for gas in process 2. Adjust detection limits
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Application specific output ▪ Application specific output ▪ Carrier mass flow ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Concentration ▪ Density ▪ Oil density ▪ Water density ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative	▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ S&W volume flow ▪ Reference density ▪ Reference density alternative	▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
882	Input signal faulty		1. Check input signal parameterization 2. Check external device 3. Check process conditions
	Measured variable status		
	Quality	Bad	
	Quality substatus	Maintenance alarm	
	Coding (hex)	0x24 to 0x27	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

Diagnostic information			Remedy instructions
No.	Short text		
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
	Measured variable status		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	F	
	Diagnostic behavior	Alarm	
	Influenced measured variables		
	–		

Diagnostic information			Remedy instructions
No.	Short text		
912	Medium inhomogeneous		1. Check process cond. 2. Increase system pressure
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	**Short text**		
913	Medium unsuitable		1. Check process conditions 2. Check electronic modules or sensor
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity ▪ Sensor electronics temperature (ISEM)	▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry ▪ Reference density	▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
915	Viscosity ouf of specification		1. Avoid 2-phase flow 2. Increase system pressure 3. Verify viscosity and density are within range 4. Check process conditions
	Measured variable status [from the factory] 1)		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
941	API/ASTM temperature out of specificat.		1. Check process temperature with selected API/ASTM commodity group 2. Check API/ASTM-related parameters
	Measured variable status [from the factory] 1)		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oil density ▪ Water density ▪ GSV flow ▪ GSV flow alternative ▪ Mass flow ▪ Oil mass flow	▪ Water mass flow ▪ NSV flow ▪ NSV flow alternative ▪ S&W volume flow ▪ Reference density alternative ▪ Corrected volume flow	▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">942</td><td colspan="2">API/ASTM density out of specification</td><td rowspan="7">1. Check process density with selected API/ASTM commodity group
2. Check API/ASTM-related parameters</td></tr>
<tr><td colspan="2">Measured variable status [from the factory] 1)</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>S</td></tr>
<tr><td>Diagnostic behavior</td><td>Warning</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oil density
▪ Water density
▪ GSV flow
▪ GSV flow alternative
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ NSV flow
▪ NSV flow alternative
▪ S&W volume flow
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

<table>
<tr><th colspan="3">Diagnostic information</th><th rowspan="2">Remedy instructions</th></tr>
<tr><th>No.</th><th colspan="2">Short text</th></tr>
<tr><td rowspan="9">943</td><td colspan="2">API pressure out of specification</td><td rowspan="7">1. Check process pressure with selected API commodity group
2. Check API related parameters</td></tr>
<tr><td colspan="2">Measured variable status [from the factory] 1)</td></tr>
<tr><td>Quality</td><td>Good</td></tr>
<tr><td>Quality substatus</td><td>Ok</td></tr>
<tr><td>Coding (hex)</td><td>0x80 to 0x83</td></tr>
<tr><td>Status signal</td><td>S</td></tr>
<tr><td>Diagnostic behavior</td><td>Warning</td></tr>
<tr><td colspan="3">Influenced measured variables</td></tr>
<tr><td colspan="3">▪ Oil density
▪ Water density
▪ GSV flow
▪ GSV flow alternative
▪ Mass flow
▪ Oil mass flow
▪ Water mass flow
▪ NSV flow
▪ NSV flow alternative
▪ S&W volume flow
▪ Reference density alternative
▪ Corrected volume flow
▪ Oil corrected volume flow
▪ Water corrected volume flow
▪ Oil volume flow
▪ Water volume flow
▪ Water cut</td></tr>
</table>

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
944	Monitoring failed		Check process conditions for Heartbeat Monitoring
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Signal asymmetry
- Carrier pipe temperature
- Sensor index coil asymmetry
- Oscillation damping 1
- Oscillation damping 2
- Test point
- Test point
- Dynamic viscosity
- Kinematic viscosity
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- Torsion signal asymmetry
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
948	Oscillation damping too high		Check process conditions
	Measured variable status [from the factory] [1]		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		

- Oscillation amplitude 1
- Oscillation amplitude 2
- Application specific output
- Application specific output
- Signal asymmetry
- Carrier mass flow
- Carrier pipe temperature
- Target corrected volume flow
- Carrier corrected volume flow
- Sensor index coil asymmetry
- Concentration
- Oscillation damping 1
- Oscillation damping 2
- Density
- Oil density
- Water density
- Test point
- Test point
- Dynamic viscosity
- Sensor electronics temperature (ISEM)
- GSV flow
- GSV flow alternative
- Kinematic viscosity
- Mass flow
- Oil mass flow
- Water mass flow
- Inhomogeneous medium index
- Suspended bubbles index
- HBSI
- NSV flow
- NSV flow alternative
- External pressure
- Exciter current 1
- Exciter current 2
- Oscillation frequency 1
- Oscillation frequency 2
- Raw value mass flow
- S&W volume flow
- Torsion signal asymmetry
- Reference density
- Reference density alternative
- Corrected volume flow
- Oil corrected volume flow
- Water corrected volume flow
- Oscillation damping fluctuation 1
- Oscillation damping fluctuation 2
- Frequency fluctuation 1
- Frequency fluctuation 2
- Target mass flow
- Carrier volume flow
- Target volume flow
- Temp. compensated dynamic viscosity
- Temp. compensated kinematic viscosity
- Temperature
- Volume flow
- Oil volume flow
- Water volume flow
- Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

Diagnostic information			Remedy instructions
No.	Short text		
984	Condensation risk		1. Decrease ambient temperature 2. Increase medium temperature
	Measured variable status [from the factory] [1)		
	Quality	Good	
	Quality substatus	Ok	
	Coding (hex)	0x80 to 0x83	
	Status signal	S	
	Diagnostic behavior	Warning	
	Influenced measured variables		
	▪ Oscillation amplitude 1 ▪ Oscillation amplitude 2 ▪ Application specific output ▪ Application specific output ▪ Signal asymmetry ▪ Carrier mass flow ▪ Carrier pipe temperature ▪ Target corrected volume flow ▪ Carrier corrected volume flow ▪ Sensor index coil asymmetry ▪ Concentration ▪ Measured values ▪ Oscillation damping 1 ▪ Oscillation damping 2 ▪ Density ▪ Oil density ▪ Water density ▪ Test point ▪ Test point ▪ Dynamic viscosity	▪ Sensor electronics temperature (ISEM) ▪ GSV flow ▪ GSV flow alternative ▪ Kinematic viscosity ▪ Mass flow ▪ Oil mass flow ▪ Water mass flow ▪ Inhomogeneous medium index ▪ Suspended bubbles index ▪ HBSI ▪ NSV flow ▪ NSV flow alternative ▪ External pressure ▪ Exciter current 1 ▪ Exciter current 2 ▪ Oscillation frequency 1 ▪ Oscillation frequency 2 ▪ Raw value mass flow ▪ S&W volume flow ▪ Torsion signal asymmetry	▪ Reference density ▪ Reference density alternative ▪ Corrected volume flow ▪ Oil corrected volume flow ▪ Water corrected volume flow ▪ Oscillation damping fluctuation 1 ▪ Oscillation damping fluctuation 2 ▪ Frequency fluctuation 1 ▪ Frequency fluctuation 2 ▪ Target mass flow ▪ Carrier volume flow ▪ Target volume flow ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Volume flow ▪ Oil volume flow ▪ Water volume flow ▪ Water cut

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

12.8 Pending diagnostic events

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

To call up the measures to rectify a diagnostic event:
- Via local display → 🗎 212
- Via web browser → 🗎 213
- Via "FieldCare" operating tool → 🗎 214
- Via "DeviceCare" operating tool → 🗎 214

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 🗎 282.

Navigation
"Diagnostics" menu

Diagnostics		
	Actual diagnostics	→ 🗎 282
	Previous diagnostics	→ 🗎 282

Operating time from restart	→ 📄 282
Operating time	→ 📄 282

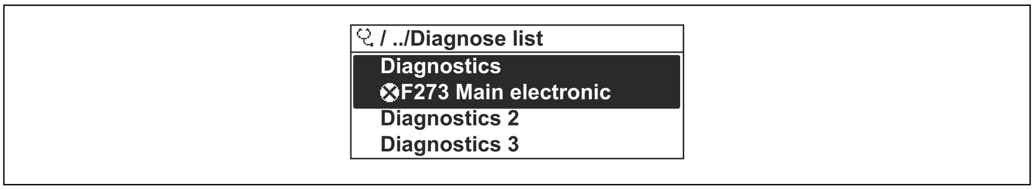
Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occured diagnostic event along with its diagnostic information. ℹ 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)

12.9 Diagnostics list

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

Navigation path
Diagnostics → Diagnostic list



📷 40 *Using the example of the local display*

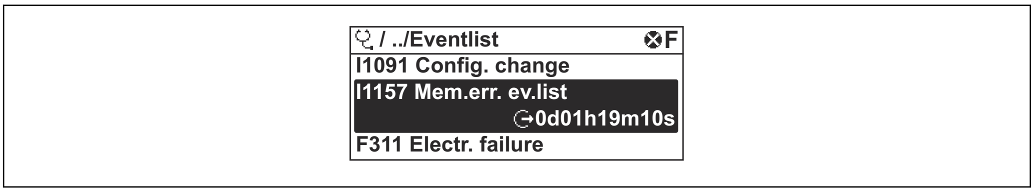
ℹ To call up the measures to rectify a diagnostic event:
- Via local display → 📄 212
- Via web browser → 📄 213
- Via "FieldCare" operating tool → 📄 214
- Via "DeviceCare" operating tool → 📄 214

12.10 Event logbook

12.10.1 Reading out the event logbook

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

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



A0014008-EN

41 Using the example of the local display

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

The event history includes entries for:
- Diagnostic events → 216
- Information events → 283

In addition to the operating time when the event occurred, each event is also assigned a symbol that indicates whether the event has occurred or is finished:
- Diagnostics event
  - : Occurrence of the event
  - : End of the event
- Information event
  : Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 212
- Via web browser → 213
- Via "FieldCare" operating tool → 214
- Via "DeviceCare" operating tool → 214

For filtering the displayed event messages → 283

12.10.2 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)

12.10.3 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

Info number	Info name
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
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
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

Info number	Info name
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
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1712	New flash file received
I1725	Sensor electronic module (ISEM) changed
I1726	Configuration backup failed

12.11 Resetting the measuring device

The entire device configuration or some of the configuration can be reset to a defined state with the **Device reset** parameter (→ 🗎 150).

12.11.1 Function range of "Device reset" parameter

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

12.12 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	→ 🗎 286
Serial number	→ 🗎 286
Firmware version	→ 🗎 286

Device name	→ 📄 286
Manufacturer	→ 📄 286
Order code	→ 📄 286
Extended order code 1	→ 📄 286
Extended order code 2	→ 📄 286
Extended order code 3	→ 📄 286
ENP version	→ 📄 286

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Character string comprising numbers, letters and special characters	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. ℹ The name can be found on the nameplate of the transmitter.	Character string comprising numbers, letters and special characters	–
Device name		Character string comprising numbers, letters and special characters	Prowirl
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. ℹ 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. ℹ 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

12.13 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware Changes	Documentation type	Documentation
2023	01.00.zz	Option **61**	Original firmware	Operating Instructions	

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

For the compatibility of the firmware version with 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 Exterior cleaning

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

13.2 Measuring and test equipment

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

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

List of some of the measuring and testing equipment: → 292

13.3 Endress+Hauser 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 (→ 286) in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

14.4 Return

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

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

14.5 Disposal

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

14.5.1 Removing the measuring device

1. Switch off the device.

⚠ WARNING

Danger to persons from process conditions!
- ▶ Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive media.

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

14.5.2 Disposing of the measuring device

⚠ WARNING

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

Observe the following notes during disposal:
- ▶ Observe valid federal/national regulations.
- ▶ Ensure proper separation and reuse of the device components.

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

Accessories	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. ▪ Additional information regarding the WLAN interface → 69. Order number: 71351317 Installation Instructions EA01238D
Connecting cable Proline 500 – digital Sensor – Transmitter	The connecting cable can be ordered directly with the measuring device (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 (1000 ft)

15.1.2 For the sensor

Accessories	Description
Disposable measuring tube	Order number: ▪ DN ⅛": DK8014-04SBOAADA2 ▪ DN ¼": DK8014-06SBOAADA2 ▪ DN ½": DK8014-15SBOAADA2 ▪ DN 1": DK8014-25SBOAADA2

15.2 Communication-specific accessories

Accessories	Description
Fieldgate FXA42	Transmission of the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42
Field Xpert SMT50	The Field Xpert SMT50 table PC for device configuration enables mobile plant asset management. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. ▪ Technical Information TI01555S ▪ Operating Instructions BA02053S ▪ Product page: www.endress.com/smt50
Field Xpert SMT70	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. ▪ Technical Information TI01342S ▪ Operating Instructions BA01709S ▪ Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. ▪ Technical Information TI01418S ▪ Operating Instructions BA01923S ▪ Product page: www.endress.com/smt77

15.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Choice of measuring devices for industrial requirements ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. ▪ Graphic illustration of the calculation results ▪ Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://portal.endress.com/webapp/applicator ▪ As a downloadable DVD for local PC installation.
Netilion	IIoT ecosystem: Unlock knowledge Endress+Hauser 's Netilion IIoT ecosystem enables you to optimize your plant performance, digitize workflows, share knowledge and improve collaboration. Based on decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem that enables you to gain useful insights from data. This knowledge can be used to optimize processes, leading to higher plant availability, efficiency and reliability, and ultimately to a more profitable plant. www.netilion.endress.com

Accessories	Description
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S

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 physically separate from each other and are attached to each other via connecting cables. ▪ The device is available in a table-top version: The transmitter and sensor form a mechanical unit. Information on the structure of the device → 🗎 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	⅛	0 to 2	0 to 4.4
6	¼	0 to 4.8	0 to 10.6
15	½	0 to 28.6	0 to 63.1
25	1	0 to 75	0 to 165.3

Recommended measuring range

Flow limit → 307

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 device:
- Operating pressure to increase measurement accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure)
- 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 → 296.

Digital communication

The measured values are written by the automation system via PROFINET with Ethernet/APL/SPE.

Current input 0/4 to 20 mA

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

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Configurable: 5 to 200 ms
Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

16.4 Output

Output signal

PROFINET with Ethernet-APL

Device use	**Device connection to an APL field switch** The device may only be operated according to the following APL port classifications: If used in non-hazardous areas: SLAX **Device connection to an SPE switch** ▪ In non-hazardous areas, the device can be used with an appropriate SPE switch: The device can be connected to an SPE switch with a maximum voltage of 30 V_{DC} and a minimum output power of 1.85 W connected. ▪ The SPE switch must support the 10BASE-T1L standard and PoDL power classes 10, 11 or 12 and have a function to disable power class detection.
PROFINET	According to IEC 61158 and IEC 61784
Ethernet-APL	According to IEEE 802.3cg, APL port profile specification v1.0, galvanically isolated
Data transmission	10 Mbit/s
Current consumption	**Transmitter** ▪ Max. 400 mA(24 V) ▪ Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)
Permitted supply voltage	9 to 30 V
Network connection	With integrated reverse polarity protection

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 µA
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 ℹ 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: ≤ 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.

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:

PROFINET with Ethernet-APL/SPE

Device diagnostics	Diagnostics according to PROFINET PA Profile 4

Current output 0/4 to 20 mA

4 to 20 mA

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

0 to 20 mA

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

Pulse/frequency/switch output

Pulse output	
Fault mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Fault mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Definable value between: 2 to 12 500 Hz
Switch output	
Fault mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

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

Local display

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

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
  PROFINET with Ethernet-APL/SPE
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

Plain text display	With information on cause and remedial measures

Web browser

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred ▪ PROFINET network available ▪ PROFINET connection established ▪ PROFINET blinking feature Diagnostic information via light emitting diodes → 208

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 potential equalization (PE) terminal

Protocol-specific data

Protocol	Application layer protocol for decentral device periphery and distributed automation, Version 2.43
Communication type	Ethernet Advanced Physical Layer 10BASE-T1L
Conformance Class	Conformance Class B (PA)
Netload Class	PROFINET Netload Robustness Class 2 10 Mbit/s
Baud rates	10 Mbit/s Full-duplex
Cycle times	64 ms
Polarity	Automatic correction of crossed "APL signal +" and "APL signal -" signal lines
Media Redundancy Protocol (MRP)	Not possible (point-to-point connection to APL field switch)
System redundancy support	System redundancy S2 (2 AR with 1 NAP)
Device profile	PROFINET PA profile 4 (Application interface identifier API: 0x9700)
Manufacturer ID	17
Device type ID	0xA43B
Device description files (GSD, DTM, FDI)	Information and files available at: ▪ www.endress.com → Downloads section ▪ www.profibus.com

Supported connections	▪ 2x AR (IO Controller AR) ▪ 2x AR (IO Supervisor Device AR connection allowed)
Configuration options for measuring device	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated Web server via Web browser and IP address ▪ Device master file (GSD), can be read out via the integrated Web server of the measuring device. ▪ Onsite operation
Configuration of the device name	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ DCP protocol ▪ Asset management software (FieldCare, DeviceCare, Field Xpert) ▪ Integrated Web server

Supported functions	▪ Identification & Maintenance, simple device identifier via:
	  ▪ Control system
	  ▪ Nameplate
	▪ Measured value status
	The process variables are communicated with a measured value status
	▪ Blinking feature via the local display for simple device identification and assignment
	▪ Device operation via asset management software (e.g. FieldCare, DeviceCare, SIMATIC PDM with FDI package)

System integration	Information regarding system integration . ▪ Cyclic data transmission ▪ Overview and description of the modules ▪ Status coding ▪ Factory setting

16.5 Power supply

Terminal assignment

→ 📄 31

Available device plugs

→ 📄 31

Available device plugs

→ 📄 31

Supply voltage

Order code "Power supply"	Terminal voltage		Frequency range
Option **I**	DC 24 V	±20%	–
	AC 100 to 240 V	−15...+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

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 pluggable data memory (HistoROM DAT). ▪ Error messages (incl. total operated hours) are stored.
Overcurrent protection element	The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own. ▪ The circuit breaker must be easy to reach and labeled accordingly. ▪ Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.
Electrical connection	→ 🗎 34
Potential equalization	→ 🗎 39
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	→ 🗎 29

Overvoltage protection

Mains voltage fluctuations	→ 🗎 302
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

ℹ To obtain measured errors, use the *Applicator* sizing tool → 🗎 292

Maximum measurement error

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

ℹ In non-condensing environment.

Base accuracy

ℹ Design fundamentals → 🗎 305

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	⅛	0.0006	0.00132
6	¼	0.0023	0.00507
15	½	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/min]	[kg/min]	[kg/min]	[kg/min]	[kg/min]	[kg/min]
4	450	45	22.5	9	4.5	0.9
6	1000	100	50	20	10	2
15	6500	650	325	130	65	13
25	18000	1800	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]
⅛	16.54	1.654	0.827	0.331	0.165	0.033
¼	36.75	3.675	1.838	0.735	0.368	0.074
½	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	±5 µA

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ±50 ppm o.r. (over the entire ambient temperature range)

Repeatability

o.r. = of reading; 1 g/cm^3 = 1 kg/l; T = medium temperature

Base repeatability

Design fundamentals → 305

Mass flow and volume flow (liquids)

±0.25 % o.r.

Density (liquids)

- Basic accuracy: ±0.01 g/cm^3
- Repeatability: ±0.005 g/cm^3

Temperature

±0.125 °C (±0.225 °F)

Response time

The response time depends on the configuration (damping).

Influence of ambient temperature

Current output

Temperature coefficient	Max. 1 μA/°C

Pulse/frequency output

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 accuracy.

A pressure of >0.2 bar is required for 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	$\pm$ 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.
$\geq \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021335	$\pm$ BaseRepeat A0021340
$< \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021336	$\pm ½ \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021337

16.7 Mounting

Mounting 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 indoor use with a relative humidity of 5 to 40 %.

Operating height

According to EN 61010-1
- ≤ 2 000 m (6 562 ft)
- > 2 000 m (6 562 ft) with additional overvoltage protection (e.g. Endress+Hauser HAW Series)

Degree of protection

Transmitter

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

Sensor

- IP54
- With housing open: IP20

External WLAN antenna

IP67

Shock and vibration resistance

Vibration sinusoidal, in accordance with 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

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

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

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

Transmitter
6 ms 50 g

Rough handling shocks according 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)

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 density

800 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 → 🗎 295

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value
- In most 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 *Applicator* sizing tool → 292

Pressure loss

To calculate the pressure loss, use the *Applicator* sizing tool → 292

16.10 Mechanical construction

Design, dimensions

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

Process connections

Hose connection nipple:
Covestro Makrolon Rx1805 polycarbonate

Surface roughness

All data refer to parts in contact with the medium. The following surface roughness categories can be ordered.
- Steel:
  Ra_{max} = 0.76 µm (30 µin) mechanically polished
- Plastic:
  Ra_{max} = 0.76 µm (30 µin)

16.11 Display and user interface

Languages

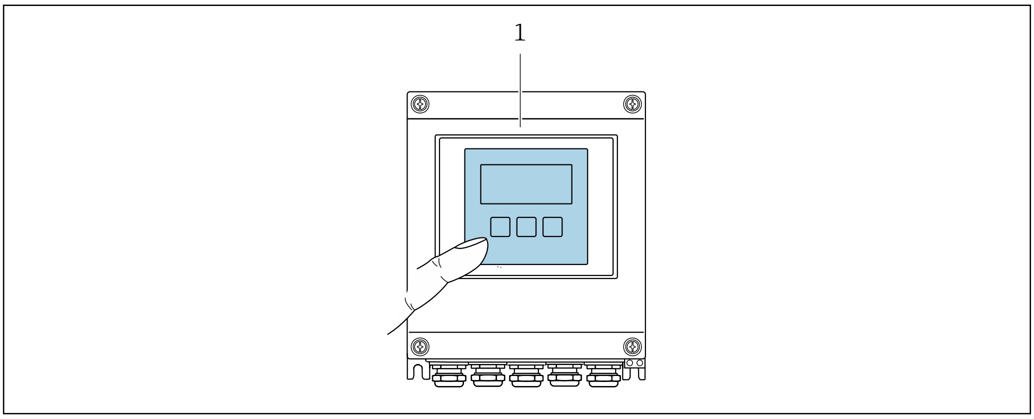
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Vietnamese, Czech, Swedish
- Via web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian,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

Onsite operation

Via display module

Features:
- 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 → 69



42 *Operation with touch control*

1 Proline 500 – digital

Display elements

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

Operating elements

External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, Ⓔ

Remote operation → 68

Service interface → 69

Supported operating tools

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

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with web browser	▪ CDI-RJ45 service interface ▪ WLAN interface	Special Documentation for device → 315
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 292
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 292

Supported operating tools	Operating unit	Interface	Additional information
Field Xpert	SMT70/77/50	▪ All Fieldbus protocols ▪ WLAN interface ▪ Bluetooth ▪ CDI-RJ45 service interface	Operating Instructions BA01202S Device description files: Use update function of handheld terminal
SmartBlue app	Smart phone or tablet with iOs or Android	WLAN	→ 📄 292

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

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

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

Web server

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

Access to the network is required for the Ethernet-APL connection.

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 device:
- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification report (PDF file, only available with the **Heartbeat Verification** 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 device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.

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

Additional information on the data storage concept

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

	HistoROM backup	T-DAT	S-DAT
Available data	▪ Event logbook, e.g. diagnostic events ▪ Parameter data record backup ▪ Device firmware package ▪ Driver for system integration for exporting via web server, e.g.: GSDML for PROFINET	▪ 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)
- Transmission of the drivers for system integration via Web server, e.g.:
  GSDML for PROFINET

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
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.

PROFINET with Ethernet-APL/SPE certification

PROFINET interface

The measuring device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e. V./PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:
- Certified according to:
  - Test specification for PROFINET devices
  - PROFINET PA Profile 4
  - PROFINET netload robustness Class 2 10 Mbit/s
  - APL conformance test
- The device can also be operated with certified devices of other manufacturers (interoperability)
- The device supports PROFINET S2 system redundancy.

Radio approval

The measuring device has radio approval.

For detailed information on the radio approval, see the Special Documentation → 315

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

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
- IEC/EN 61326-2-3
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications

- 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 → 315

16.14 Accessories

Overview of accessories available to order → 291

16.15 Supplementary documentation

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

Standard documentation **Brief Operating Instructions**

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Promass U	KA0XXXXD

Brief Operating Instructions for the transmitter

Measuring device	Documentation code
Proline 500 – digital	KA01521D

Technical Information

Measuring device	Documentation code

Description of Device Parameters

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

Installation instructions

Contents	Note
Installation instructions for spare part sets and accessories	▪ Access the overview of all the available spare part sets via *Device Viewer* → 289 ▪ Accessories available for order with Installation Instructions → 291

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