BA02321D/06/EN/01.23-00
71637044
2024-03-15

Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Proline Teqwave MW 300

Total solids measurement via microwave transmission
Modbus RS485

Endress+Hauser
People for Process Automation

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

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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

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

⚠ WARNING
This symbol alerts you to a 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
	Flat-blade screwdriver
	Allen key
	Open-ended wrench

1.2.5 Symbols for certain types of information

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

1.2.6 Symbols in graphics

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

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

1.3 Documentation

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

1.3.1 Document function

The following documentation may be available depending on the 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** The Operating Instructions contain all the information that is required in the various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. The Safety Instructions are an integral part of the Operating Instructions. Information on the Safety Instructions (XA) relevant to the device is provided on the nameplate.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the device documentation.

1.4 Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

2 Safety instructions

2.1 Requirements for the personnel

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

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

2.2 Intended use

Application and media
The measuring device described in this manual is intended only for solids content measurement in water-based liquids.

Measuring devices for use in explosive atmospheres are labeled accordingly on the nameplate.

To ensure that the measuring device is in proper condition during the operation period:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Refer to the nameplate to check whether the ordered device can be operated for the intended application in areas requiring specific approvals (e.g. explosion protection, pressure equipment safety).
- Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- Keep within the specified pressure and temperature range.
- Keep within the specified ambient temperature range.
- Protect the measuring device permanently against corrosion from environmental influences.

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

⚠ 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.

Residual risks

⚠ CAUTION

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

- Mount suitable touch protection.
- Use suitable protective equipment.

2.3 Workplace safety

When working on and with the device:

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

2.4 Operational safety

Damage to the device!

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

Modifications to the device

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

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

Repair

To ensure continued operational safety and reliability:

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

2.5 Product safety

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

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity..

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
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) → 🖹 12	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 → 🖹 117.

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 (→ 🖹 116).

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 (→ 68), which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter (→ 108).

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" → 116.

2.7.3 Access via web server

→ 61With the integrated web server, the device can be operated and configured via a web browser. The connection is via the service interface (CDI-RJ45) or the WLAN interface.

The web server is enabled when the device is delivered. The web server can be disabled 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.

For detailed information on device parameters, see:
"Description of device parameters" document → 188.

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.

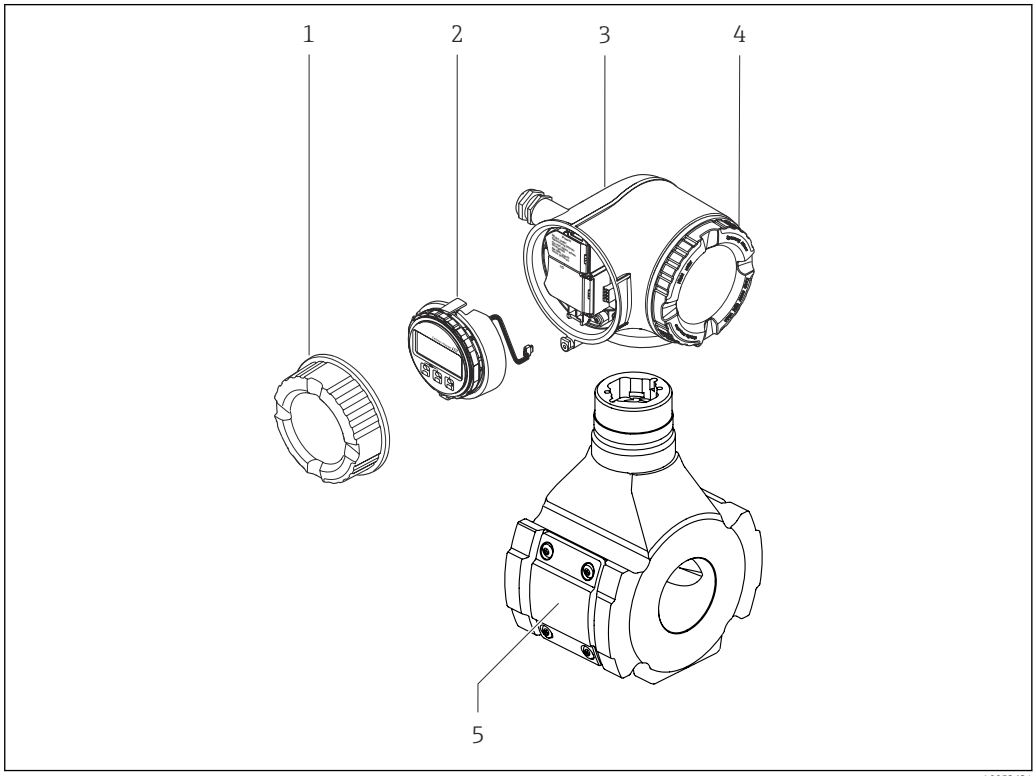
The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures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

3 Product description

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

3.1 Product design



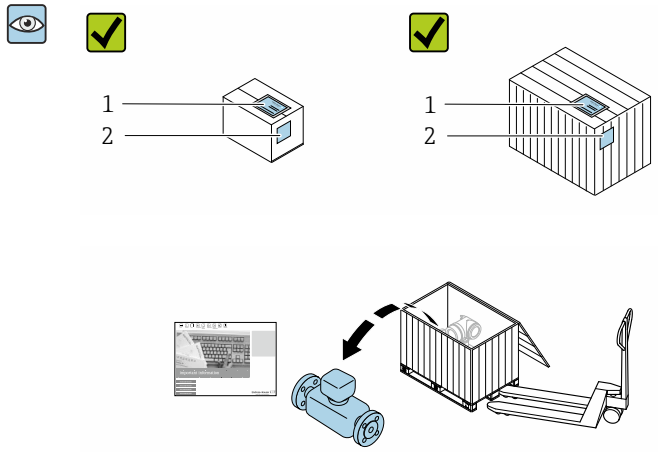
1 *Important components of a measuring device*

1 *Connection compartment cover*
2 *Display module*
3 *Transmitter housing*
4 *Electronics compartment cover*
5 *Sensor*

Use of the device with the remote display and operating module DKX001 → 39.

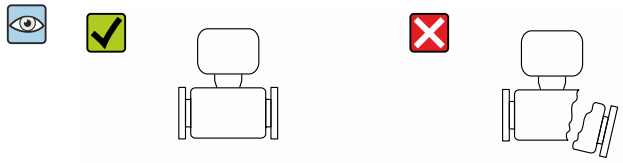
4 Incoming acceptance and product identification

4.1 Incoming acceptance

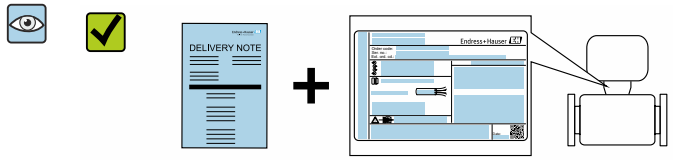


Are the order codes on the delivery note (1) and the product sticker (2) identical?

Are the goods undamaged?



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



Is the envelope present with accompanying documents?

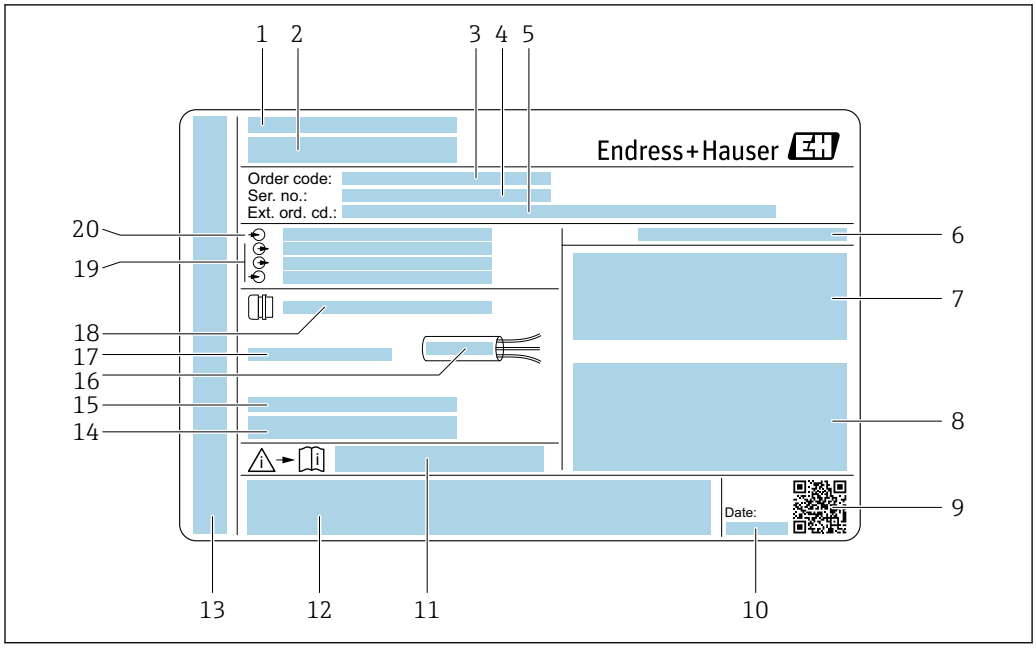
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations app*: Product identification→ 15.

4.2 Product identification

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

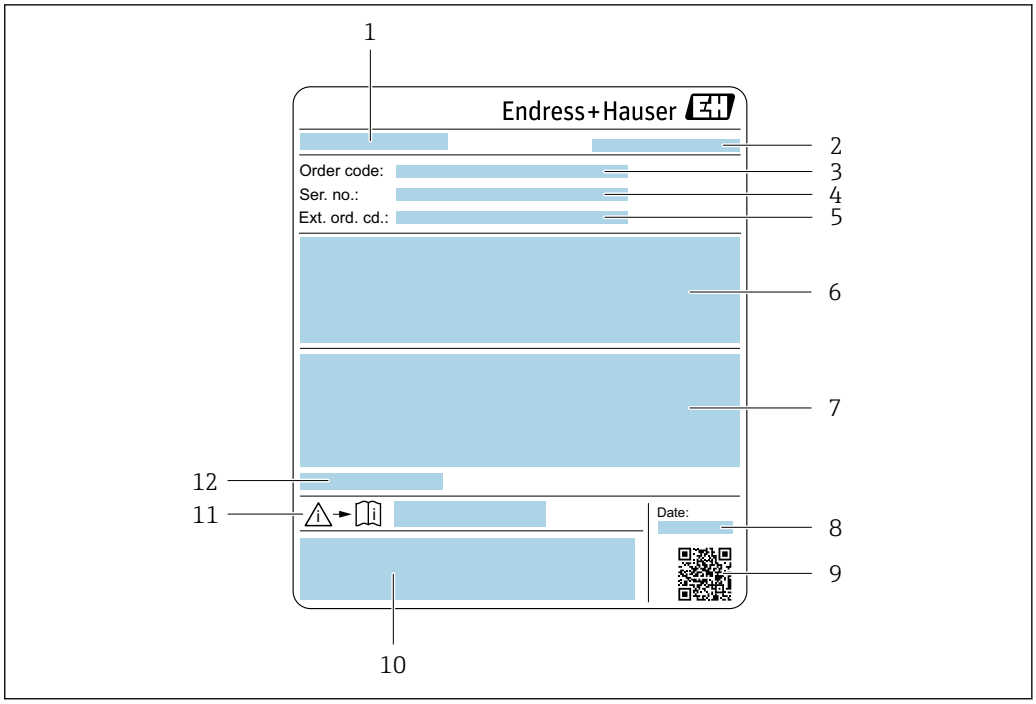
4.2.1 Transmitter nameplate



2 *Example of a transmitter nameplate*

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

4.2.2 Sensor nameplate



A0051311

1 *Name of sensor*
2 *Manufacturer address/certificate holder*
3 *Order code*
4 *Serial number (Ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Full scale value; nominal diameter of the sensor; pressure rating; nominal pressure; static pressure; medium temperature range; measuring tube material, antennas, temperature sensor and gasket between antenna holder and cast body, antenna ceramic*
7 *Approval information for explosion protection, Pressure Equipment Directive and degree of protection*
8 *Date of manufacture: year-month*
9 *2-D matrix code*
10 *CE mark, RCM-Tick mark*
11 *Document number of safety-related supplementary documentation*
12 *Permitted ambient temperature (T_a)*

Order code

The measuring device is reordered using the order code.

Extended order code

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

4.2.3 Symbols on the device

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

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature → 174

5.2 Transporting the product

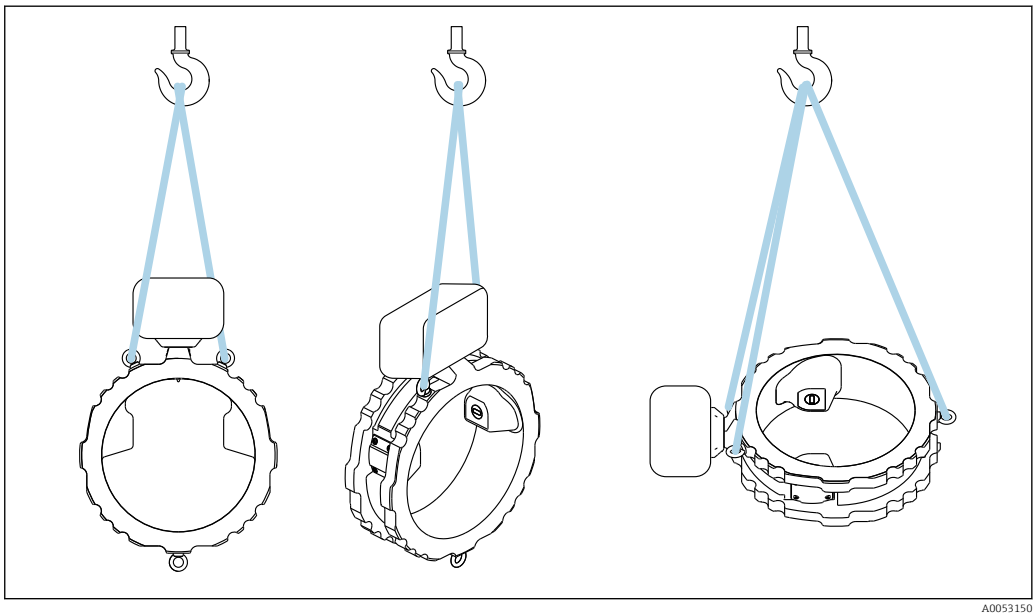
Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

5.2.1 Measuring devices with lifting lugs

Devices with a nominal diameter of DN 200 to 300 mm (8 to 12 in) have two options for mounting lifting lugs (eyebolts) for the purpose of transport. The two upper threaded holes are provided for vertically transporting the device, while the two upper threaded holes and one of the opposite lower threaded holes are provided for horizontal transport.

CAUTION

Special transportation instructions for devices with lifting lugs
- Only use the lifting lugs fitted to the device for transport.
- The device must always be attached to two lifting lugs when transported vertically and three lifting lugs when transported horizontally.



3 *Vertical and horizontal transport of the device using mounted lifting lugs*

5.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

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

6 Mounting procedure

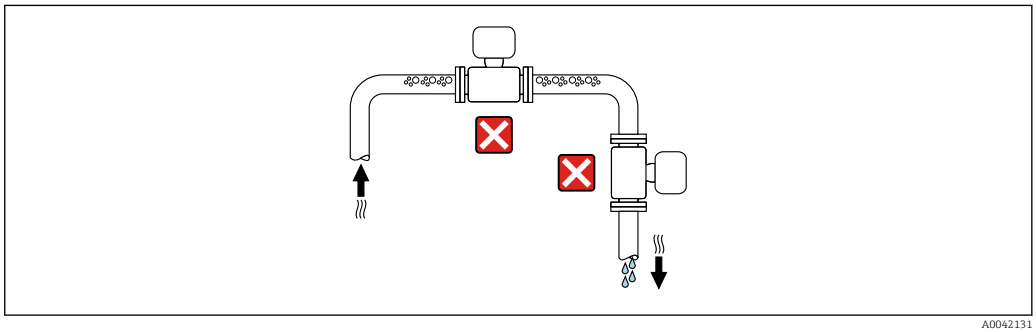
6.1 Mounting requirements

6.1.1 Mounting position

Installation point

Installation in pipe

Do **not** install the device:
- At the highest point of the pipe (risk of gas bubbles accumulating in the measuring tube)
- Upstream of a free pipe outlet in a down pipe



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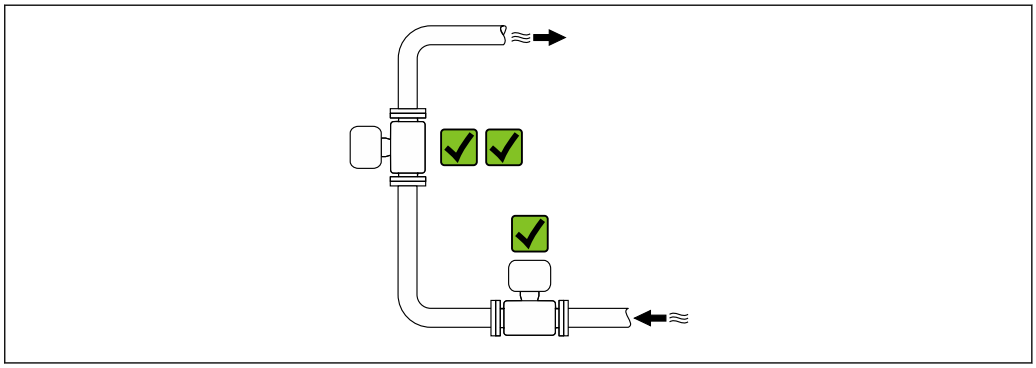
Install the device:
- Ideally in an ascending pipe
- Upstream of an ascending pipe or in areas where the device is filled with medium



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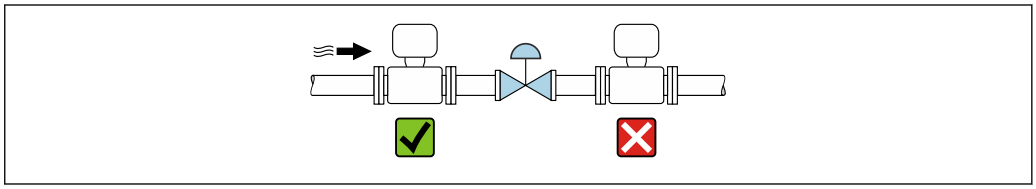
Installation near valves

Mount the sensor upstream from control valves if possible.



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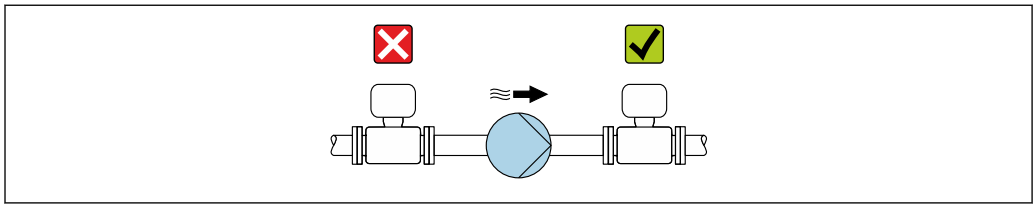
Installation near pumps

- Install the device in the direction of flow downstream from the pump.
- Also install pulsation dampers if reciprocating, diaphragm or peristaltic pumps are used.



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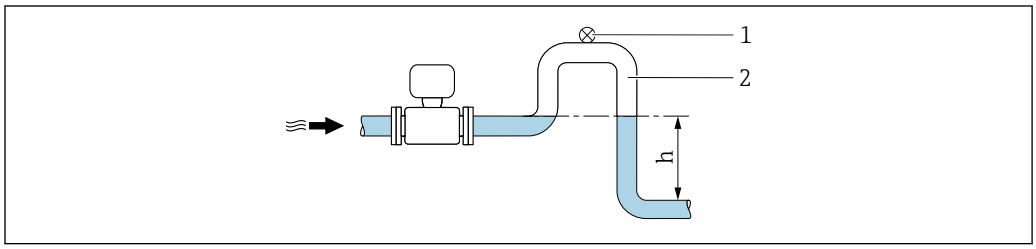
Installation upstream from a down pipe

If installing upstream of down pipes with a length h ≥ 5 m (16.4 ft): Install a siphon with a vent valve downstream of the device.



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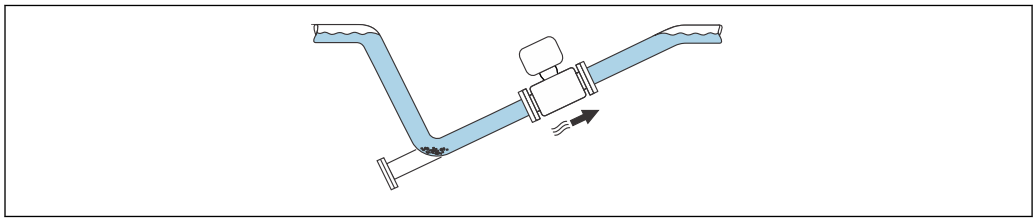
4 *This arrangement prevents the flow of liquid stopping in the pipe and the formation of air pockets.*

1 *Vent valve*
2 *Pipe siphon*
h *Length of down pipe*

Installation with partially filled pipes

- Partially filled pipes with a gradient require a drain-type configuration.
- The installation of a cleaning valve is recommended.



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Installation in event of pipe vibrations

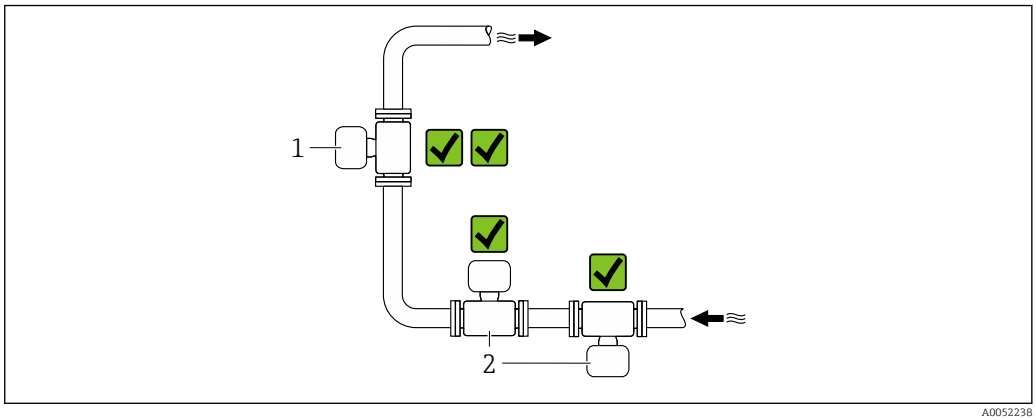
NOTICE

Pipe vibrations can damage the device!

▶ Do not expose the device to strong vibrations.

Information on the measuring system's resistance to vibration and shock → 175

Orientation



1 Vertical orientation
2 Horizontal orientation

Vertical orientation

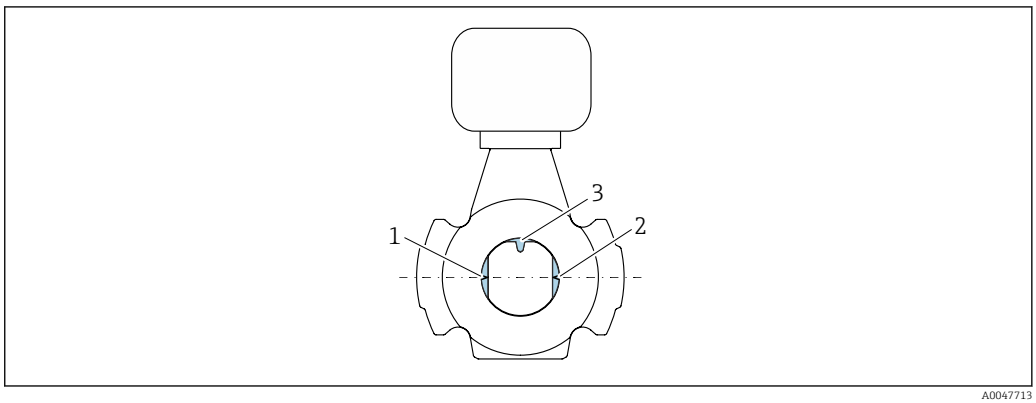
The device should ideally be installed in a rising pipe:
- To avoid having a partially filled pipe
- To avoid any gas accumulation
- The measuring tube can be completely drained and protected against the buildup of deposits.

In the case of total solids of ≥ 20 %TS:

Install the device vertically. If it is installed horizontally, separating layers can form as a result of sedimentation, separating liquid and solids. This can lead to measurement errors.

Horizontal orientation

The antennas (transmitter and receiver) should be positioned horizontally in order to avoid interference to the measurement signal caused by entrained air bubbles.



1 Antenna - transmitter
2 Antenna - receiver
3 Temperature sensor

Flow direction

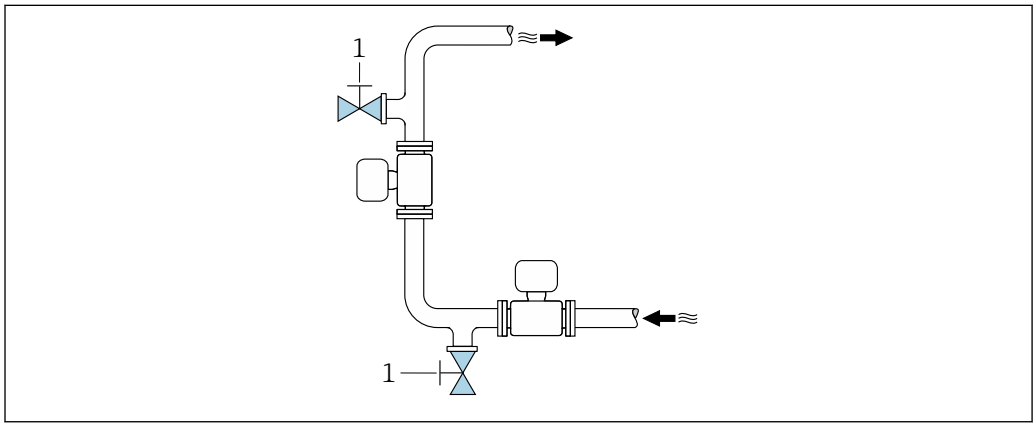
The device can be installed independently of the flow direction.

Inlet and outlet runs

When installing the device, no inlet and outlet runs need to be taken into account. No special precautions need to be taken for fittings that create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs.

Installation with sampling points

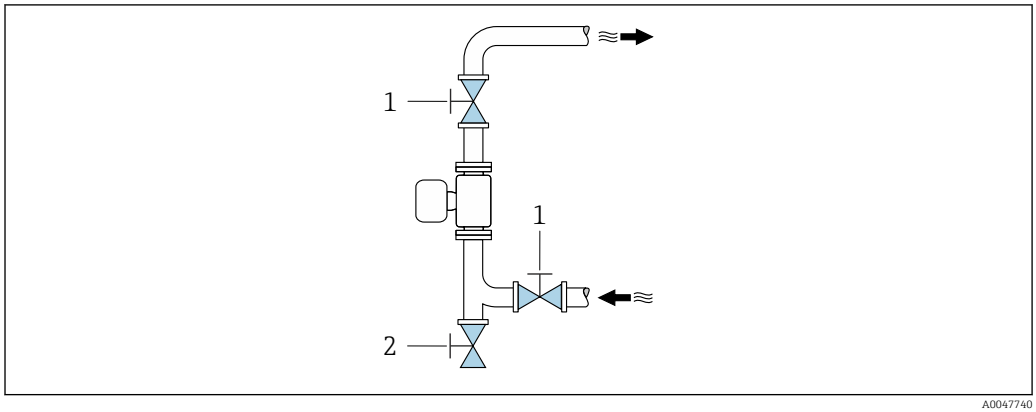
To obtain a representative sample, the sampling points should be installed in the immediate vicinity of the device. This also makes it easier to take the sample and run the wizards via the device's local operation.



1 Sampling point

Installation with option for cleaning

Depending on the process conditions (e.g. grease deposits), it may be necessary to clean the device. Additional components can be fitted to avoid any need to remove the device for cleaning:
- Rinse connection
- Cleaning shaft



1 Shutoff valve
2 Shut-off flap for cleaning

If there is a risk of deposits building up in the measuring tube, as a result of grease for example, a flow velocity of >2 m/s (6.5 ft/s) is recommended.

Dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section .→ 187

6.1.2 Environmental and process requirements

Ambient temperature range

Technical data for the ambient temperature range → 174

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

A weather protection cover is available as an accessory.→ 160

Static pressure

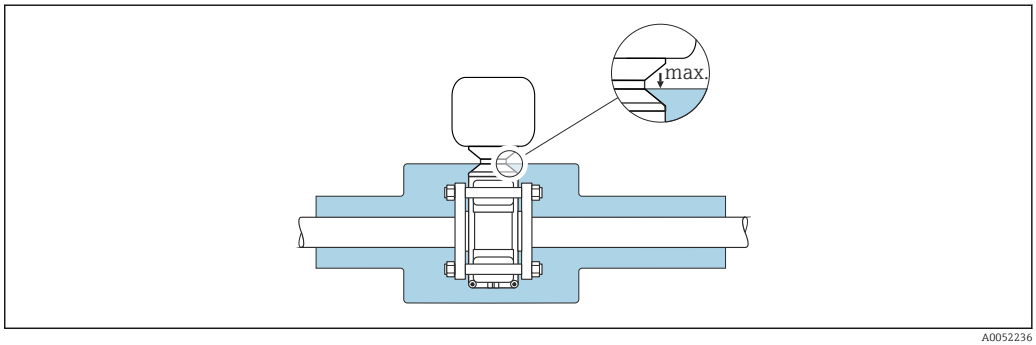
Technical data for the static pressure → 175

Vibration and shock resistance

Technical data for vibration and shock resistance → 175

Thermal insulation

- For very hot media: To reduce energy losses and prevent accidental contact with hot pipes
- In cold environments: To prevent cooling of the pipe wall and the sensor from the outside, which could promote the formation of grease deposits



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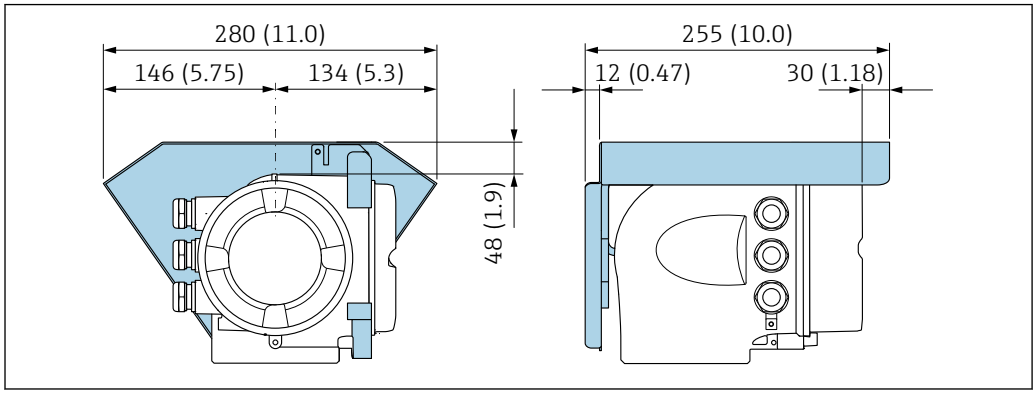
WARNING

Electronics overheating on account of thermal insulation!

- ▶ Do not insulate the transmitter housing.
- ▶ Insulation may be provided as far as the connection between the sensor and the transmitter housing.
- ▶ Maximum permissible temperature at the lower end of the transmitter housing: 75 °C (167 °F)

6.1.3 Special mounting instructions

Weather protection cover



5 *Unit mm (in)*

A weather protection cover is available as an accessory.→ 160

6.2 Mounting the measuring device

6.2.1 Preparing the measuring device

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

6.2.2 Mounting the sensor

⚠ WARNING

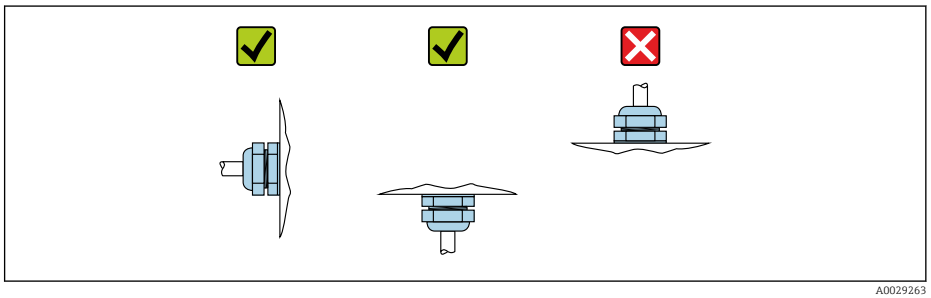
Danger due to improper process sealing!

- Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- Ensure that the gaskets are clean and undamaged.
- Secure the gaskets correctly.
- Apply the correct screw tightening torques and comply with the mounting instructions → 28.

Center the sensor between the pipe flanges and mount it in the measuring path.

A mounting kit consisting of screws/mounting bolts, gaskets, nuts and washers can be ordered as an optional extra:
- Directly with the device: Order code for "Accessory enclosed", option PE
- Separately as an accessory → 160

1. Position the device or rotate the transmitter housing so that the cable entries do not point upwards.



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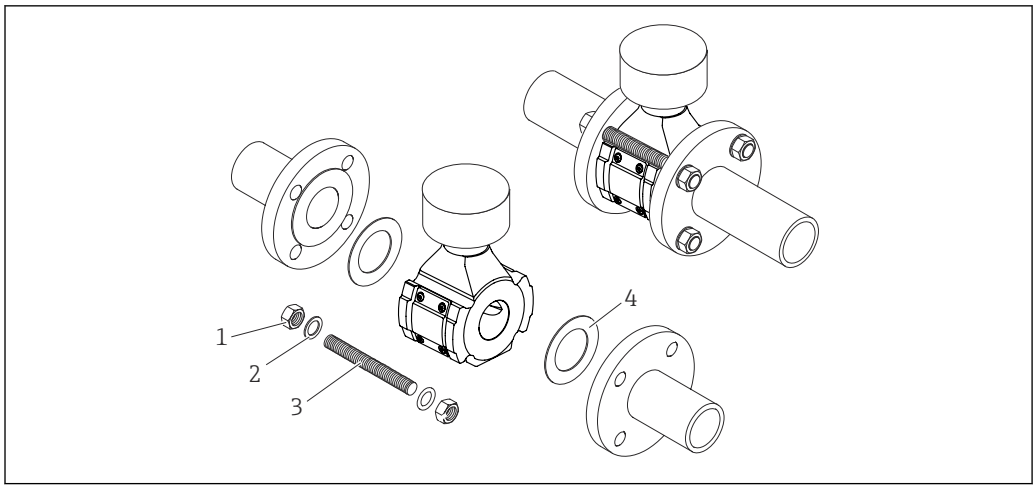
2. Following the correct screw tightening torques and mounting instructions → 28, mount the sensor between the pipe flanges in the measurement path.



6 *Mounting the sensor*

1 *Nut*
2 *Washer*
3 *Screw/mounting bolt*
4 *Gasket*

Screw tightening torques

NOTICE

Failure to observe screw tightening torques or mounting instructions

The process connection may be overloaded if screw tightening torques are not observed or the mounting instructions cannot be followed. This can produce a leaking process connection from which the medium escapes.

▶ Apply the correct screw tightening torques and comply with the mounting instructions.

The following mounting instructions must be observed:

- The specified screw tightening torques only apply when using the mounting kit, which can be ordered as an accessory → 161.
- Nuts, threads and screw head surfaces must be greased before assembly.
- The pipes must be free of tensile stress.
- The screws must be tightened evenly in diagonally opposite sequence.

The values for the screw tightening torques depend on variables such as seals, screws, lubricants, tightening methods etc. These variables are outside the control of the manufacturer. The values indicated are therefore guideline values only.

Maximum screw tightening torques for EN 1092-1

Nominal diameter		Pressure rating	Screws	Max. screw tightening torque
[mm]	[in]		[mm]	
50	2	PN 10	4 x M16	85 Nm (62.7 lbf ft)
		PN 16		
80	3	PN 10	8 x M16	85 Nm (62.7 lbf ft)
		PN 16		
100	4	PN 10	8 x M16	100 Nm (73.8 lbf ft)
		PN 16		
150	6	PN 10	8 x M20	200 Nm (147.5 lbf ft)
		PN 16		
200	8	PN 10	8 x M20	200 Nm (147.5 lbf ft)
		PN 16	12 x M20	200 Nm (147.5 lbf ft)

Nominal diameter		Pressure rating	Screws	Max. screw tightening torque
[mm]	[in]		[mm]	
250	10	PN 10	12 x M20	220 Nm (162.3 lbf ft)
		PN 16	12 x M24	250 Nm (184.4 lbf ft)
300	12	PN 10	12 x M20	220 Nm (162.3 lbf ft)
		PN 16	12 x M24	300 Nm (221.3 lbf ft)

Maximum screw tightening torques for ASME B16.5

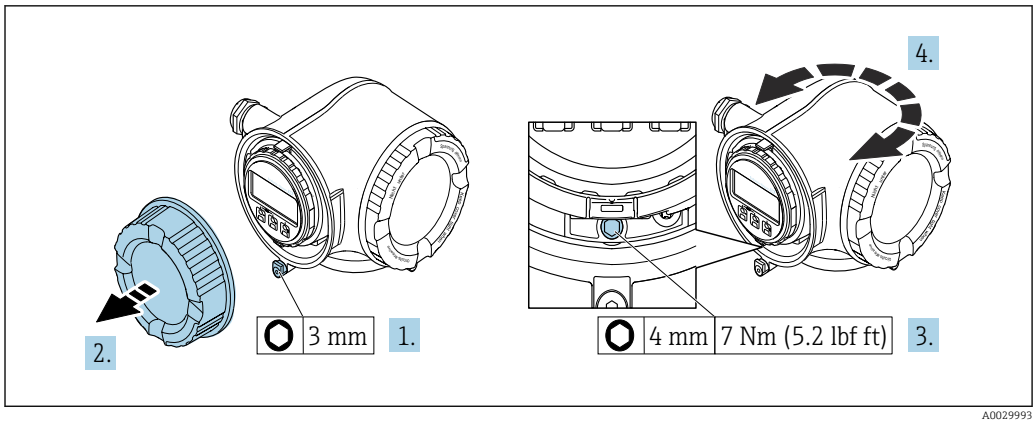
Nominal diameter		Pressure rating	Screws	Max. screw tightening torque
[mm]	[in]		[in]	
50	2	Class 150	4 x 5/8"	110 Nm (81.1 lbf ft)
80	3	Class 150	4 x 5/8"	130 Nm (95.9 lbf ft)
100	4	Class 150	8 x 5/8"	130 Nm (95.9 lbf ft)
150	6	Class 150	8 x 3/4"	220 Nm (162.3 lbf ft)
200	8	Class 150	8 x 3/4"	250 Nm (184.4 lbf ft)
250	10	Class 150	12 x 7/8"	300 Nm (221.3 lbf ft)
300	12	Class 150	12 x 7/8"	350 Nm (258.2 lbf ft)

Maximum screw tightening torques for JIS B2220

Nominal diameter		Pressure rating	Screws	Max. screw tightening torque
[mm]	[in]		[mm]	
50	2	10K	4 x M16	90 Nm (66.4 lbf ft)
80	3	10K	8 x M16	90 Nm (66.4 lbf ft)
100	4	10K	8 x M16	90 Nm (66.4 lbf ft)
150	6	10K	8 x M20	200 Nm (147.5 lbf ft)
200	8	10K	12 x M20	200 Nm (147.5 lbf ft)
250	10	10K	12 x M22	280 Nm (206.5 lbf ft)
300	12	10K	16 x M22	280 Nm (206.5 lbf ft)

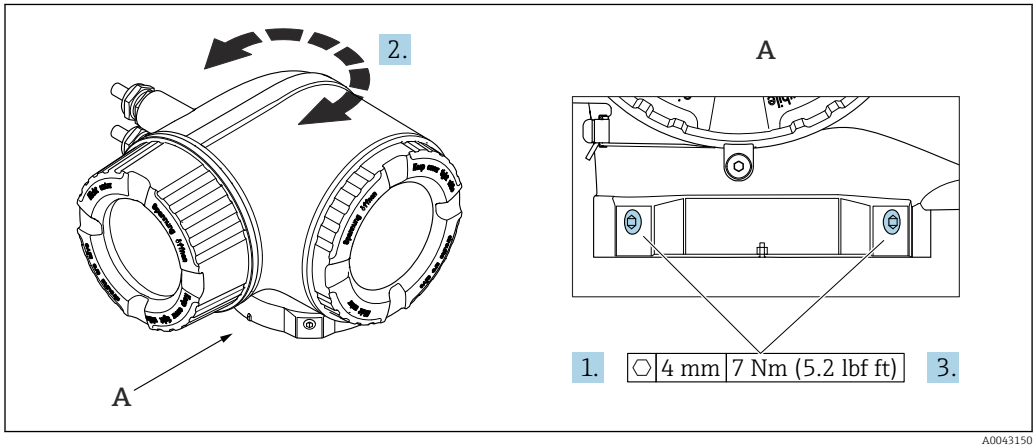
6.2.3 Turning the transmitter housing

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



7 *Non-Ex housing*

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

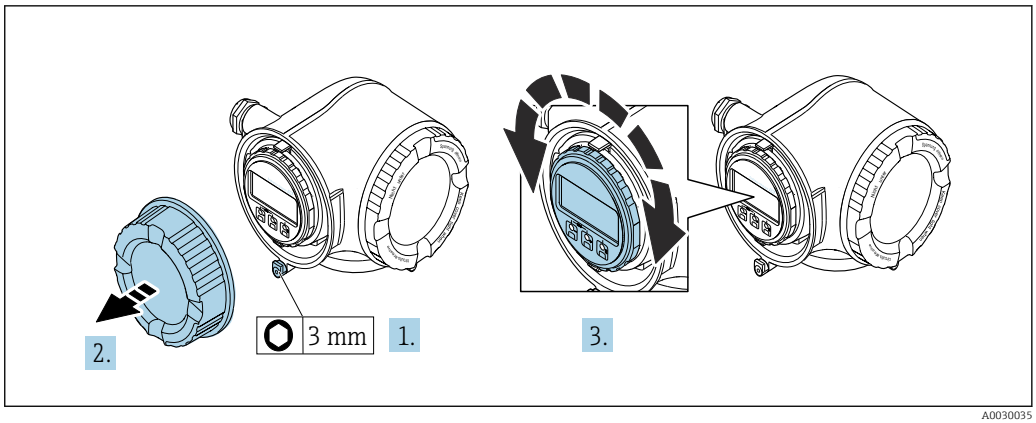


8 *Ex housing*

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

6.2.4 Turning the display module

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



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

6.3 Post-mounting check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ 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	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected against precipitation and direct sunlight?	❑
Have the fixing screws been tightened with the correct tightening torque?	❑

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

7.2.2 Requirements for connection cable

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

Protective grounding cable for the outer ground terminal

Conductor cross-section < 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

Modbus RS485

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

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm^2 (22 AWG)

Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

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

Requirements for connecting cable – remote display and operating module DKX001

Optionally available connecting cable

A cable is supplied depending on the order option
- Order code for measuring device: order code **030** for "Display; operation", option **O**
  or
- Order code for measuring device: order code **030** for "Display; operation", option **M**
  and
- Order code for DKX001: order code **040** for "Cable", option **A, B, D, E**

Standard cable	2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded)
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shield	Tin-plated copper braid, optical cover ≥ 85 %
Capacitance: core/shield	≤ 200 pF/m
L/R	≤ 24 µH/Ω
Available cable length	5 m (15 ft)/10 m (35 ft)/20 m (65 ft)/30 m (100 ft)
Operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

Standard cable - customer-specific cable

With the following order option, no cable is supplied with the device and must be provided by the customer:
Order code for DKX001: Order code **040** for "Cable", option **1** "None, provided by customer, max 300 m"

A standard cable with the following minimum requirements can be used as the connecting cable, even in the hazardous area (Zone 2, Class I, Division 2 and Zone 1, Class I, Division 1):

Standard cable	4 wires (2 pairs); pair-stranded with common shield, minimum wire cross-section 0.34 mm^2 (22 AWG)
Shield	Tin-plated copper braid, optical cover ≥ 85 %
Cable impedance (pair)	Minimum 80 Ω
Cable length	Maximum 300 m (1 000 ft), maximum loop impedance 20 Ω
Capacitance: core/shield	Maximum 1 000 nF for Zone 1, Class I, Division 1
L/R	Maximum 24 µH/Ω for Zone 1, Class I, Division 1

7.2.3 Terminal assignment

Transmitter: supply voltage, input/outputs

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

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

Terminal assignment of the remote display and operating module → 39.

7.2.4 Shielding and grounding

Shielding and grounding concept

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

Grounding of the cable shield

NOTICE

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

Damage to the bus cable shield.

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

To comply with EMC requirements:

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

7.2.5 Preparing the measuring device

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

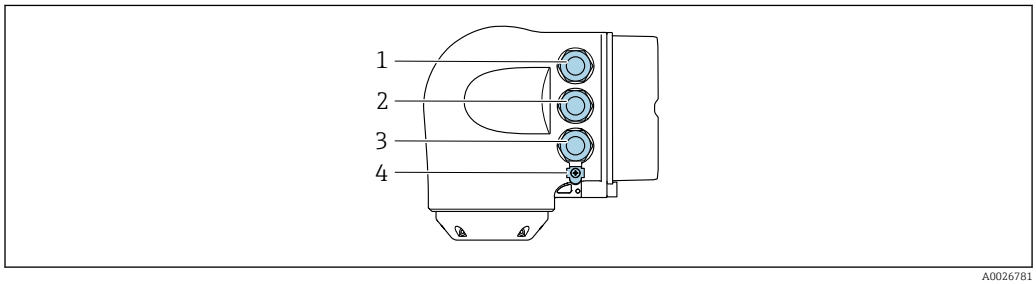
7.3 Connecting the measuring device

NOTICE

An incorrect connection compromises electrical safety!

- ▶ Only properly trained specialist staff may perform electrical connection work.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.
- ▶ Always connect the protective ground cable ⏚ before connecting additional cables.
- ▶ When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

7.3.1 Connecting the transmitter



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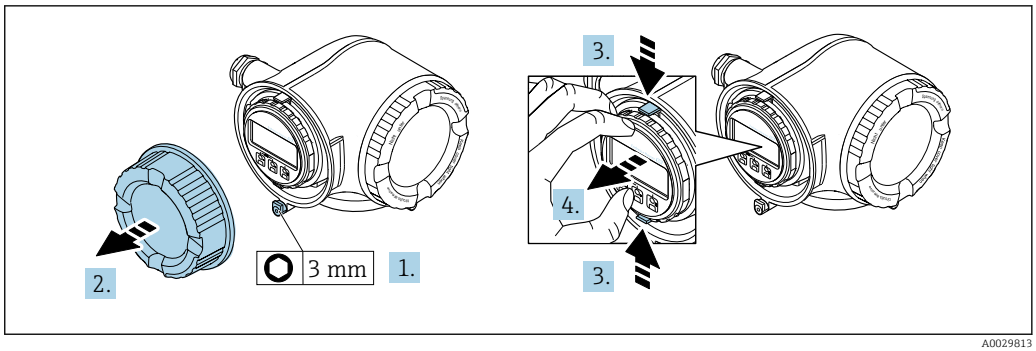
1 *Terminal connection for supply voltage*
2 *Terminal connection for signal transmission, input/output*
3 *Terminal connection for signal transmission, input/output or terminal connection for network connection via service interface (CDI-RJ45); optional: connection for external WLAN antenna or remote display and operating module DKX001*
4 *Protective earth (PE)*



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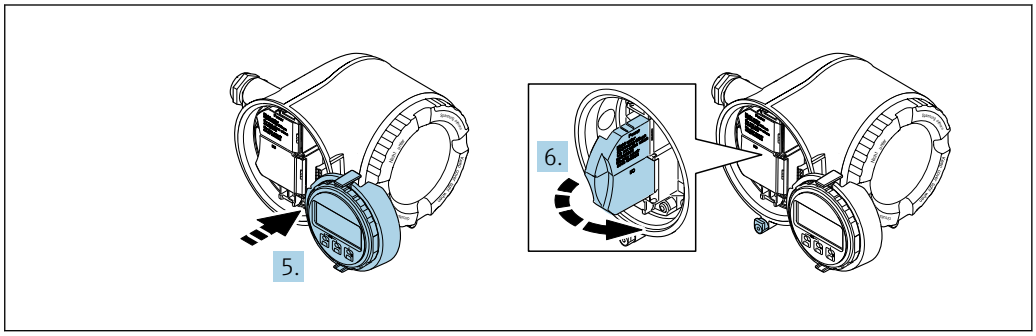
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze the tabs of the display module holder together.
4. Remove the display module holder.



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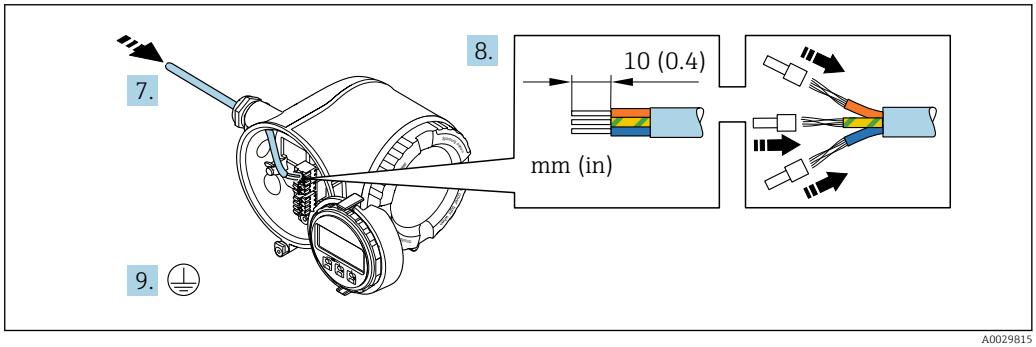
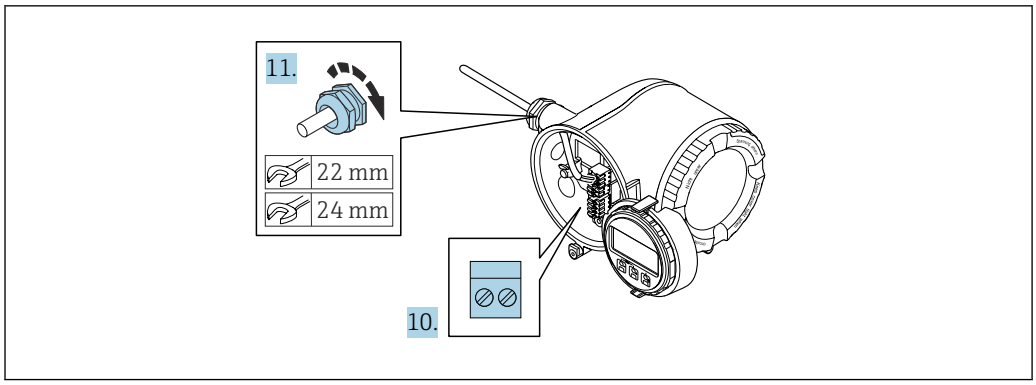
5. Attach the holder to the edge of the electronics compartment.
6. Open the terminal cover.



A0029815

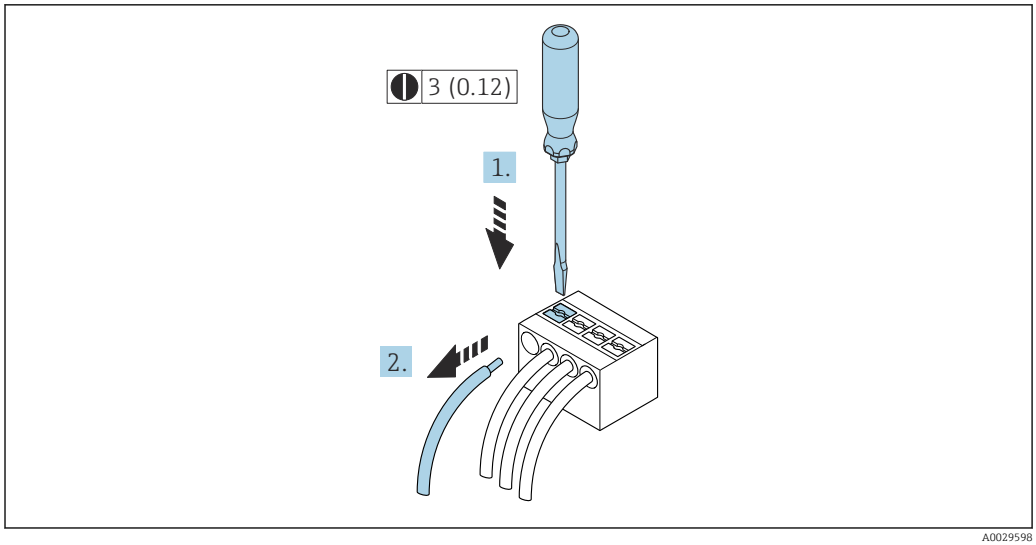
7. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
8. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
9. Connect the protective ground.



10. 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 connection terminal assignment: Adhesive label in the terminal cover or → 🖹 35.
11. Firmly tighten the cable glands.
    ↳ This concludes the cable connection process.
12. Close the terminal cover.
13. Fit the display module holder in the electronics compartment.
14. Screw on the connection compartment cover.
15. Secure the securing clamp of the connection compartment cover.

Removing a cable

To remove a cable from the terminal:



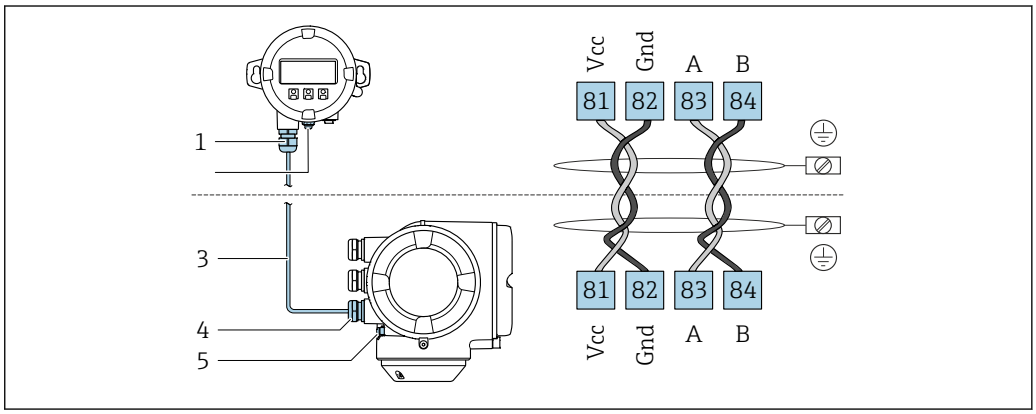
🖼 9 *Engineering unit mm (in)*

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.

7.3.2 Connecting the remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra → 160.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



1 *Remote display and operating module DKX001*
2 *Terminal connection for potential equalization (PE)*
3 *Connecting cable*
4 *Measuring device*
5 *Terminal connection for potential equalization (PE)*

7.4 Potential equalization

7.4.1 Requirements

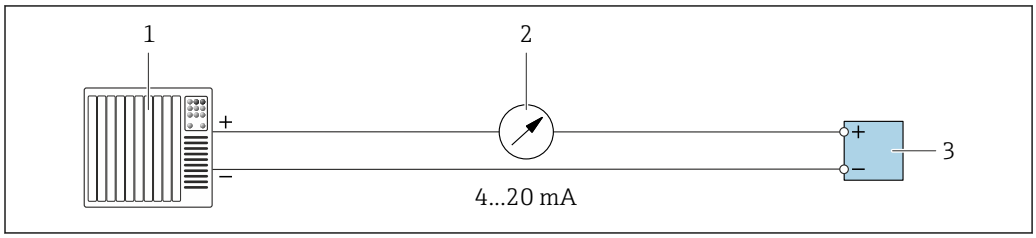
For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Medium, Connect the sensor and transmitter to the same electric potential [1)]
- Use a ground cable with a minimum cross-section of 6 mm^2 (10 AWG)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

1)

7.5 Special connection instructions

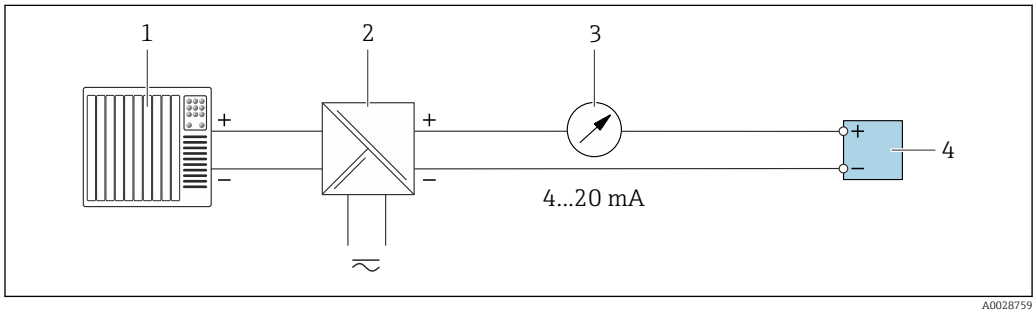
7.5.1 Connection examples

Current output 4-20 mA



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

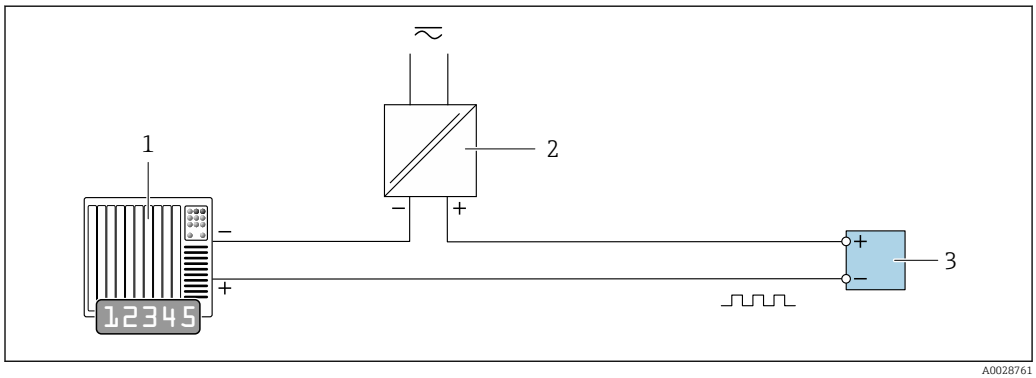
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load → 166*
3 *Transmitter*



11 *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 → 166*
4 *Transmitter*

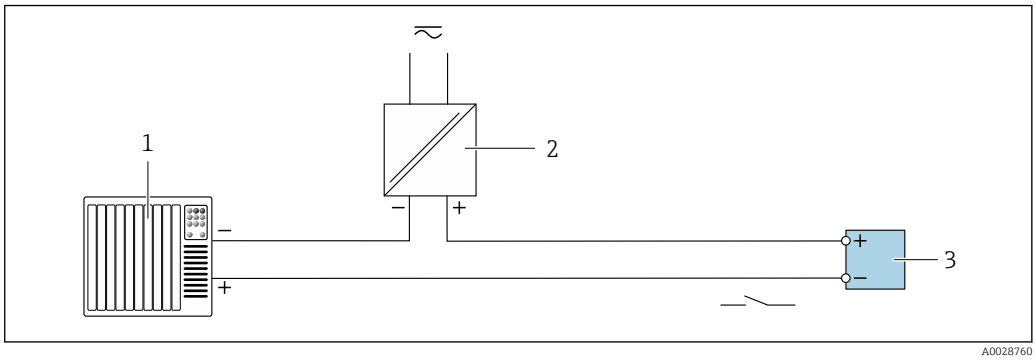
Pulse/frequency output



12 *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 → 166*

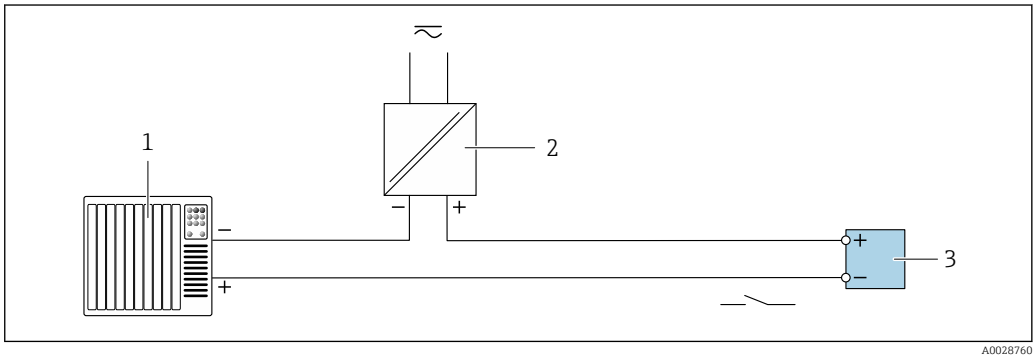
Switch output



13 *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 → 166*

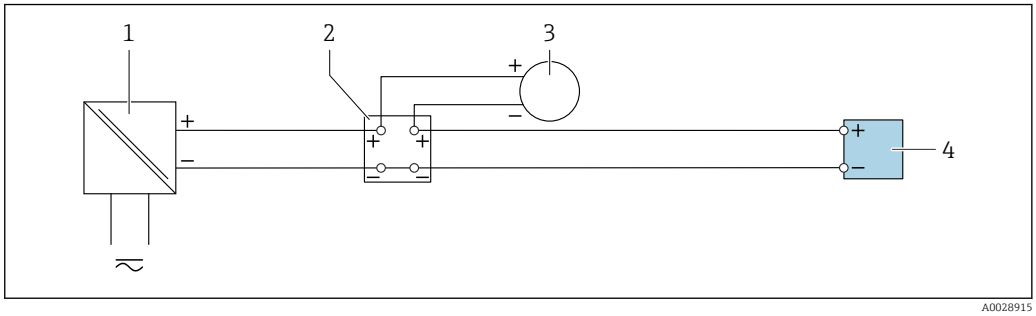
Relay output



14 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: observe input values → 167*

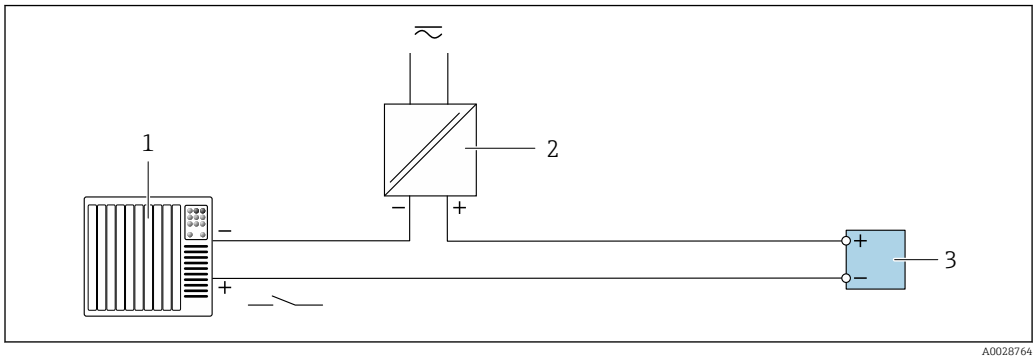
Current input



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

1 *Power supply*
2 *Terminal box*
3 *External device (for reading in the flow rate value in order to calculate the load rate)*
4 *Transmitter*

Status input



16 Connection example for status input

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

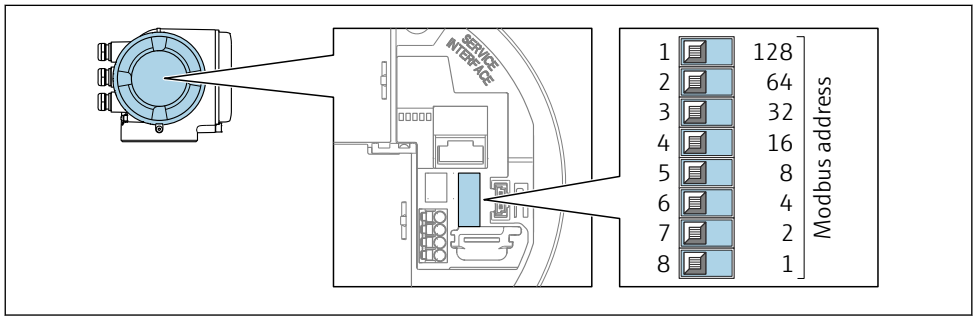
7.6 Hardware settings

7.6.1 Setting the device address

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

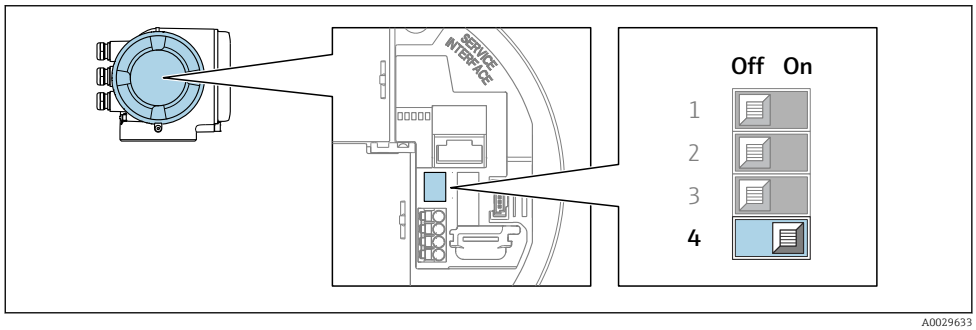
Hardware addressing

1.



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

2.



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

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

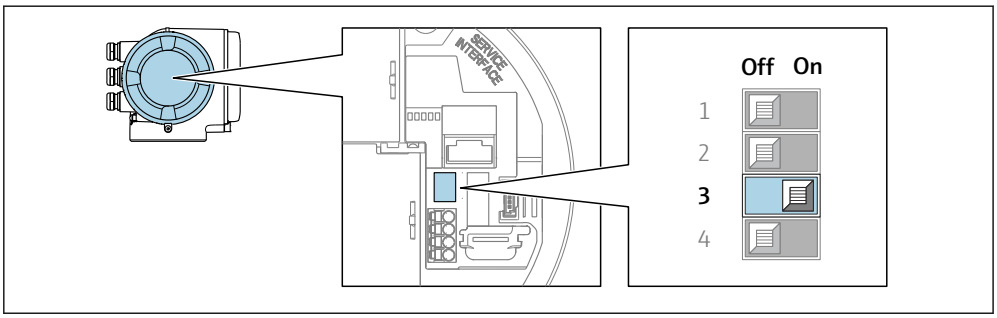
Software addressing

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

7.6.2 Activating the terminating resistor

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

▶



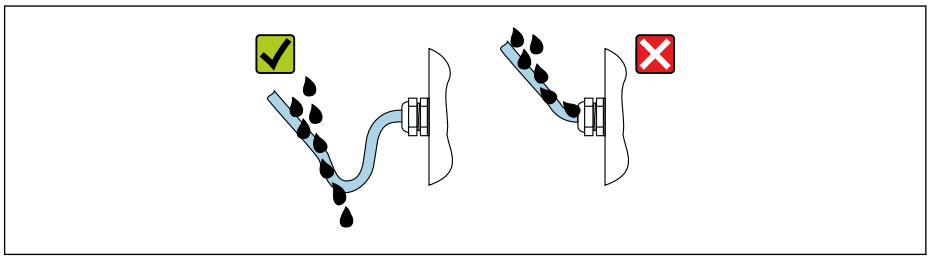
Switch DIP switch no. 3 to **On**.

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").



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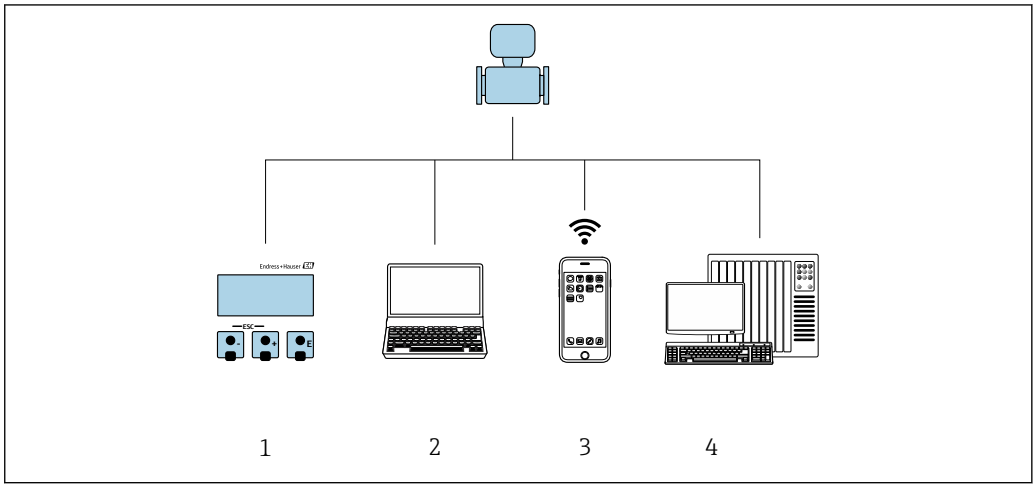
6. The cable glands supplied do not ensure housing protection when not in use. They must therefore be replaced by dummy plus corresponding to the housing protection.

7.8 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used comply with the requirements → 🖹 33?	❑
Does the supply voltage match the specifications on the transmitter nameplate → 🖹 171?	❑
Is the terminal assignment correct → 🖹 35?	❑
Are the power supply and signal cables correctly connected?	❑
Is the protective earthing established correctly?	❑
Is the cable type route completely isolated? Without loops and cross-overs?	❑
Do the cables have adequate strain relief? Are they routed securely?	❑
▪ Are all cable glands installed, securely tightened and leak-tight? ▪ Cable run with "water trap" → 🖹 45?	❑
Is the sensor connected to the right transmitter? Check the serial number on the nameplate of the sensor and transmitter.	❑
Are all housing covers installed and securely tightened?	❑
Is the securing clamp securely tightened?	❑
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



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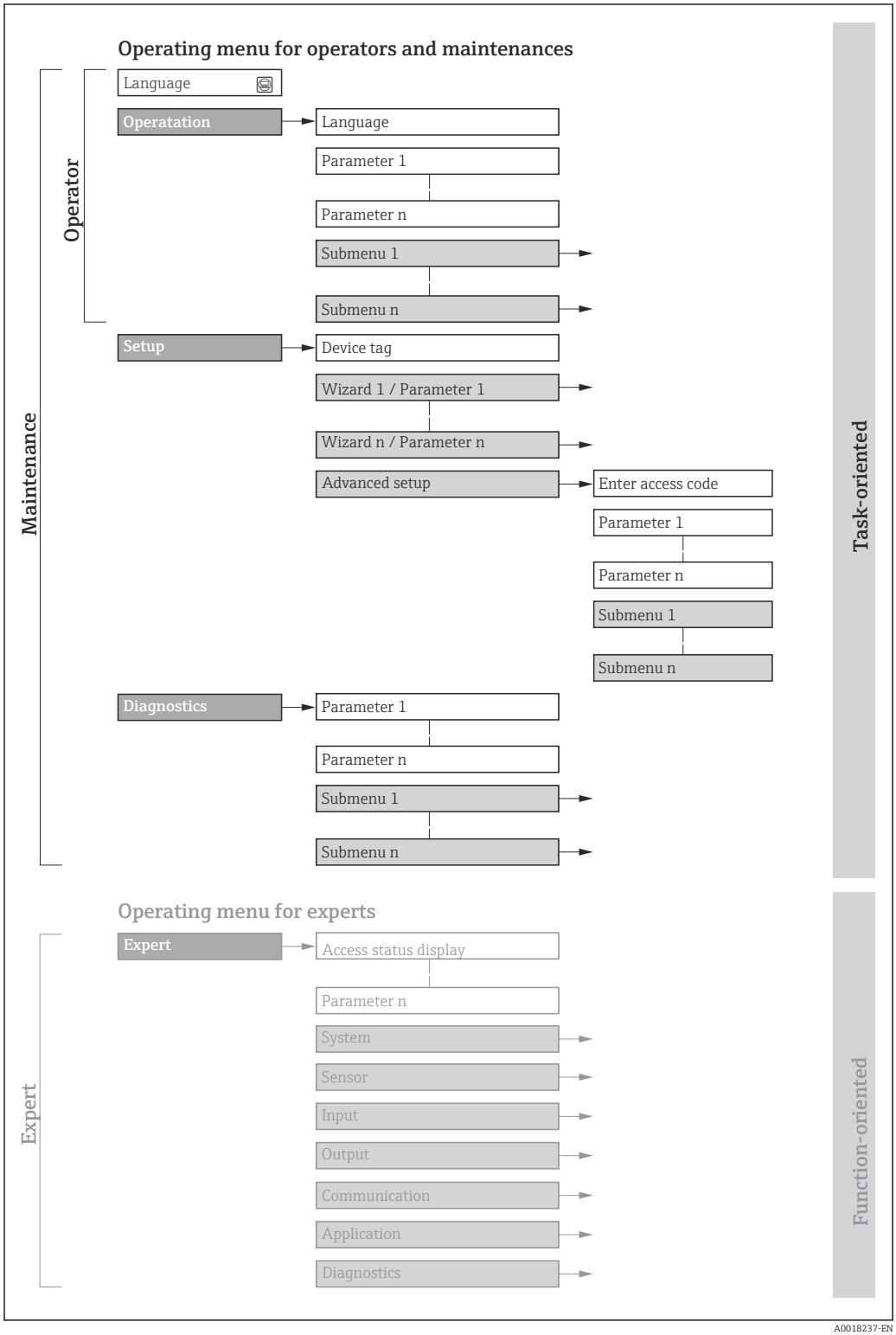
1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Mobile handheld terminal with SmartBlue App*
4 *Control system (e.g. PLC)*

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

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



17 *Schematic structure of the operating menu*

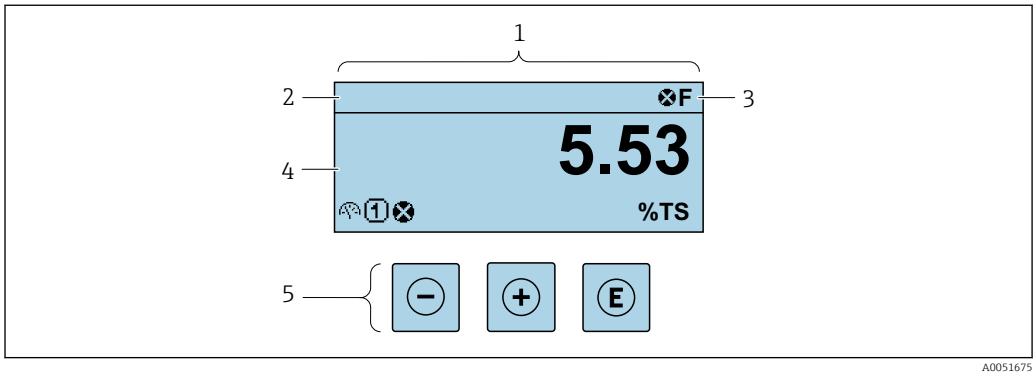
8.2.2 Operating philosophy

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 ▪ Displaying the I/O configuration ▪ Configuring the inputs ▪ Configuring the outputs ▪ Configuration of the operational display ▪ Configuring the low flow cut off Advanced setup ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configuration of WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		**"Maintenance" role** Troubleshooting: ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: ▪ Diagnostic list Contains up to 5 currently pending diagnostic messages. ▪ Event logbook Contains event messages that have occurred. ▪ Device information Contains information for identifying the device ▪ Measured values Contains all current measured values. ▪ **Data logging** submenu with the "Extended HistoROM" order option Storage and visualization of measured values ▪ Heartbeat Technology Verification of device functionality on request and documentation of verification results ▪ Simulation Used to simulate measured values or output values.
Expert	Function-oriented	Tasks that require detailed knowledge of the function of the device: ▪ Commissioning measurements under difficult conditions ▪ Optimal adaptation of the measurement to difficult conditions ▪ Detailed configuration of the communication interface ▪ Error diagnostics in difficult cases	Contains all of the device parameters and allows direct access to these by means of an access code. The structure of this menu is based on the function blocks of the device: ▪ System Contains all higher-level device parameters that do not affect measurement or measured value communication ▪ Sensor Configuration of the measurement. ▪ Input Configuration of the status input ▪ Output Configuration of the analog current outputs as well as the pulse/frequency and switch output ▪ Communication Configuration of the digital communication interface and the Web server ▪ Application Configuration of the functions that go beyond the actual measurement (e.g. totalizer) ▪ Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to operating menu via local display

8.3.1 Operational display



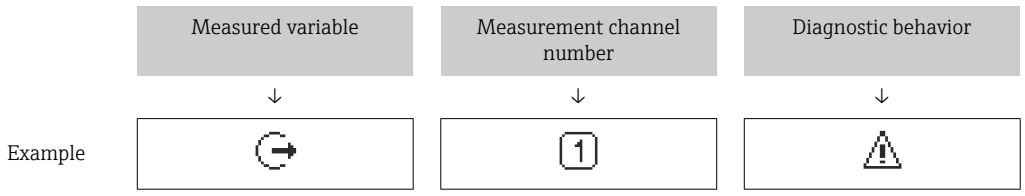
1 *Operational display*
2 *Device tag*
3 *Status area*
4 *Display range for measured values (up to 4 lines)*
5 *Operating elements*

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 138
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 139
  - : 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:



Appears only if a diagnostics event is present for this measured variable.

Measured variables

Symbol	Meaning
	Dry matter concentration
	Solids load

	Temperature
G	Conductivity

The number and display format of the measured variables can be configured via the **Format display** parameter (→ 97).

Totalizer

Symbol	Meaning
Σ	Totalizer

Output

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

Input

Symbol	Meaning
	Status input

Measurement channel numbers

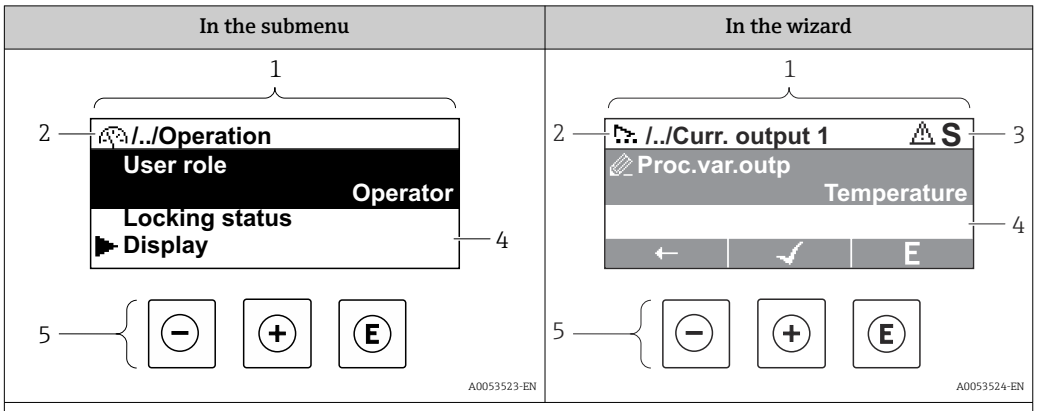
Symbol	Meaning
1 ... 4	Measurement channel 1 to 4 The measurement channel number is displayed only if more than one channel is present for the same measured variable type .

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



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
  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 → 🖹 138

Display area

Menus

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

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

Submenus, wizards, parameters

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

Locking procedure

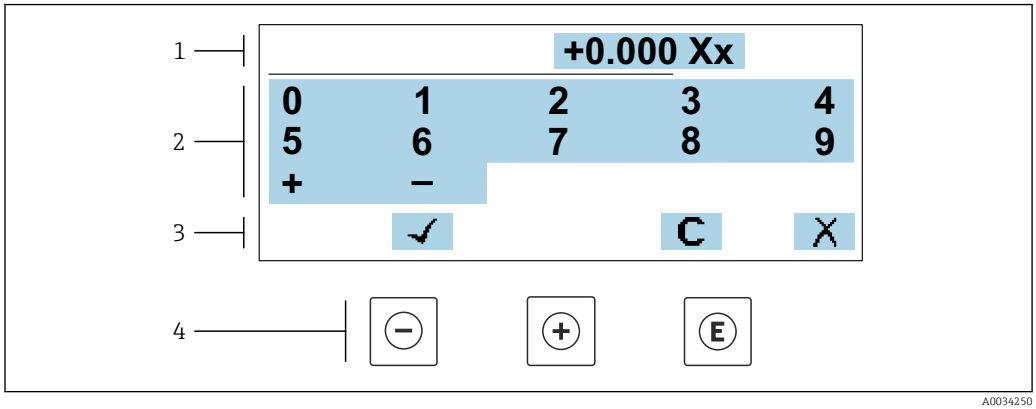
Symbol	Meaning
	**Parameter locked** When displayed in front of a parameter name, indicates that the parameter is locked. ▪ By a user-specific access code ▪ By the hardware write protection switch

Wizards

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

8.3.3 Editing view

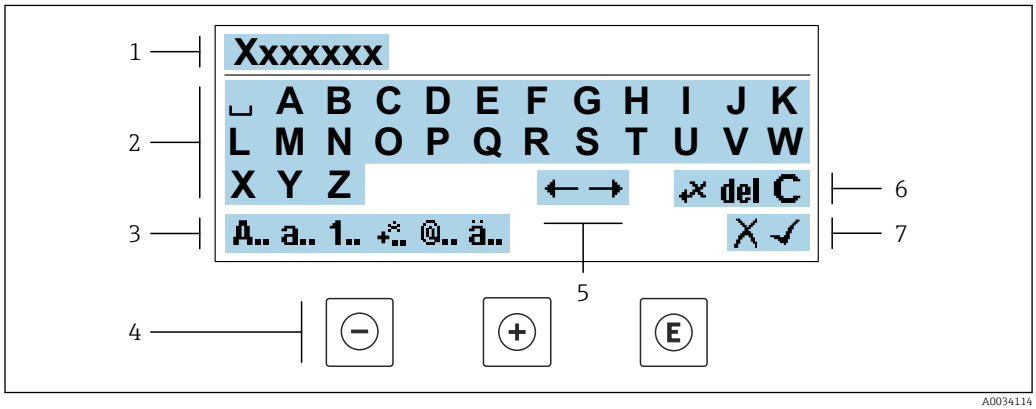
Numeric editor



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

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

Text editor



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

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

Using the operating elements in the editing view

Operating key	Meaning
⊖	**Minus key** Move the entry position to the left.
⊕	**Plus key** Move the entry position to the right.

Operating key	Meaning
	**Enter key** ▪ Pressing the key briefly confirms your selection. ▪ Pressing the key for 2 s confirms your entry. ▪ Pressing the key for > 3 s calls up the wizards: Compare measured value with reference value.
	**Escape key combination (press keys simultaneously)** Close the editing view without accepting a change.

Input screens

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

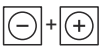
Controlling data entries

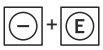
Symbol	Meaning
	Move entry position
	Reject entry
	Confirm entry
	Delete character immediately to the left of the entry position
	Delete character immediately to the right of the entry position
	Clear all the characters entered

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.
	▪ Pressing the key for > 3 s opens a context menu with the options:
	  ▪ Call up the wizards: Compare measured value with reference value
	  ▪ Activate keypad lock
	In menu, submenu
	▪ Pressing the key briefly:
	  ▪ Opens the selected menu, submenu or parameter.
	  ▪ Starts the wizard.
	  ▪ If help text is open, closes the help text of the parameter.
	▪ Pressing the key for 2 s in a parameter:
	  If present, opens the help text for the function of the parameter.
	In wizards
	Opens the editing view of the parameter and confirms the parameter value
	In the text and numeric editor
	▪ Pressing the key briefly 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

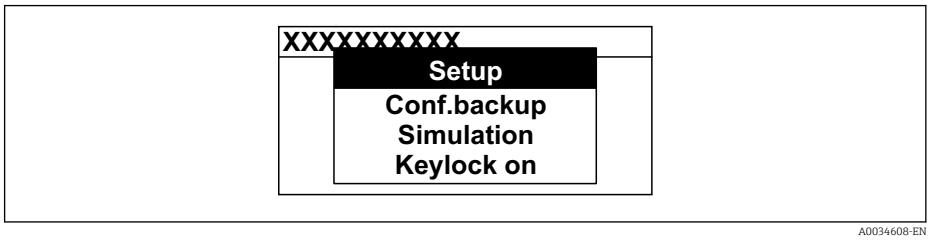
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- 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.



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

Calling up the menu via the context menu

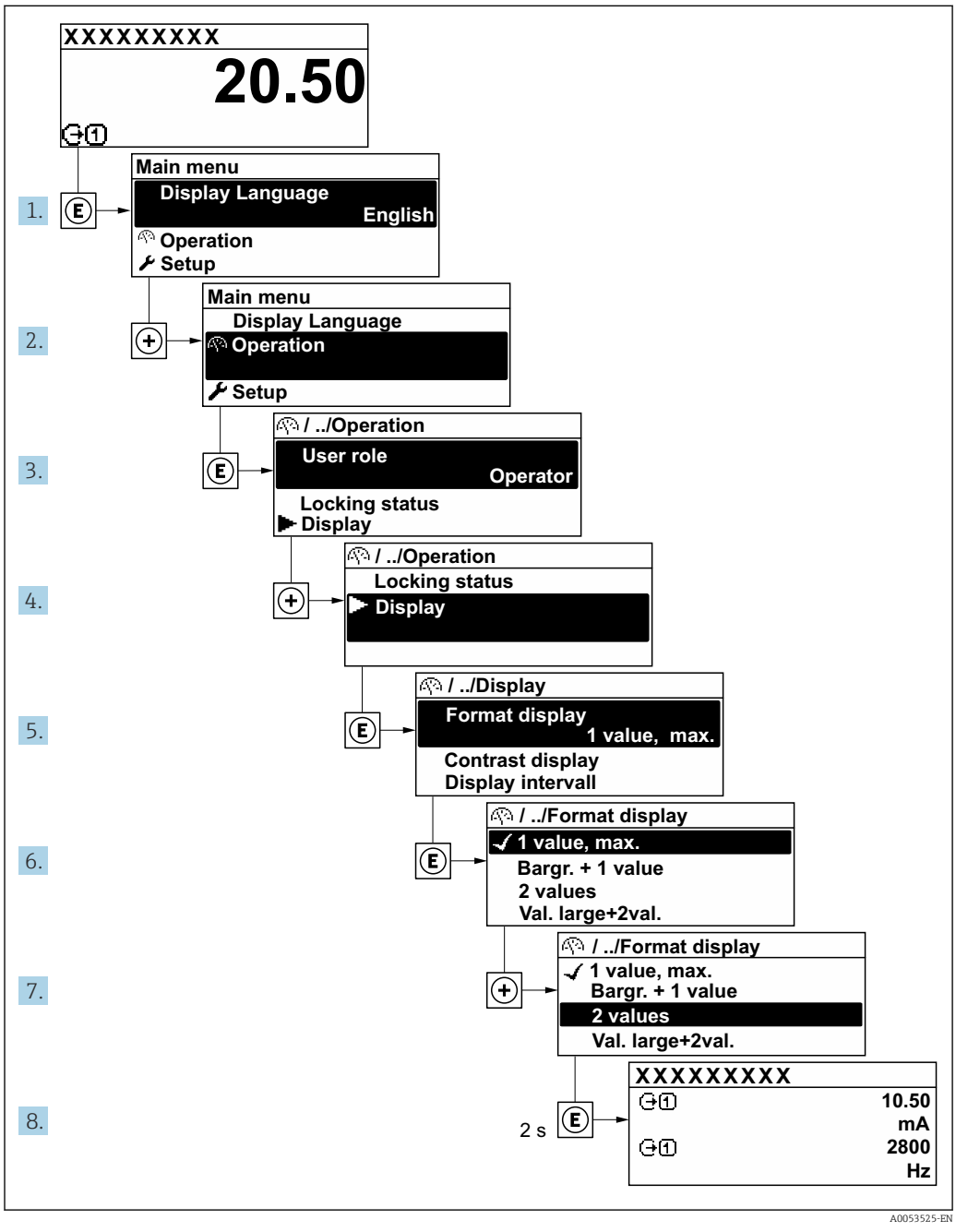
1. Open the context menu.
2. Press ⊞ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

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"



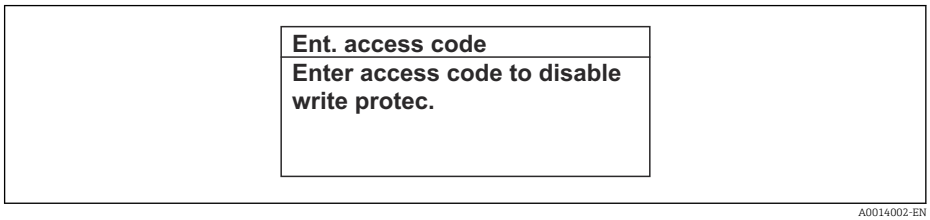
8.3.7 Calling up help text

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.



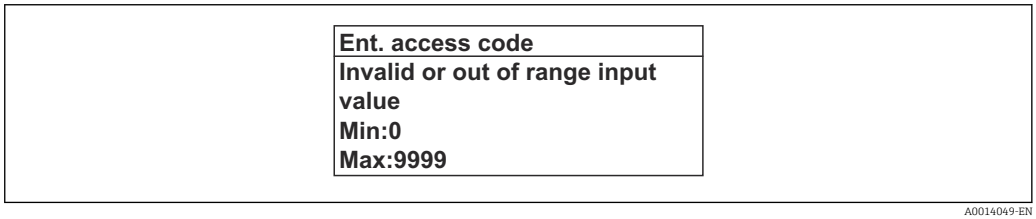
20 *Example: Help text for parameter "Enter access code"*

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

8.3.8 Changing the parameters

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

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



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

8.3.9 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 → 116.

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 → 116

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

8.3.10 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 → 116.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 101) 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.

8.3.11 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 E 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 E keys for 3 seconds.
↳ The keypad lock is switched off.

8.4 Access to operating menu via web browser

8.4.1 Function range

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

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.

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** .	

Settings	Interface	
	CDI-RJ45	WLAN
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:

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 → 66

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 → 66

8.4.3 Connecting the device

Via service interface (CDI-RJ45)

Preparing the measuring device

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)

1. Switch on the measuring device.

2. Connect the computer to the RJ45 plug via the standard Ethernet cable → 68.
3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

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

Via WLAN interface

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

Note the following to avoid a network conflict:

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

Preparing the mobile terminal

- Enable WLAN on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH__300_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password:
   Serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ The LED on the display module flashes. It is now possible to operate the measuring device with the web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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

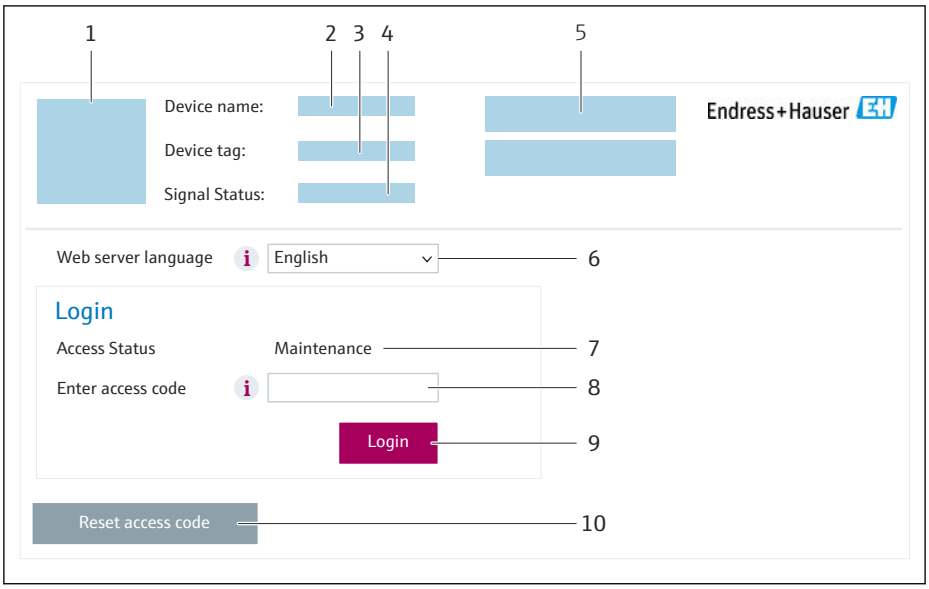
Terminating the WLAN connection

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

Starting the web browser

1. Start the web browser on the computer.

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



1 *Picture of device*
2 *Device name*
3 *Device tag (→ 81)*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 112)*

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

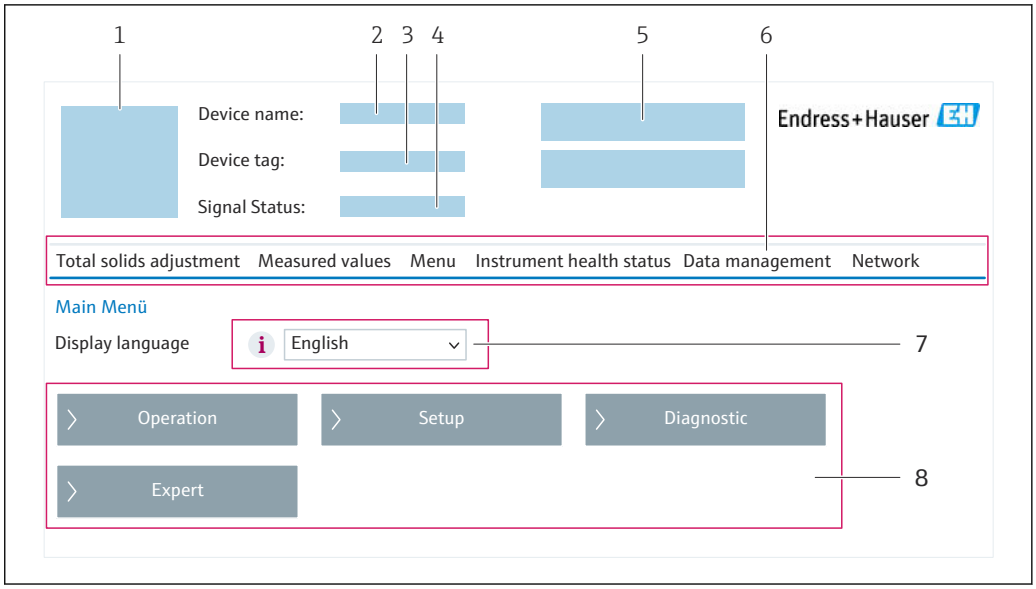
8.4.4 Logging on

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

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

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

8.4.5 User interface



1 *Picture of device*
2 *Device name*
3 *Device tag*
4 *Status signal*
5 *Current measured values*
6 *Function row*
7 *Local display language*
8 *Navigation area*

Header

The following information appears in the header:
- Device name
- Device tag
- Device status with status signal → 141
- Current measured values

Function row

Functions	Meaning
Adjustment of solids content	Call up the wizards: adjust measured value based on reference value
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

Functions	Meaning

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) → 62.

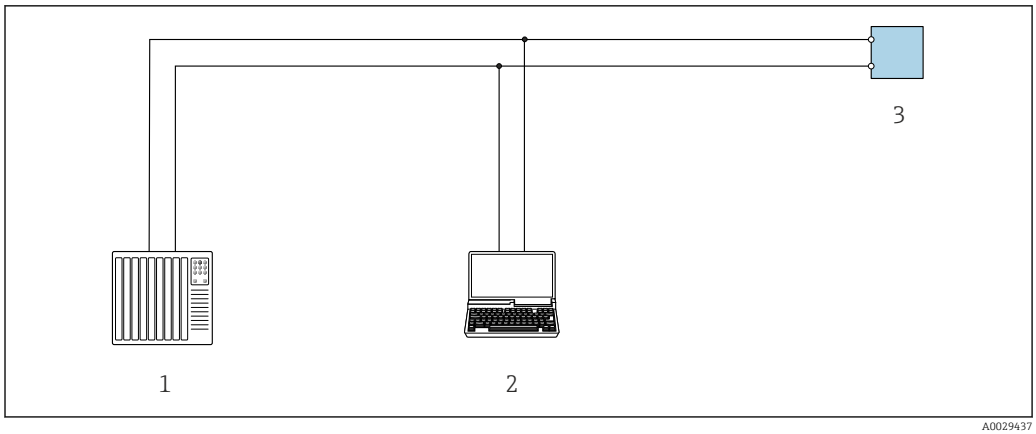
8.5 Access to the operating menu via the operating tool

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

8.5.1 Connecting the operating tool

Via Modbus RS485 protocol

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



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

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

Service interface

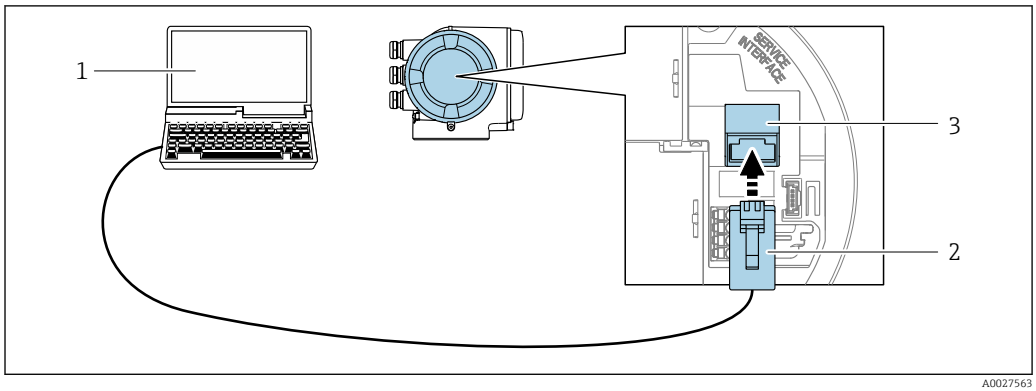
Via service interface (CDI-RJ45)

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 for the non-hazardous area:

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.

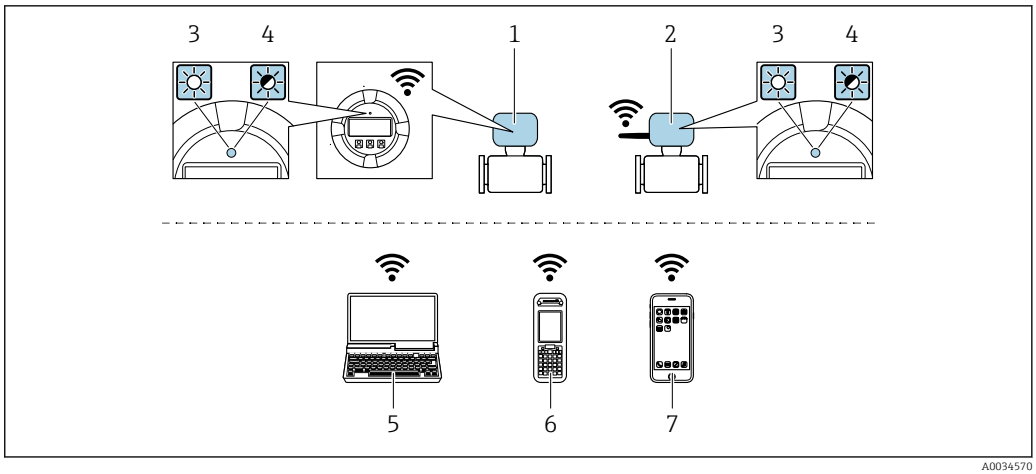


22 *Connection via service interface (CDI-RJ45)*

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" or Modbus DTM*
2 *Standard Ethernet connecting cable with RJ45 plug*
3 *Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server*

Via WLAN interface

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



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1 *Transmitter with integrated WLAN antenna*
2 *Transmitter with external WLAN antenna*
3 *LED lit constantly: WLAN reception is enabled on measuring 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__300_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 → 68
- WLAN interface → 68

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

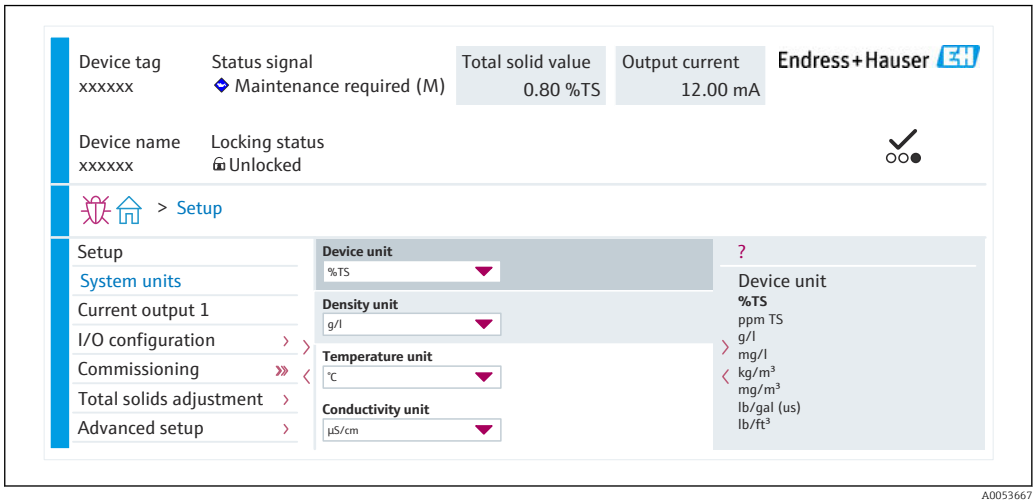
- Operating Instructions BA00027S
- Operating Instructions BA00059S

Source for device description files → 73

Establishing a connection

- Operating Instructions BA00027S
- Operating Instructions BA00059S

User interface



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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 → 73

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
Release date of firmware version	03.2024	---

For an overview of the various firmware versions for the device

9.1.2 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 the device → 🖹 188
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	Service-specific accessories → 🖹 162 Sources for obtaining device descriptions www.endress.com → Download-Area
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	Service-specific accessories → 🖹 162 Sources for obtaining device descriptions www.endress.com → Download-Area

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

9.2 Modbus RS485 information

9.2.1 Function codes

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

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

Code	Name	Description	Application
16	Write multiple registers	Master writes a new value to multiple Modbus registers of the device. A maximum of 120 consecutive registers can be written with 1 telegram. If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map → 76	Write multiple device parameters
23	Read/Write multiple registers	Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed **before** read access.	Write and read multiple device parameters Example: ▪ Read mass flow ▪ Reset totalizer

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

9.2.2 Register information

For an overview of device parameters and their corresponding Modbus register information, refer to the "Modbus RS485 register information" section in the "Description of device parameters" documentation → 188.

9.2.3 Response time

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

9.2.4 Data types

The measuring device supports the following data types:

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

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

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

9.2.5 Byte transmission sequence

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

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

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

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

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

9.2.6 Modbus data map

Function of the Modbus data map

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

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

Structure of the Modbus data map

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

For an overview of device parameters and their corresponding Modbus register information, refer to the "Modbus RS485 register information" section in the "Description of device parameters" documentation → 188.

Scan list configuration

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

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

Configuration of the scan list via FieldCare or DeviceCare

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

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

Configuration of the scan list via Modbus RS485

Carried out using register addresses 5001 - 5016

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

Reading out data via Modbus RS485

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

Master access to data area	Via register addresses 5051-5081

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

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

10 Commissioning

10.1 Post-mounting and post-connection check

Before commissioning the device:

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

- Checklist for "Post-mounting" check→ 32
- Checklist for "Post-connection check" → 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.

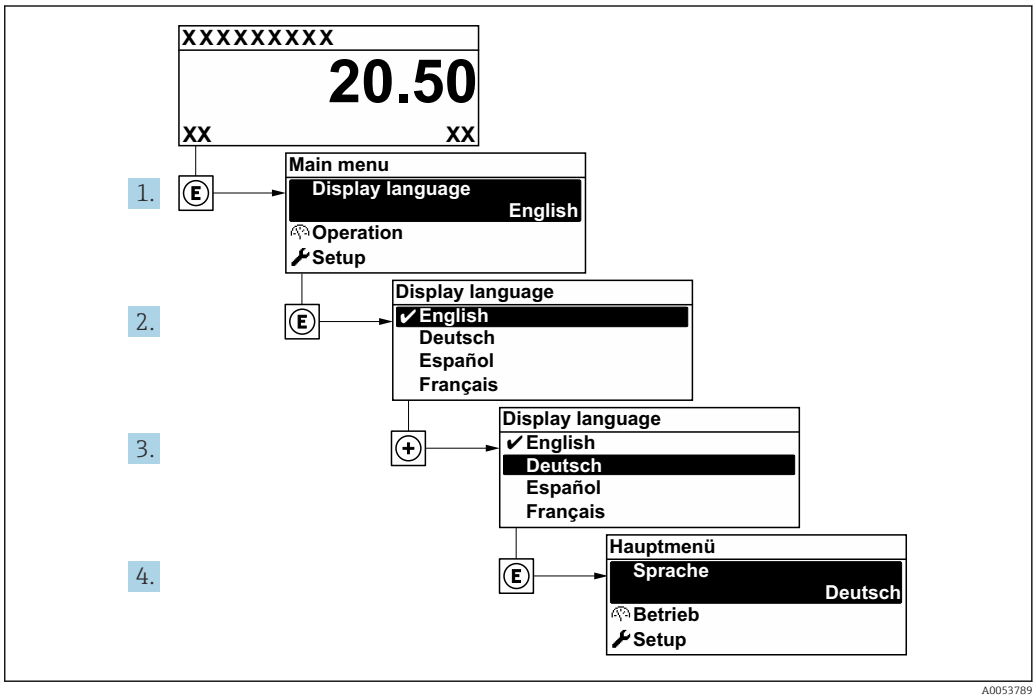
If nothing appears on the local display or if a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" .

10.3 Connecting via FieldCare

- For connecting FieldCare → 68
- For connecting via FieldCare → 70
- For user interface of FieldCare → 71

10.4 Setting the operating language

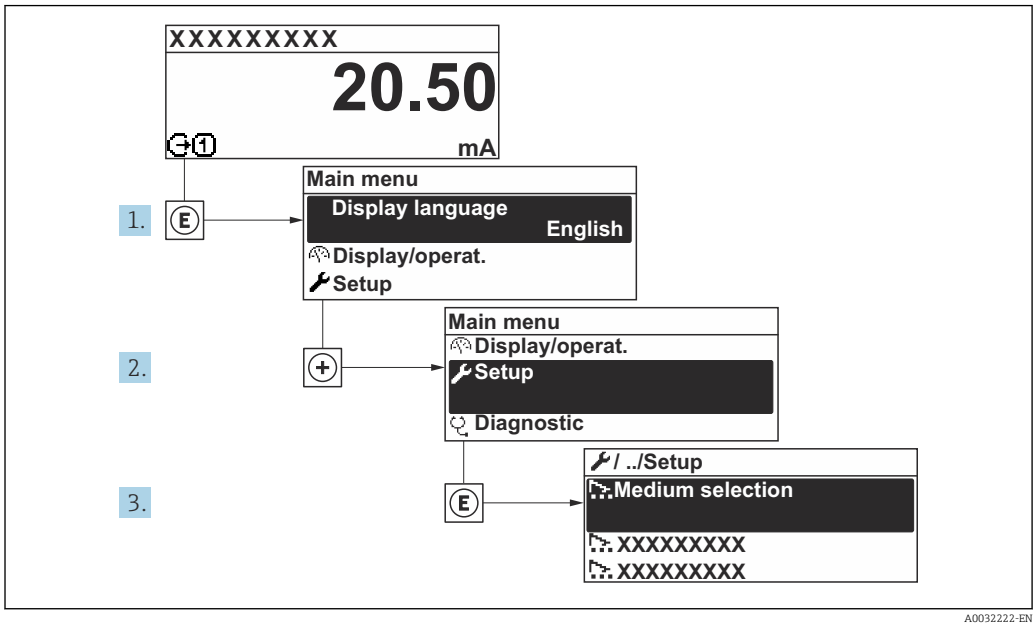
Factory setting: English or ordered local language



23 *Using 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.

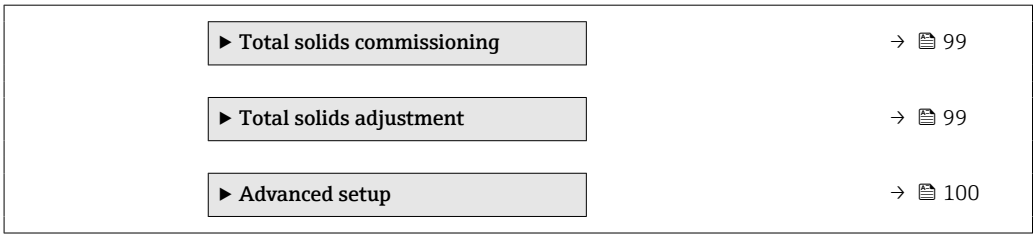


24 *Navigation to "Setup" menu using the example of the local display*

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").

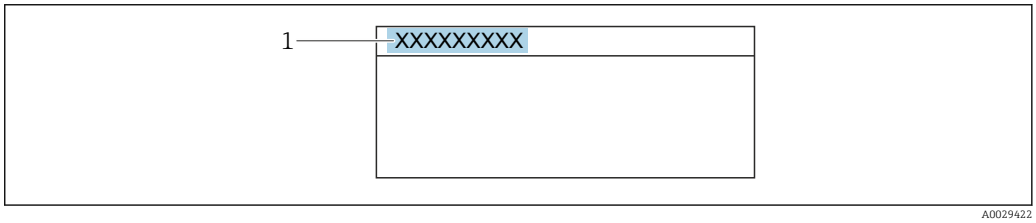
Setup

Device tag	
▶ System units	→ 82
▶ Communication	→ 83
▶ I/O configuration	→ 84
▶ Status input 1 to n	→ 86
▶ Current input 1 to n	→ 85
▶ Current output 1 to n	→ 87
▶ Pulse/frequency/switch output 1 to n	→ 89
▶ Relay output 1 to n	→ 95
▶ Display	→ 96



10.5.1 Defining the tag name

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



25 Header of the operational display with tag name

1 Tag name

Enter the tag name in the "FieldCare" operating tool → 71

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

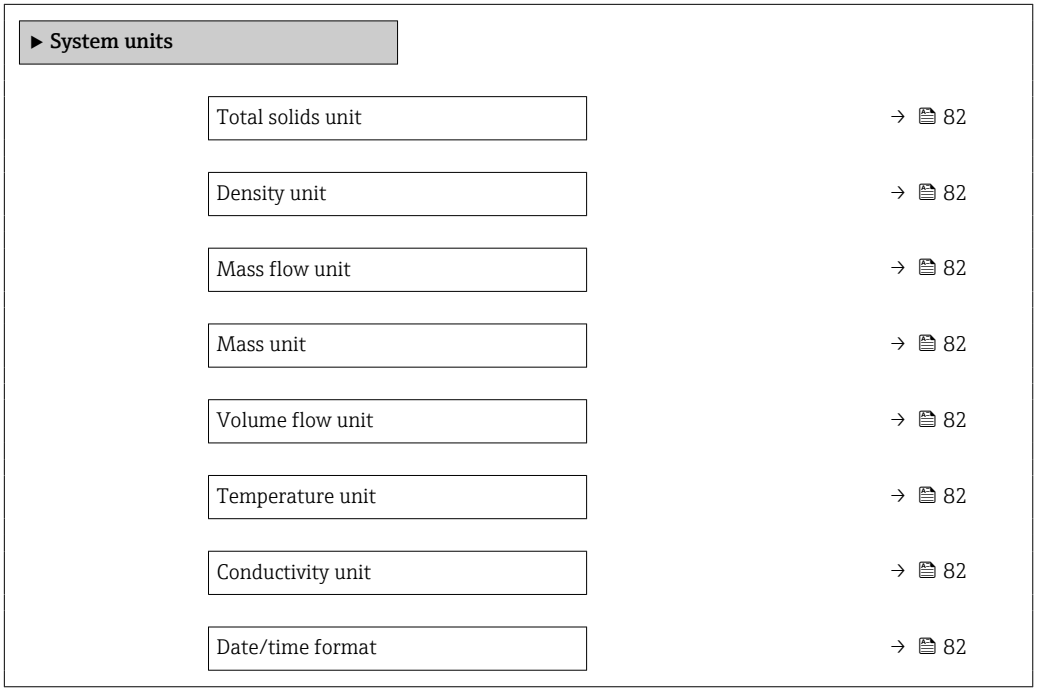
Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Prowirl

10.5.2 Setting the system units

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

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

Navigation
"Expert" menu → Sensor → System units



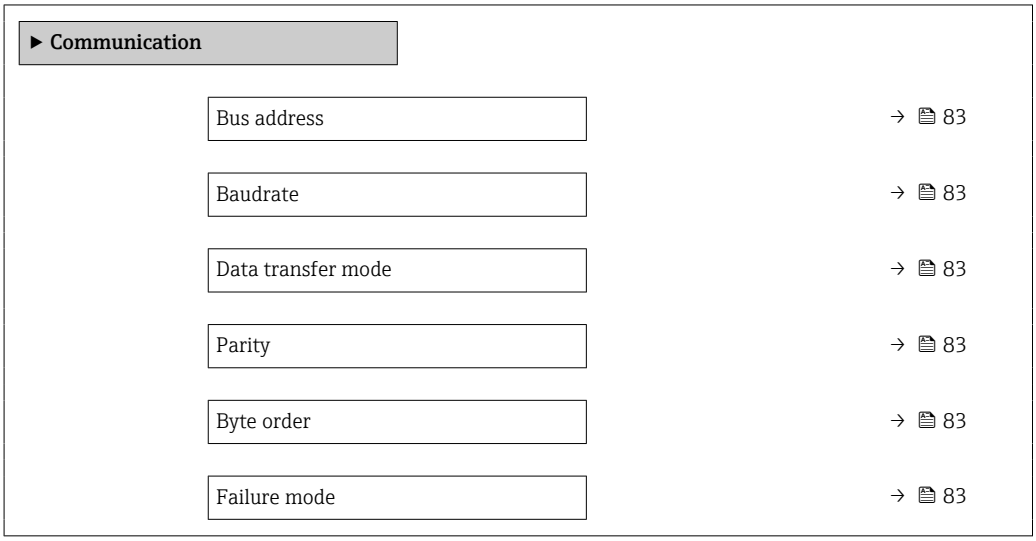
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Total solids unit	–	Select total solids unit.	Unit choose list	Depends on country
Density unit	–	Select density unit.	Unit choose list	Depends on country
Mass flow unit	The volume flow of the medium is read in via the Current input 1 to n.	Select mass flow unit.	Unit choose list	Depends on country
Mass unit	The volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select mass unit.	Unit choose list	Depends on country
Volume flow unit	The volume flow of the medium is read in via the Current input 1 to n.	Select volume flow unit.	Unit choose list	l/h
Temperature unit	–	Select temperature unit.	Unit choose list	Depends on country
Conductivity unit	–	Select conductivity unit.	Unit choose list	µS/cm
Date/time format	–	Select date and time format.	▪ dd.mm.yy hh:mm ▪ dd.mm.yy hh:mm am/pm ▪ mm/dd/yy hh:mm ▪ mm/dd/yy hh:mm am/pm	dd.mm.yy hh:mm

10.5.3 Configuring the communication interface

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

Navigation
"Setup" menu → Communication



Parameter overview with brief description

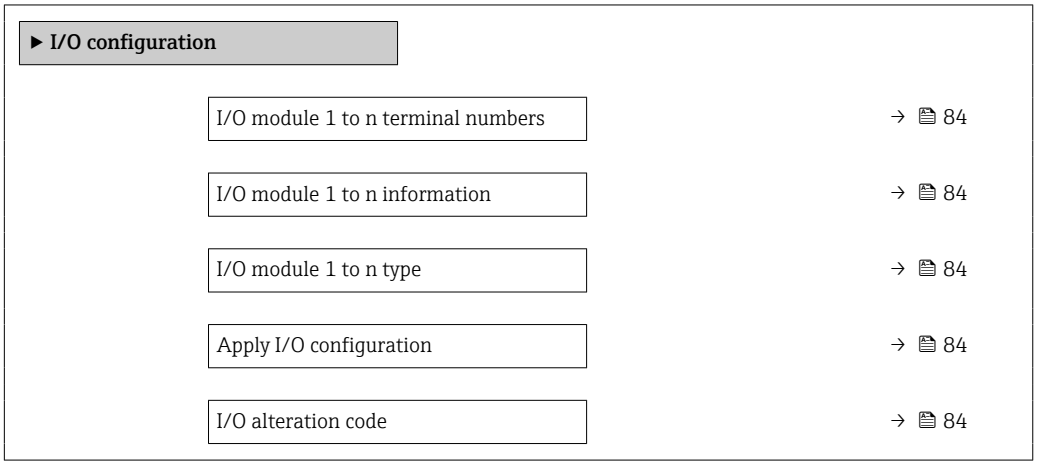
Parameter	Description	User entry / Selection	Factory setting
Bus address	Enter device address.	1 to 247	247
Baudrate	Define data transfer speed.	▪ 1200 BAUD ▪ 2400 BAUD ▪ 4800 BAUD ▪ 9600 BAUD ▪ 19200 BAUD ▪ 38400 BAUD ▪ 57600 BAUD ▪ 115200 BAUD ▪ 230400 BAUD	19200 BAUD
Data transfer mode	Select data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

1) Not a Number

10.5.4 Displaying the I/O configuration

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

Navigation
"Setup" menu → I/O configuration



Parameter overview with brief description

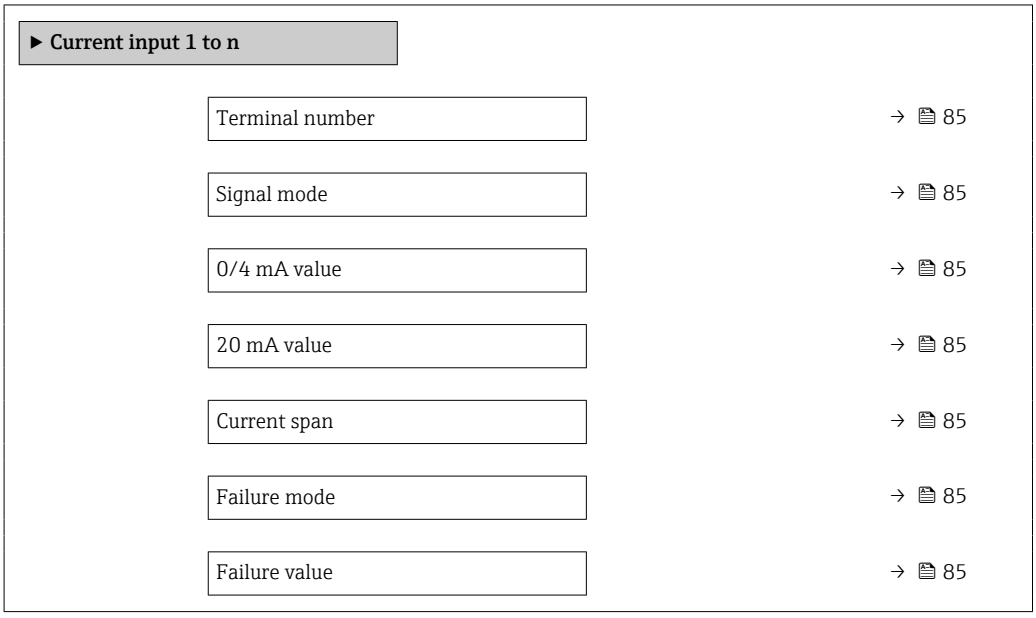
Parameter	Description	User interface / Selection / User entry	Factory setting
I/O module 1 to n terminal numbers	Shows the terminal numbers used by the I/O module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
I/O module 1 to n information	Shows information of the plugged I/O module.	▪ Not plugged ▪ Invalid ▪ Not configurable ▪ Configurable ▪ MODBUS	–
I/O module 1 to n type	Shows the I/O module type.	▪ Off ▪ Current output * ▪ Current input * ▪ Status input * ▪ Pulse/frequency/switch output * ▪ 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

10.5.5 Configuring the current input

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

Navigation
"Setup" menu → Current input



Parameter overview with brief description

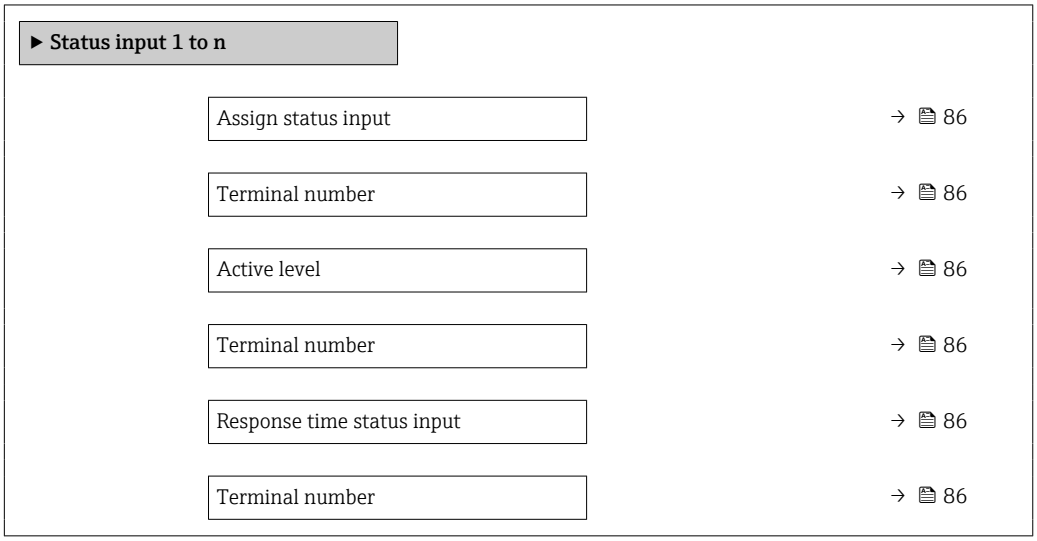
Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the current input.	▪ Passive ▪ Active *	Passive
0/4 mA value	–	Enter 4 mA value.	Signed floating-point number	0 % TS
20 mA value	–	Enter 20 mA value.	Signed floating-point number	12 %TS
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

10.5.6 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



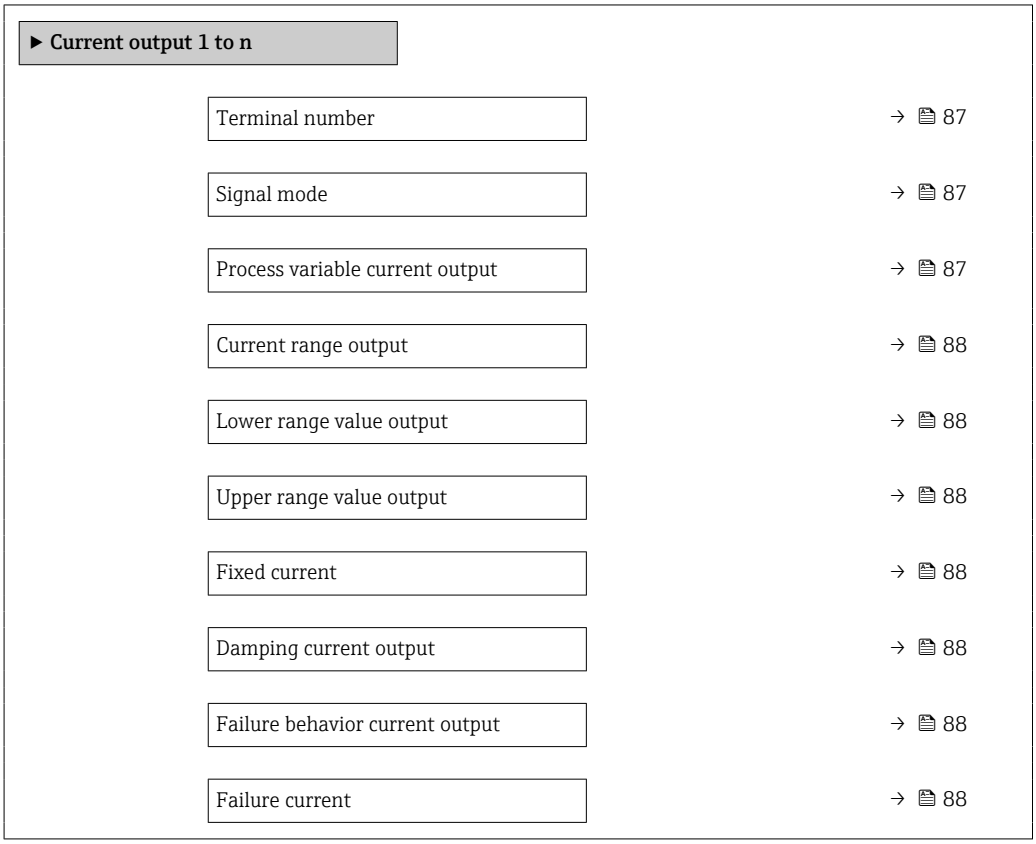
Parameter overview with brief description

Parameter	Description	Selection / User interface / User entry	Factory setting
Assign status input	Select function for the status input.	▪ Off ▪ Reset totalizer 1 ▪ Flow override	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)	–
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

10.5.7 Configuring the current output

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

Navigation
"Setup" menu → Current output



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the current output.	▪ Active * ▪ Passive *	Active
Process variable current output	The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the process variable for the current output.	▪ Off ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate *	Total solids

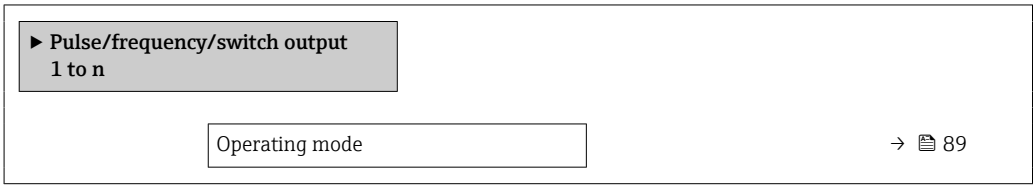
Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Current range output	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA) ▪ 4...20 mA (4...20.5 mA) ▪ 0...20 mA (0...20.5 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 (→ 🖹 88), 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.	Floating point number with sign	0 %TS
Upper range value output	In **Current span** parameter (→ 🖹 88), 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.	Floating point number with sign	12 %TS
Fixed current	The **Fixed current** option is selected in the **Current span** parameter (→ 🖹 88).	Defines the fixed output current.	0 to 22.5 mA	22.5 mA
Damping current output	A process variable is selected in the **Assign current output** parameter (→ 🖹 87) and one of the following options is selected in the **Current span** parameter (→ 🖹 88): ▪ 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 a time constant for output damping (PT1 element). Damping reduces the effect of fluctuations in the measured value on the output signal.	0.0 to 999.9 s	1.0 s
Failure behavior current output	A process variable is selected in the **Assign current output** parameter (→ 🖹 87) and one of the following options is selected in the **Current span** parameter (→ 🖹 88): ▪ 4...20 mA NE (3.8...20.5 mA) ▪ 4...20 mA US (3.9...20.8 mA) ▪ 4...20 mA (4...20.5 mA) ▪ 0...20 mA (0...20.5 mA)	Select output behavior in the event of a device alarm.	▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Fixed value	Max.
Failure current	The **Defined value** option is selected in the **Failure mode** parameter.	Enter current output value in alarm condition.	0 to 22.5 mA	22.5 mA

* Visibility depends on order options or device settings

10.5.8 Configuring the pulse/frequency/switch output

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

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

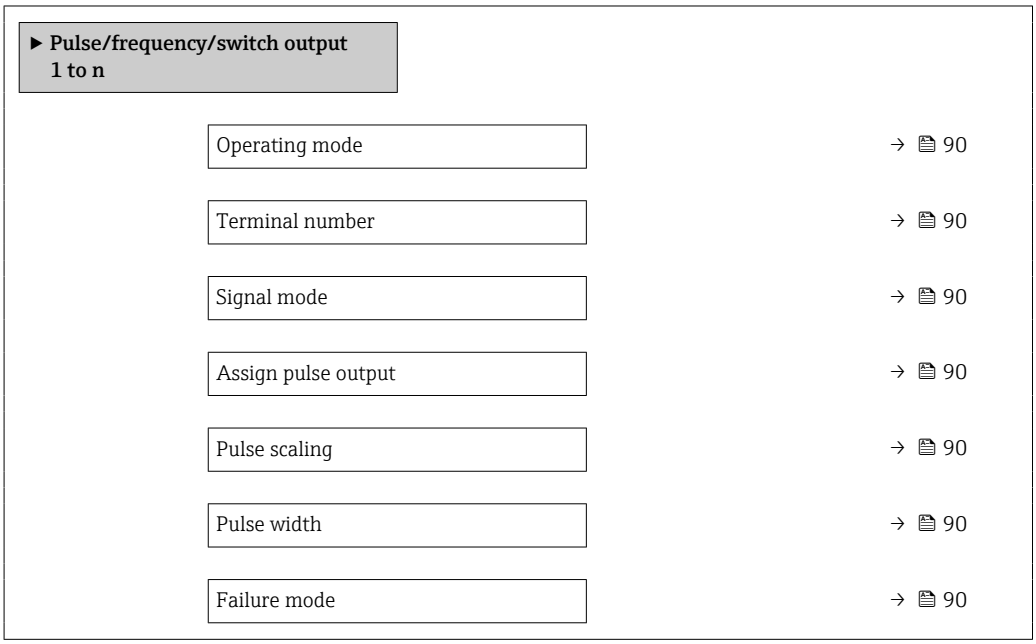


Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Operating mode	If the **Pulse** option is selected, the **Load rate** option must be selected in the **Assign pulse output** parameter.	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



Parameter overview with brief description

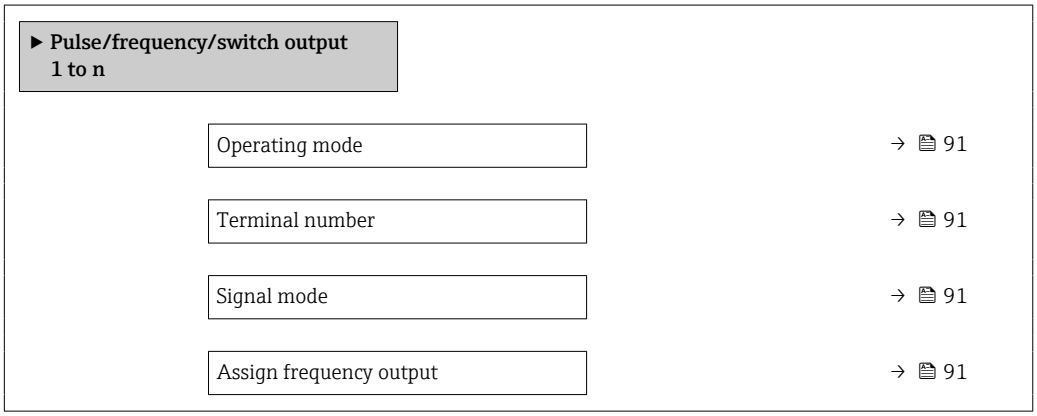
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	If the **Pulse** option is selected, the **Load rate** option must be selected in the **Assign pulse output** parameter.	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ 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)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active * ▪ Passive NE	Passive
Assign pulse output	The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus. The **Pulse** option is selected in **Operating mode** parameter.	Select process variable for pulse output.	▪ Off ▪ Load rate *	Off
Pulse scaling	The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 89) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 90).	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 (→ 🖹 89) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 90).	Define time width of the output pulse.	0.05 to 2 000 ms	100 ms
Failure mode	The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 89) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 90).	Select output behavior in the event of a device alarm.	▪ Actual value ▪ No pulses	No pulses

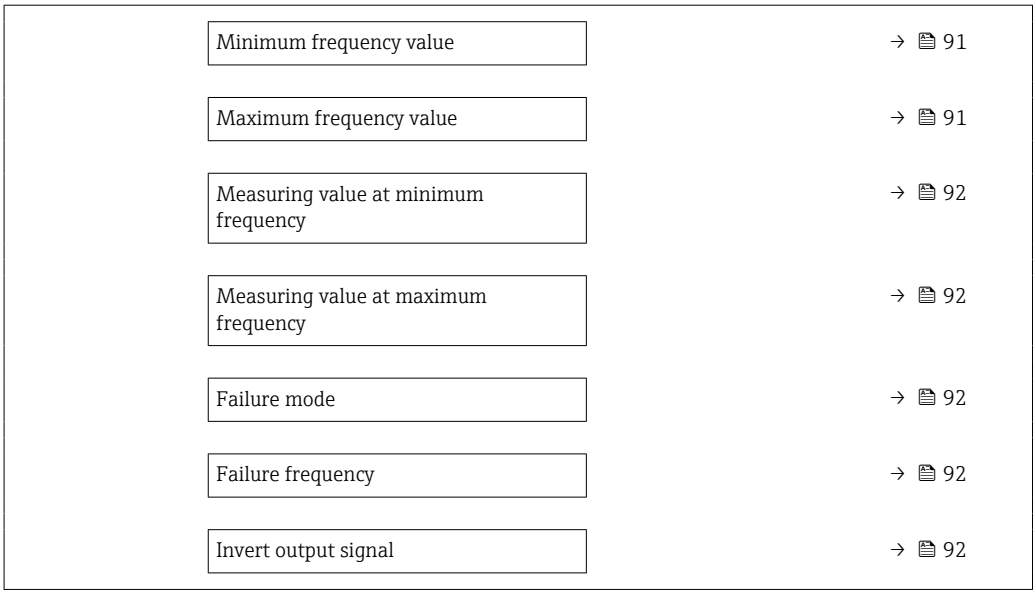
* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output





Parameter overview with brief description

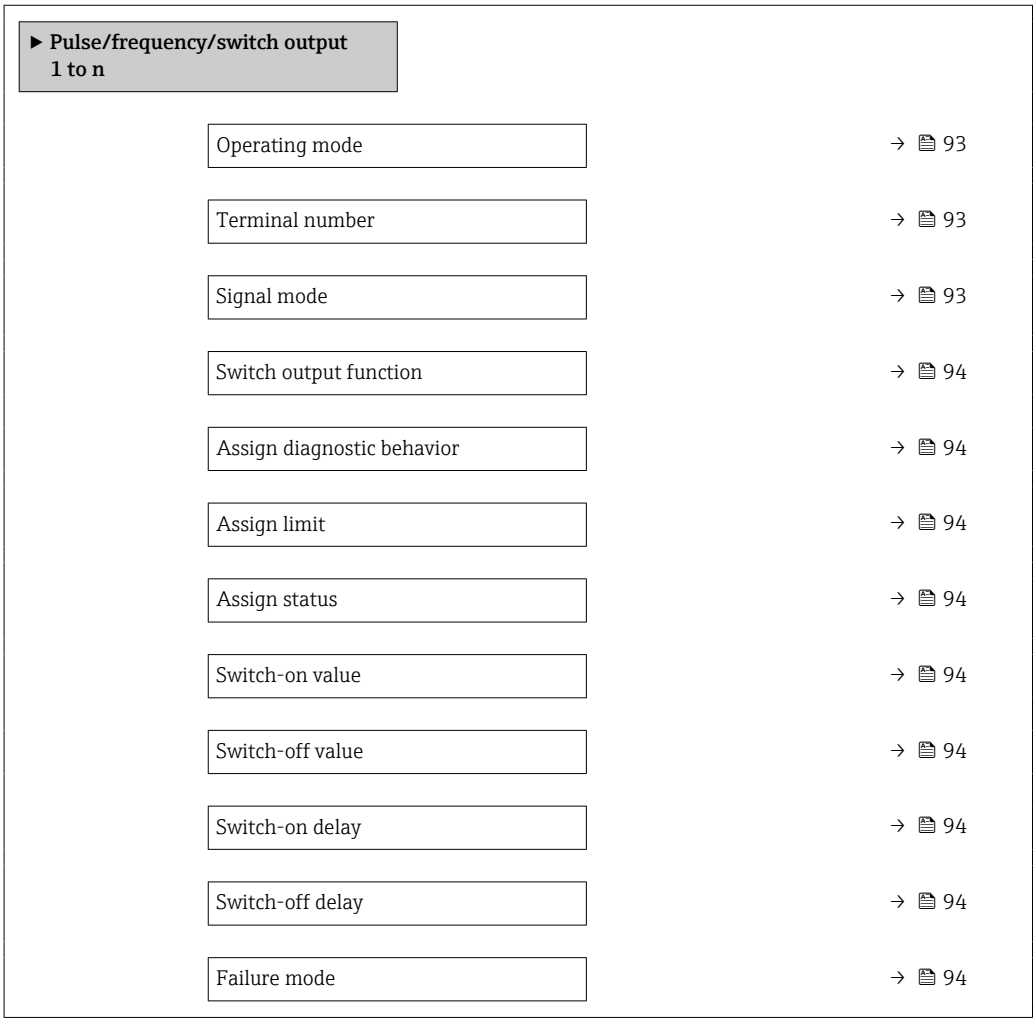
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	If the **Pulse** option is selected, the **Load rate** option must be selected in the **Assign pulse output** parameter.	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ 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)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active * ▪ Passive NE	Passive
Assign frequency output	▪ The **Frequency** option is selected in **Operating mode** parameter (→ 89). ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select process variable for frequency output.	▪ Off ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate *	Off
Minimum frequency value	The **Frequency** option is selected in the **Operating mode** parameter (→ 89) and a process variable is selected in the **Assign frequency output** parameter (→ 91).	Enter minimum frequency.	0.0 to 10000.0 Hz	0.0 Hz
Maximum frequency value	The **Frequency** option is selected in the **Operating mode** parameter (→ 89) and a process variable is selected in the **Assign frequency output** parameter (→ 91).	Enter maximum frequency.	0.0 to 10000.0 Hz	10000.0 Hz

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Measuring value at minimum frequency	The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 89) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 91).	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 (→ 🖹 89) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 91).	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter
Failure mode	The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 89) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 91).	Select output behavior in the event of a device alarm.	▪ Actual value ▪ Defined value ▪ 0 Hz	0 Hz
Failure frequency	In the **Operating mode** parameter (→ 🖹 89), the **Frequency** option is selected, in the **Assign frequency output** parameter (→ 🖹 91) 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



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	If the **Pulse** option is selected, the **Load rate** option must be selected in the **Assign pulse output** parameter.	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)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active * ▪ Passive NE	Passive

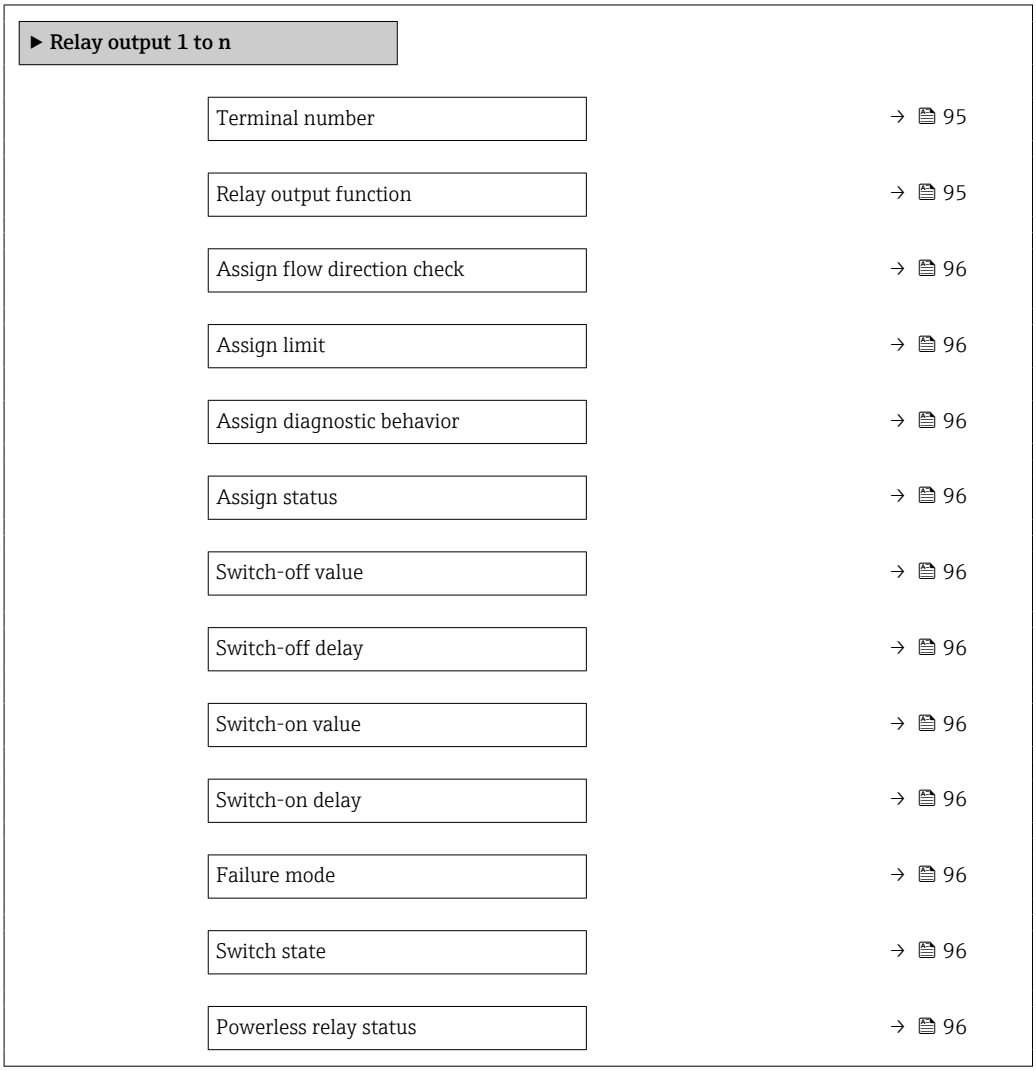
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch output function	The **Switch** option is selected in the **Operating mode** parameter.	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	Off
Assign diagnostic behavior	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Diagnostic behavior** option is selected.	The output is switched on (closed, conductive), if there is a pending diagnostic event of the assigned behavioral category.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign limit	▪ The **Switch** option is selected in **Operating mode** parameter. ▪ The **Limit** option is selected in **Switch output function** parameter. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the variable to monitor in case the specified limit value is exceeded. If a limit value is exceeded, the output is switched on (conductive).	▪ Off ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Totalizer 1 *	Temperature
Assign status	▪ The **Switch** option is selected in **Operating mode** parameter. ▪ The **Status** option is selected in **Switch output function** parameter.	Select the device function for which to display the status. If the switch on point is reached, the output is switched on (closed, conductive).	▪ Off ▪ Partially filled pipe detection	Partially filled pipe detection
Switch-on value	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Enter limit value for switch-on point (process variable > switch-on value = closed, conductive).	Floating point number with sign	0 °C
Switch-off value	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Enter limit value for switch-off point (process variable < switch-off value = open, nonconductive).	Floating point number with sign	0 °C
Switch-on delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Enter a delay before the output is switched on.	0.0 to 100.0 s	0.0 s
Switch-off delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Enter a delay before the output is switched off.	0.0 to 100.0 s	0.0 s
Failure mode	–	Select output behavior in the event of a device alarm.	▪ Actual status ▪ Open ▪ Closed	Open

* Visibility depends on order options or device settings

10.5.9 Configuring the relay output

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

Navigation
"Setup" menu → Relay output 1 to n



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Relay output function	–	Select the function for the relay output.	▪ Closed ▪ Open ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	Closed

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Assign flow direction check	The **Flow direction check** option is selected in the **Relay output function** parameter.	Select process variable for flow direction monitoring.		Off
Assign limit	▪ The **Limit** option is selected in **Relay output function** parameter. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the variable to monitor in case the specified limit value is exceeded. If a limit value is exceeded, the output is switched on (conductive).	▪ Off ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Totalizer 1 *	Temperature
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	The output is switched on (closed, conductive), if there is a pending diagnostic event of the assigned behavioral category.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select the device function for which to display the status. If the switch on point is reached, the output is switched on (closed, conductive).	▪ Off ▪ Partially filled pipe detection	Off
Switch-off value	The **Limit** option is selected in the **Relay output function** parameter.	Enter limit value for switch-off point (process variable < switch-off value = open, nonconductive).	Floating point number with sign	0 °C
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Enter a delay before the output is switched off.	0.0 to 100.0 s	0.0 s
Switch-on value	The **Limit** option is selected in the **Relay output function** parameter.	Enter measured value for the switch-on point.	Floating point number with sign	0 °C
Switch-on delay	In the **Relay output function** parameter, the **Limit** option is selected.	Enter a delay before the output is switched on.	0.0 to 100.0 s	0.0 s
Failure mode	–	Select output behavior in the event of a device alarm.	▪ Actual status ▪ Open ▪ Closed	Open
Switch state	–	Indicates the current switch state of the output.	▪ Open ▪ Closed	–
Powerless relay status	–	Select quiescent state for relay.	▪ Open ▪ Closed	Open

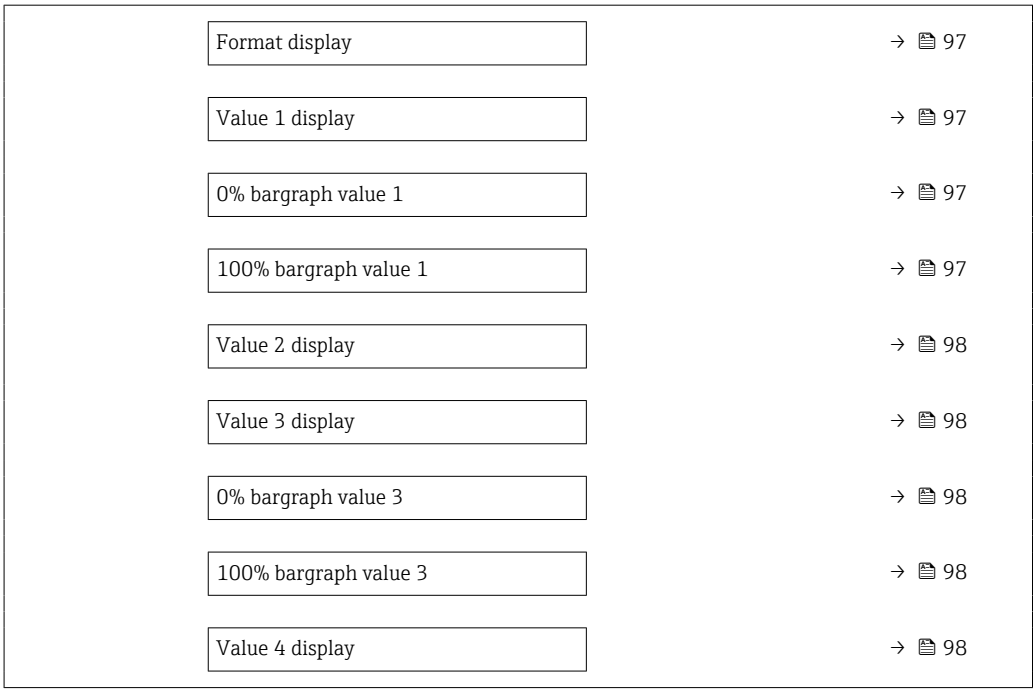
* Visibility depends on order options or device settings

10.5.10 Configuring the local display

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

Navigation

"Setup" menu → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Totalizer 1 * ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Total solids
0% bargraph value 1	A local display is provided.	Enter 0 % value for bar graph display.	Signed floating-point number	0 %TS
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

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Value 2 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	▪ None ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Totalizer 1 * ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	None
Value 3 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	For the picklist, see **Value 1 display** parameter (→ 🖹 97)	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	0
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. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	For the picklist, see **Value 1 display** parameter (→ 🖹 97)	None

* Visibility depends on order options or device settings

10.5.11 "Total solids commissioning" wizard

The **Total solids commissioning** wizard is used to perform the basic settings for adjusting the measured value based on a reference value.

Wizard description → 130.

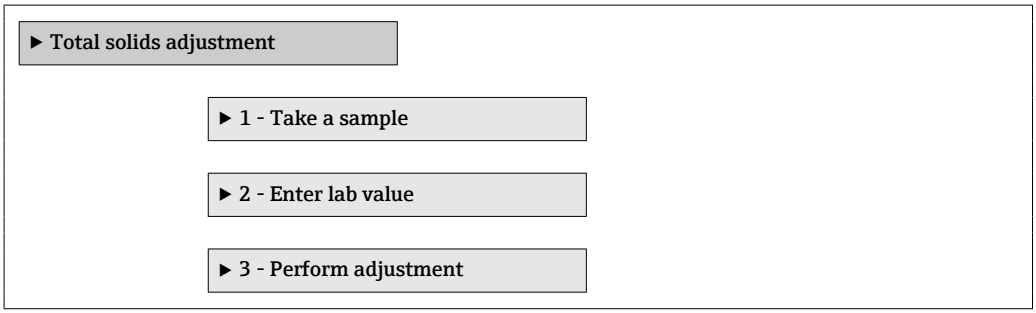
Navigation
"Setup" menu → Total solids commissioning

10.5.12 "Total solids adjustment" submenu

Using the **Total solids adjustment** submenu, you can call up the wizards for adjusting the measured value based on a reference value.

Description and access to the wizards → 130

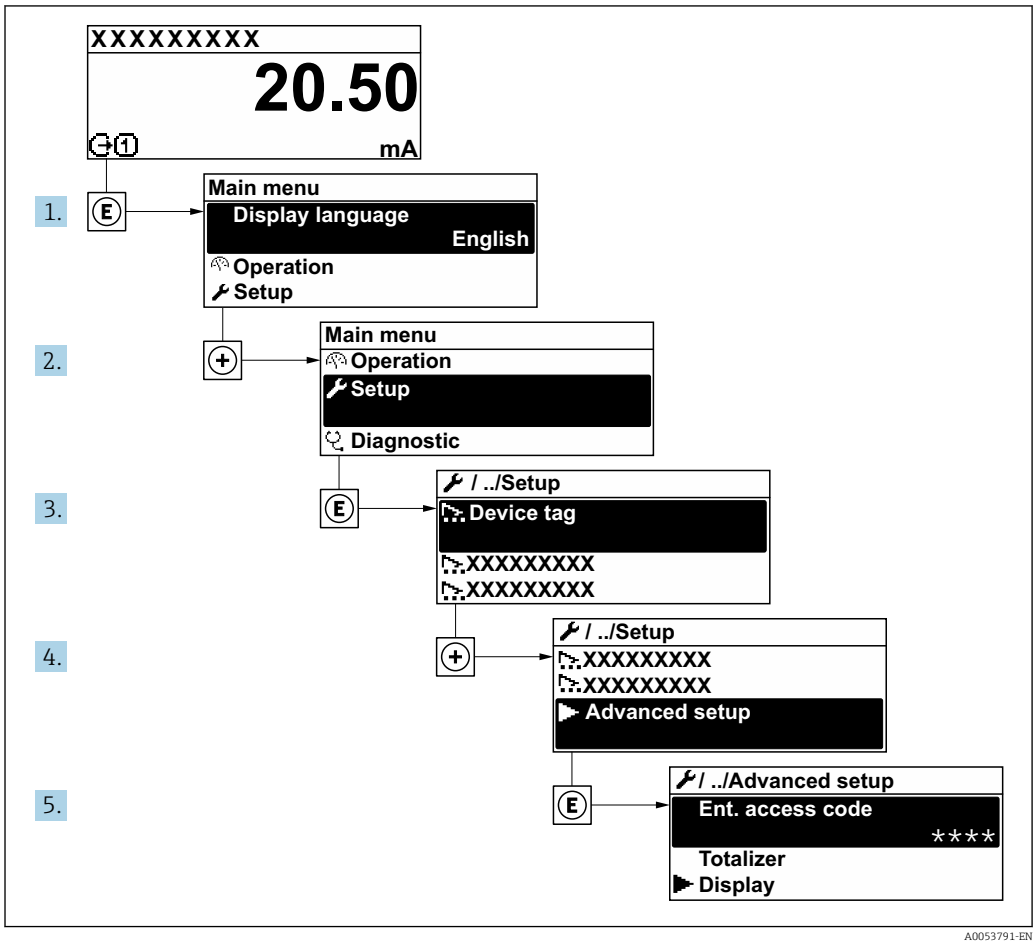
Navigation
"Setup" menu → Total solids adjustment



10.6 Advanced settings

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

Navigation to the "Advanced setup" submenu

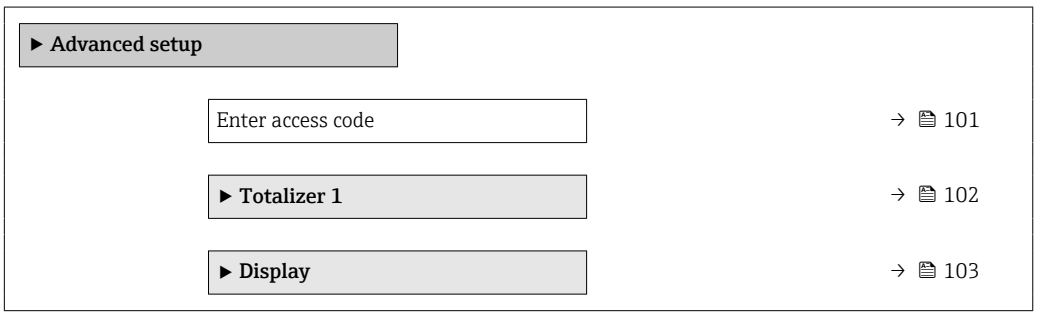


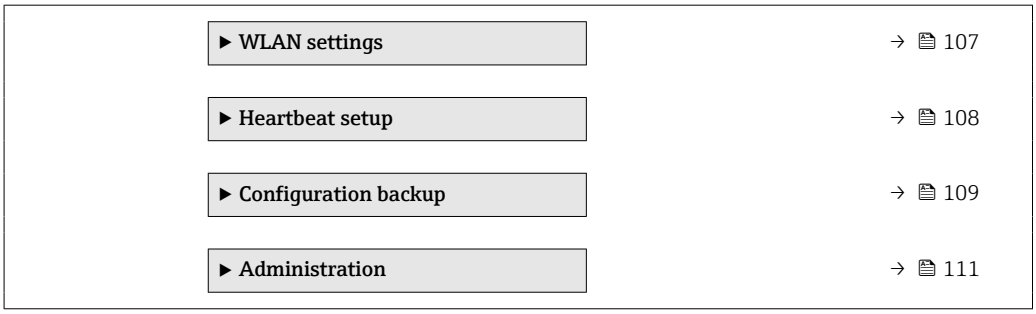
The number of submenus and parameters can vary depending on the device version and the available application packages. These submenus and their parameters are explained in the Special Documentation for the device and not in Operating Instructions.

For detailed information on the parameter descriptions of the application packages, see the Special Documentation for the device. → 188

Navigation

"Setup" menu → Advanced setup





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

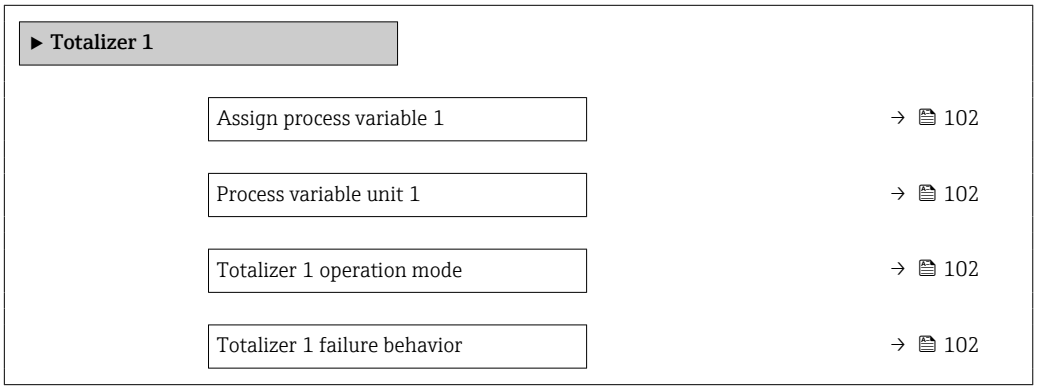
10.6.2 Configuring the totalizer

The totalizer is used to calculate the total load rate. The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n.

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

Navigation

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



Parameter overview with brief description

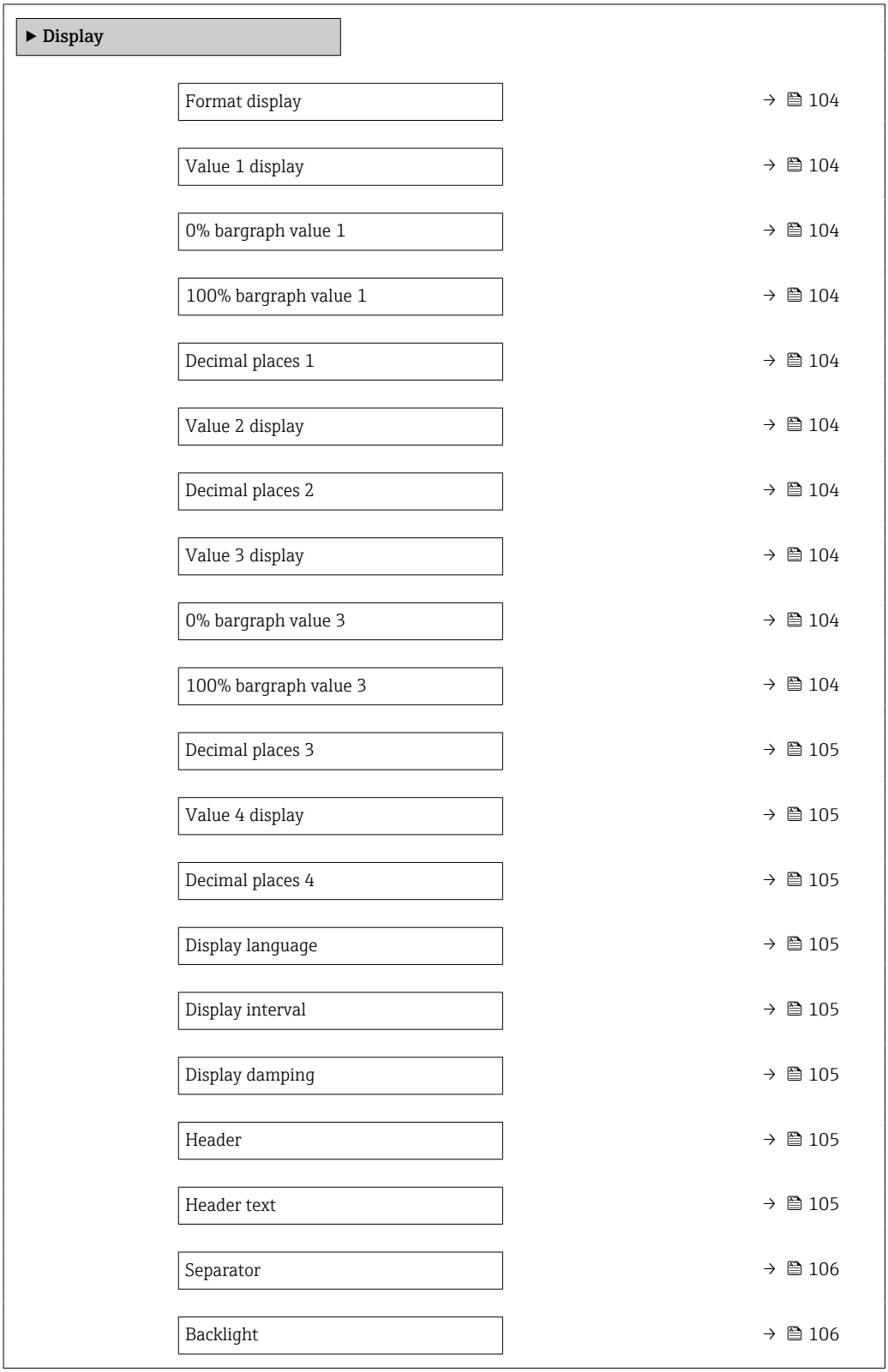
Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable 1	The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select process variable for totalizer.	▪ Off ▪ Load rate *	Off
Process variable unit 1	A process variable is selected in the **Assign process variable** parameter (→ 102) of the **Totalizer 1 to n** submenu.	Select the unit for the process variable of the totalizer.	Unit choose list	Depends on country
Totalizer 1 operation mode	A process variable is selected in the **Assign process variable** parameter (→ 102) of the **Totalizer 1 to n** submenu.	Select totalizer operation mode, e.g. only totalize forward flow or only totalize reverse flow.	▪ Net ▪ Forward ▪ Reverse	Net
Totalizer 1 failure behavior	A process variable is selected in the **Assign process variable** parameter (→ 102) of the **Totalizer 1 to n** submenu.	Select totalizer behavior in the event of a device alarm.	▪ Hold ▪ Continue ▪ Last valid value + continue	Hold

* Visibility depends on order options or device settings

10.6.3 Carrying out additional display configurations

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

Navigation
"Setup" menu → Advanced setup → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Totalizer 1 * ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Total solids
0% bargraph value 1	A local display is provided.	Enter 0 % value for bar graph display.	Signed floating-point number	0 %TS
100% bargraph value 1	A local display is provided.	Enter 100 % value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is specified in the **Value 1 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 2 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	▪ None ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Totalizer 1 * ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	None
Decimal places 2	A measured value is specified in the **Value 2 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 3 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	For the picklist, see **Value 1 display** parameter (→ 🖹 97)	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	0
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100 % value for bar graph display.	Signed floating-point number	0

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Decimal places 3	A measured value is specified in the **Value 3 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 4 display	▪ A local display is provided. ▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select the measured value that is shown on the local display.	For the picklist, see **Value 1 display** parameter (→ 97)	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.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) ▪ čeština (Czech)	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	▪ Device tag ▪ Free text	Device tag
Header text	The **Free text** option is selected in the **Header** parameter.	Enter display header text.	Max. 12 characters, such as letters, numbers or special characters (e.g. @, %, /)	----------

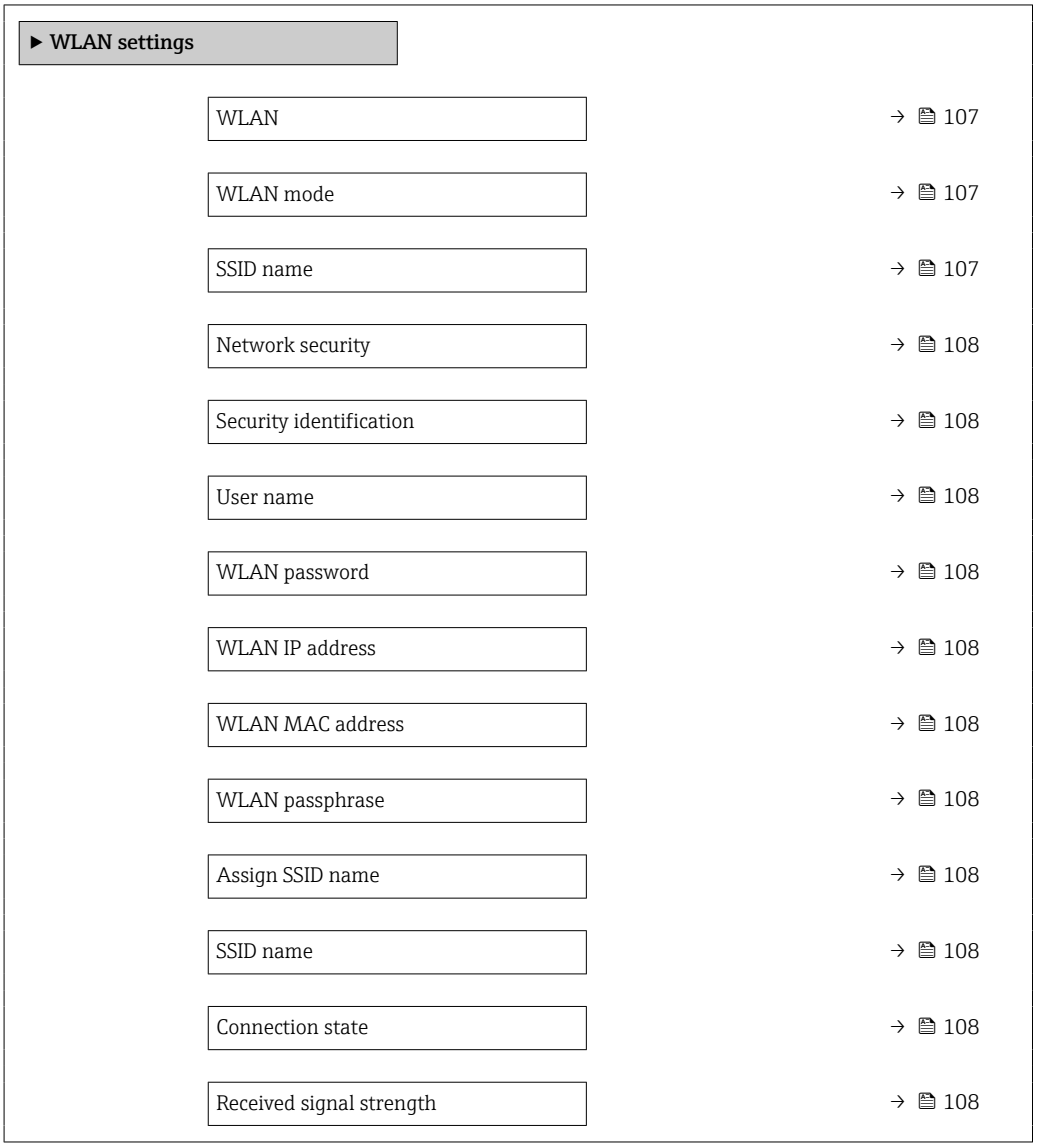
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	▪ . (point) ▪ , (comma)	. (point)
Backlight	One of the following conditions is met: ▪ Order code for "Display; operation", option **F** "4-line, illum.; touch control" ▪ Order code for "Display; operation", option **G** "4-line, illum.; touch control +WLAN" ▪ Order code for "Display; operation", option **O** "Remote display 4-line illuminated; 10m/30ft cable; touch control"	Switch the local display backlight on and off.	▪ Disable ▪ Enable	Enable

* Visibility depends on order options or device settings

10.6.4 WLAN configuration

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

Navigation
"Setup" menu → Advanced setup → WLAN settings



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
WLAN	–	Switch WLAN on and off.	▪ Disable ▪ Enable	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).	–	–

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
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). The network key supplied with the device should be changed during commissioning for security reasons.	8 to 32-digit character string comprising numbers, letters and special characters (without spaces)	Serial number of the measuring device (e.g. L100A802000)
Assign SSID name	–	Select which name will be used for SSID: device tag or user-defined name.	▪ Device tag ▪ User-defined	User-defined
SSID name	▪ The **User-defined** option is selected in the **Assign SSID name** parameter. ▪ The **WLAN access point** option is selected in the **WLAN mode** parameter.	Enter the user-defined SSID name (max. 32 characters). The user-defined SSID name may only be assigned once. If the SSID name is assigned more than once, the devices can interfere with one another.	Max. 32-digit character string comprising numbers, letters and special characters	
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

10.6.5 Heartbeat Technology application package

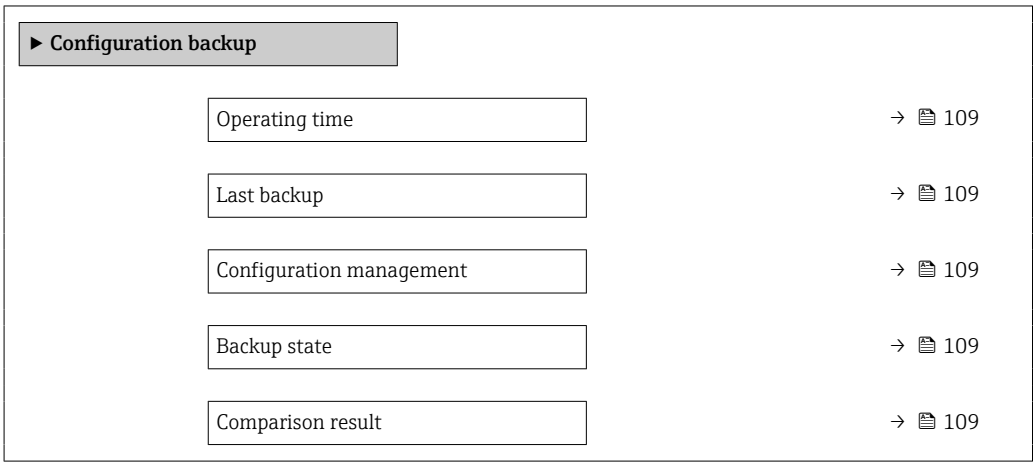
For detailed information on the parameter descriptions of the application packages, see the Special Documentation for the device. → 188

Navigation
"Setup" menu → Advanced setup → Heartbeat setup

10.6.6 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



Parameter overview with brief description

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

* Visibility depends on order options or device settings

Function 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.

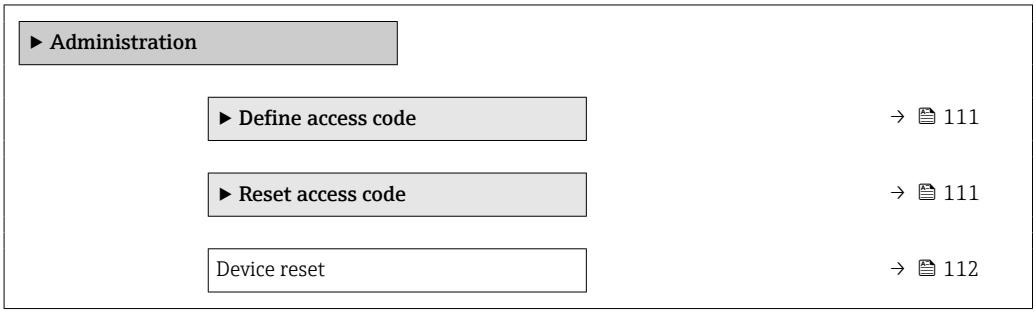
HistoROM backup
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

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.

10.6.7 Using parameters for device administration

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

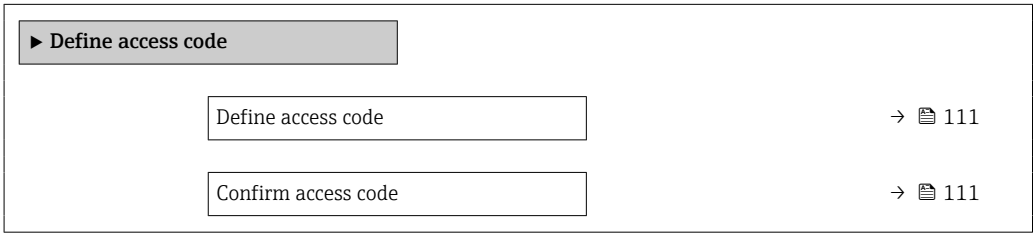
Navigation
"Setup" menu → Advanced setup → Administration



Using the parameter to define the access code

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

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

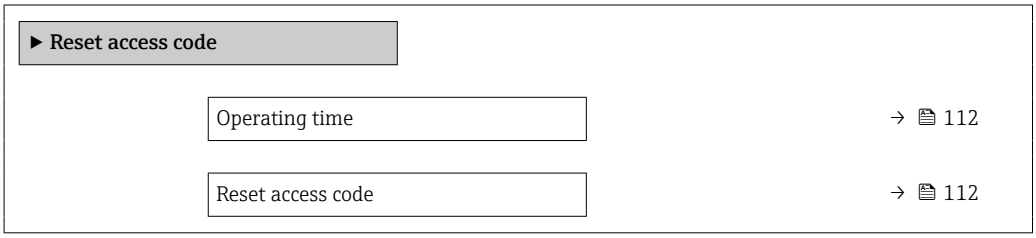


Parameter overview with brief description

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

Using the parameter to reset the access code

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



Parameter overview with brief description

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

Using the parameter to reset the device

Navigation
"Setup" menu → Advanced setup → Administration

Parameter overview with brief description

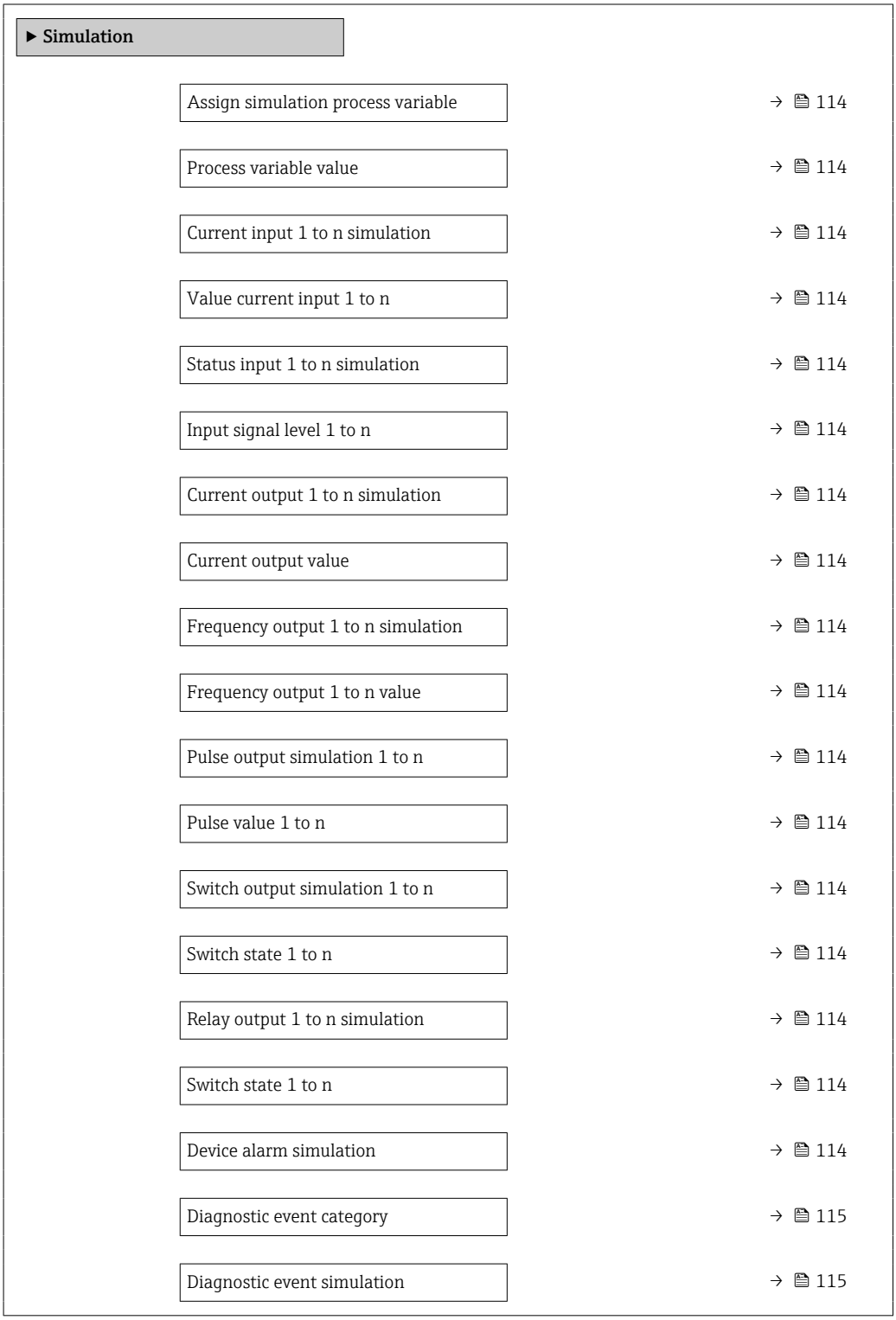
Parameter	Description	Selection	Factory setting
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	▪ Cancel ▪ To delivery settings ▪ Restart device ▪ Restore S-DAT backup *	Cancel

* Visibility depends on order options or device settings

10.7 Simulation

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

Navigation
"Diagnostics" menu → Simulation



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign simulation process variable	The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Select a process variable for the simulation process that is activated.	▪ Off ▪ Load rate * ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity	Off
Process variable value	–	Enter the simulation value for the selected process variable.	Signed floating-point number	0
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
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
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 (→ 90) 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

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
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

* 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 → 116
- Protect access to local operation via key locking → 60
- Protect access to measuring device via write protection switch → 117

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

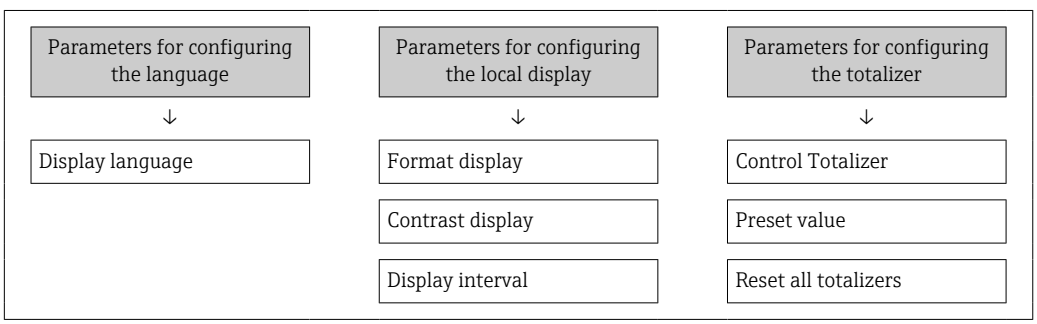
1. Navigate to the **Define access code** parameter (→ 111).
2. Maximum of 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 111) to confirm.
   ↳ The symbol appears in front of all write-protected parameters.

- Disabling parameter write protection via access code → 60.
- If the access code is lost: Resetting the access code → 117.
- 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 → 59

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

Parameters which can always be modified via the local display

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



Defining the access code via the web browser

1. Navigate to the **Define access code** parameter (→ 111).

2. Define a 16-digit (max.) numeric code as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 111) 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 → 117.
- 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 → 59

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 (→ 112).
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 116.

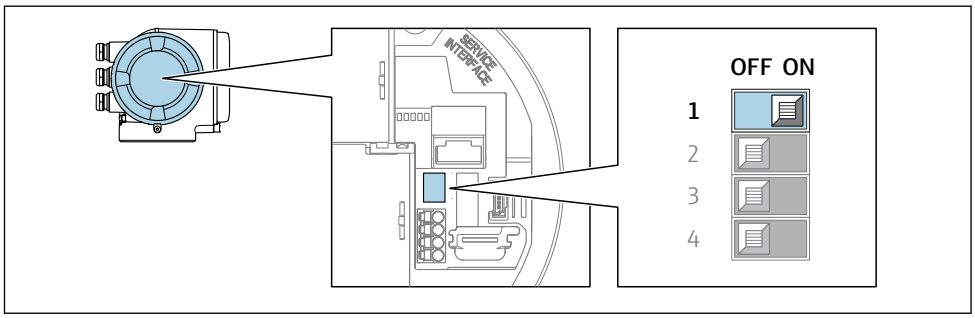
For IT security reasons, the calculated reset code is only valid for 96 hours from the specified operating time and for the specific serial number. If you cannot return to the device within 96 hours, you should either increase the operating time you read out by a few days or switch off the device.

10.8.2 Write protection via write protection switch

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

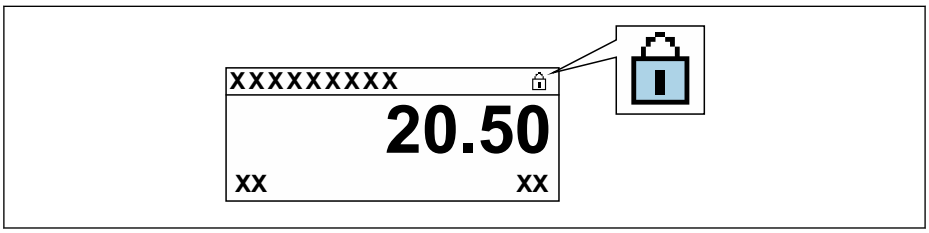
The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via MODBUS RS485 protocol

1.



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

↳ In the **Locking status** parameter, the **Hardware locked** option is displayed → 119. In addition, on the local display the symbol appears in front of the parameters in the header of the operational display and in the navigation view.



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

↳ No option is displayed in the **Locking status** parameter → 119. On the local display, the symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

11 Operation

11.1 Reading 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 → 🖹 59. 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) → 🖹 117.
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
- For information on the operating languages supported by the measuring device → 🖹 178

11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 🖹 96
- On the advanced settings for the local display → 🖹 103

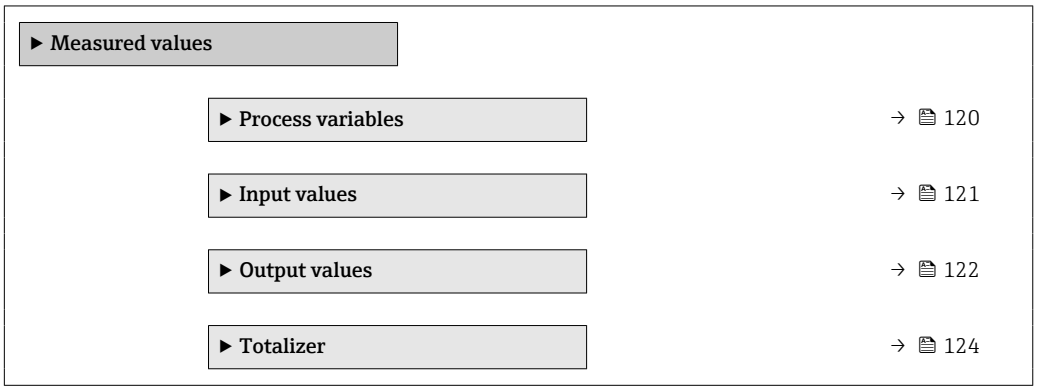
11.4 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 🖹 80)
- Advanced settings using the**Advanced setup** submenu (→ 🖹 100)

11.5 Reading off measured values

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

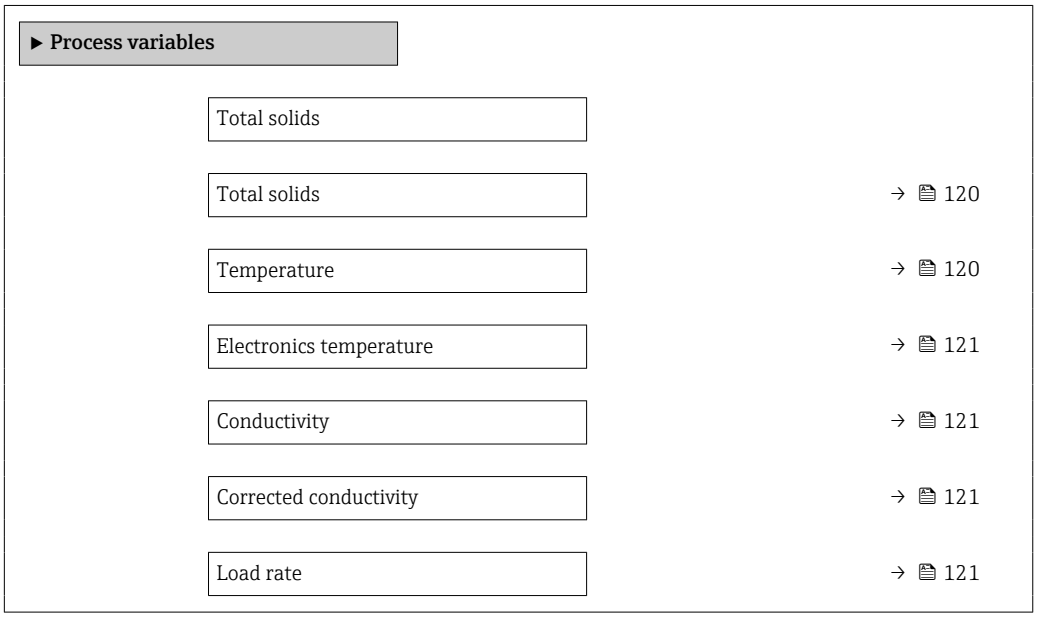
Navigation
"Diagnostics" menu → Measured values



11.5.1 "Process variables" submenu

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

Navigation
"Diagnostics" menu → Measured values → Process variables



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Total solids	–	Shows total solids (fraction of total weight or concentration per volume unit).	Signed floating-point number
Temperature	–	Shows the medium temperature currently measured.	Signed floating-point number

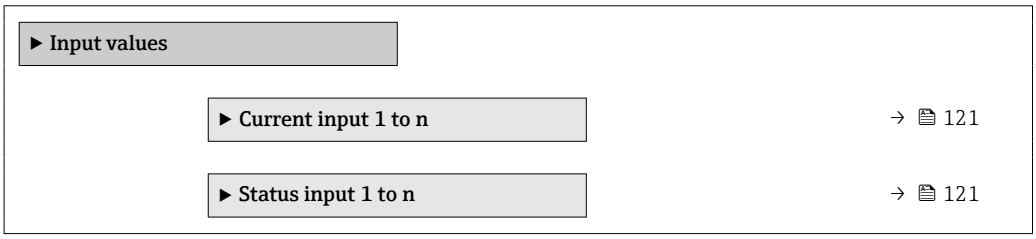
Parameter	Prerequisite	Description	User interface
Electronics temperature	–	Shows the electronics temperature currently measured.	Signed floating-point number
Conductivity	–	Shows the conductivity currently measured.	Floating-point number
Corrected conductivity	–	Shows the conductivity measured compensated for temperature.	Floating-point number
Load rate	The volume flow of the medium is read in via the Current input 1 to n or the fieldbus.	Shows the total solids flow rate.	Signed floating-point number

11.5.2 "Input values" submenu

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

Navigation

"Diagnostics" menu → Measured values → Input values

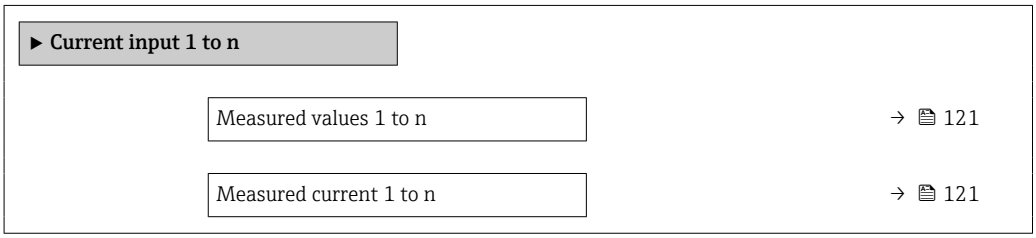


Input values of current input

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

Navigation

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



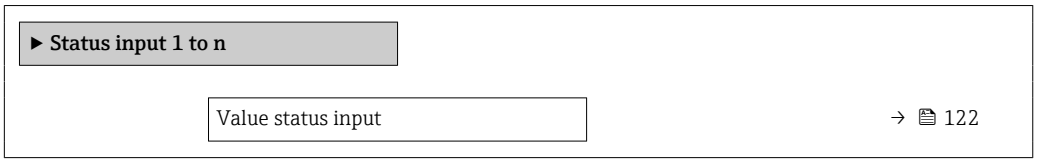
Parameter overview with brief description

Parameter	Description	User interface
Measured values 1 to n	Displays the current input value.	Signed floating-point number
Measured current 1 to n	Displays the current value of the current input.	0 to 22.5 mA

Input values of status input

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

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



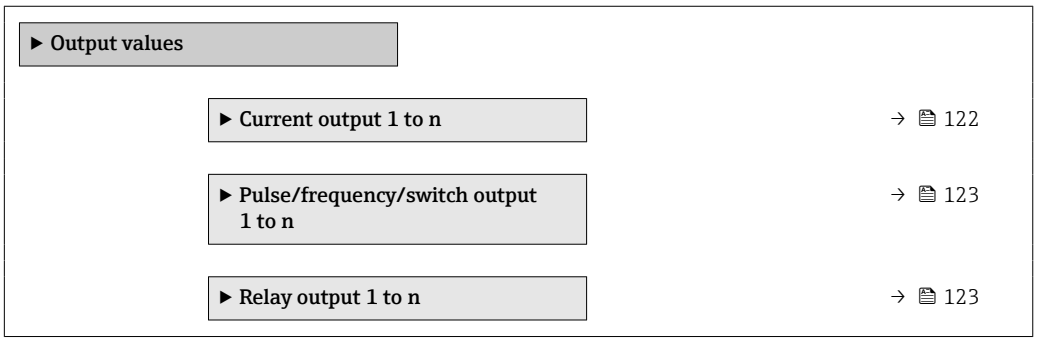
Parameter overview with brief description

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

11.5.3 Output values

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

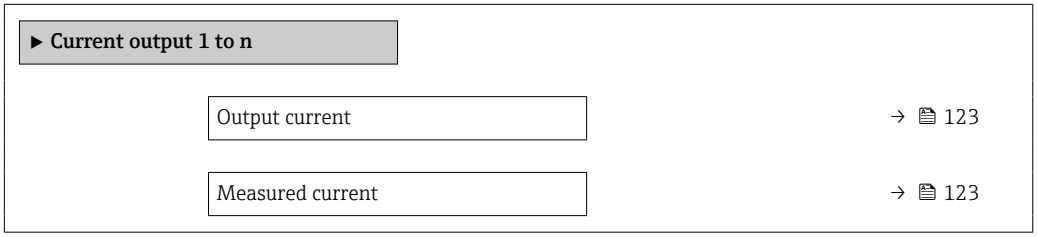
Navigation
"Diagnostics" menu → Measured values → Output values



Output values of current output

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

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



Parameter overview with brief description

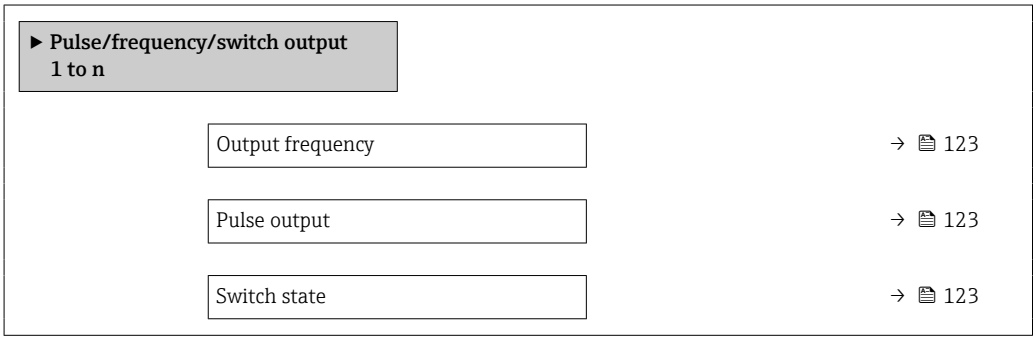
Parameter	Description	User interface
Output current	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current	Displays the current value currently measured for the current output.	0 to 30 mA

Output values for pulse/frequency/switch output

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

Navigation

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



Parameter overview with brief description

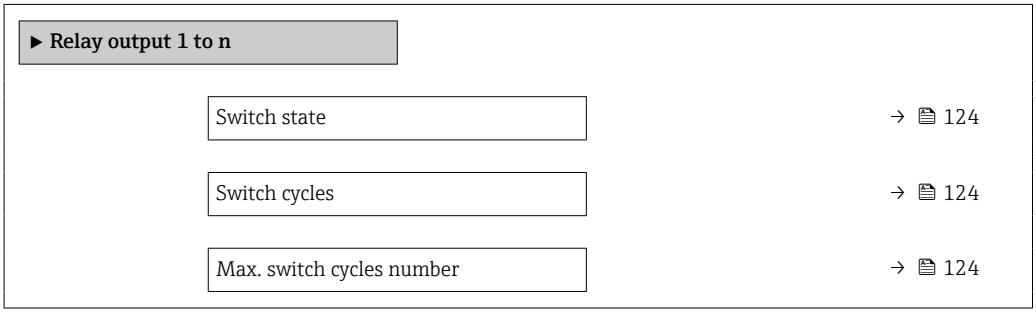
Parameter	Prerequisite	Description	User interface
Output frequency	In the **Operating mode** parameter, the **Frequency** option is selected.	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz
Pulse output	The **Pulse** option is selected in the **Operating mode** parameter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

Output values for relay output

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

Navigation

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



Parameter overview with brief description

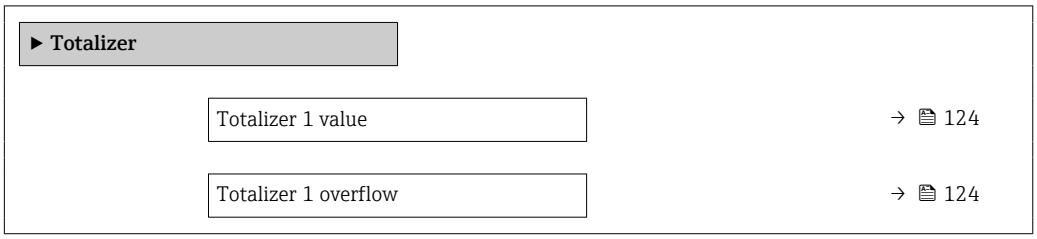
Parameter	Description	User interface
Switch state	Indicates the current switch state of the output.	▪ Open ▪ Closed
Switch cycles	Shows number of all performed switch cycles.	Positive integer
Max. switch cycles number	Shows the maximal number of guaranteed switch cycles.	Positive integer

11.5.4 "Totalizer" submenu

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

Navigation

"Diagnostics" menu → Measured values → Totalizer



Parameter overview with brief description

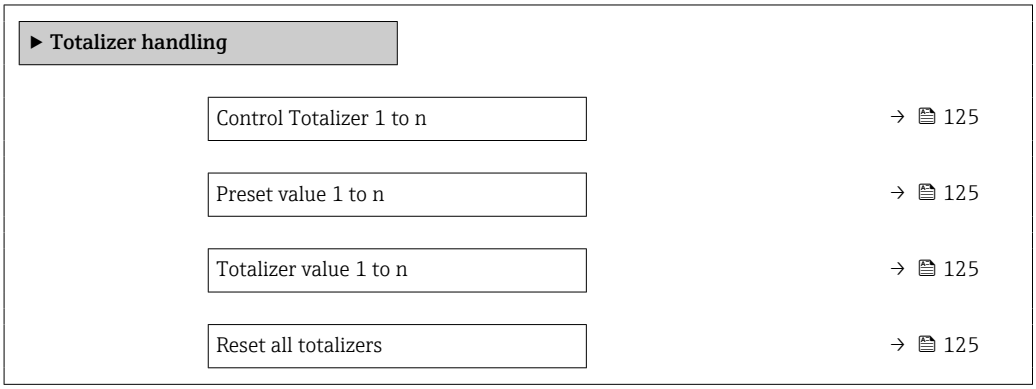
Parameter	Description	User interface
Totalizer 1 value	Displays the current totalizer counter value.	Signed floating-point number
Totalizer 1 overflow	Displays the current totalizer overflow.	Integer with sign

11.6 Performing a totalizer reset

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

Navigation

"Operation" menu → Totalizer handling



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Totalizer 1 control	A process variable is selected in the **Assign process variable** parameter (→ 102) of the **Totalizer 1 to n** submenu.	Operate the totalizer.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize ▪ Hold	Totalize
Preset value 1	A process variable is selected in the **Assign process variable** parameter (→ 102) of the **Totalizer 1 to n** submenu.	Specify start value for totalizer. *Dependency* The unit of the selected process variable is defined in the **Unit totalizer** parameter (→ 102) for the totalizer.	Signed floating-point number	0 kg
Totalizer value	–	Displays the current totalizer counter value.	Signed floating-point number	–
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.

Options	Description
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

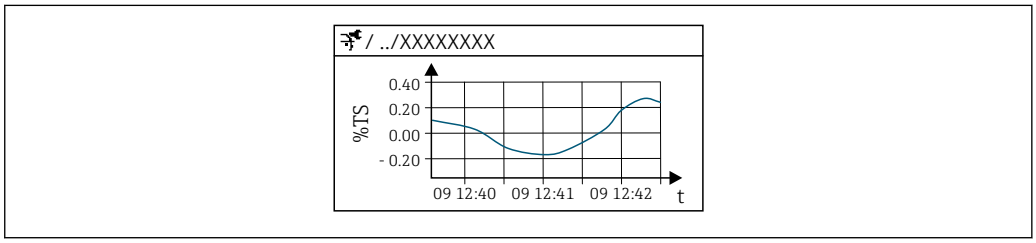
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets the totalizer to 0 and restarts the totaling process. The previously aggregated load quantity is thus deleted.

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 → 70.
- 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



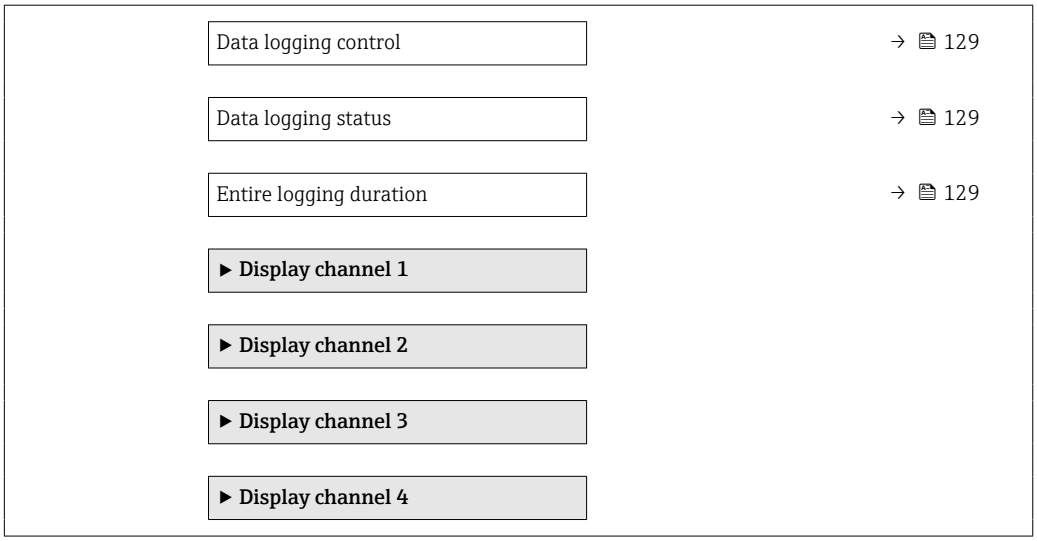
26 Chart of a measured value trend

- 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	→ 128
Assign channel 2	→ 128
Assign channel 3	→ 128
Assign channel 4	→ 129
Logging interval	→ 129
Clear logging data	→ 129
Data logging	→ 129
Logging delay	→ 129



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 ▪ Total solids ▪ Temperature ▪ Electronics temperature ▪ Conductivity ▪ Corrected conductivity ▪ Load rate * ▪ Current output 1 * ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Off
Assign channel 2	▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus. ▪ The **Extended HistoROM** application package is available. The software options currently enabled are displayed in the **Software option overview** parameter.	Assign a process variable to logging channel.	For the picklist, see **Assign channel 1** parameter (→ 128)	Off
Assign channel 3	▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus. ▪ The **Extended HistoROM** application package is available. The software options currently enabled are displayed in the **Software option overview** parameter.	Assign a process variable to logging channel.	For the picklist, see **Assign channel 1** parameter (→ 128)	Off

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign channel 4	▪ The **Load rate** option is only available if the volume flow of the medium is read in via the Current input 1 to n or the fieldbus. ▪ The **Extended HistoROM** application package is available. The software options currently enabled are displayed in the **Software option overview** parameter.	Assign a process variable to logging channel.	For the picklist, see **Assign channel 1** parameter (→ 128)	Off
Logging interval	The **Extended HistoROM** application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	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 Adjusting the measured value with the aid of wizards

In practice, the measurement typically needs to be adjusted based a reference value (e.g. lab value) when commissioning the device to ensure optimum measurement performance during subsequent operation. Repeating this adjustment is recommended if there are significant changes to the process conditions or following replacement of the sensor electronics module (ISEM).

The deviation from the value determined by the device can be checked and adjusted if necessary with the aid of manually taken samples of the medium, which are analyzed in the laboratory. The lab value is compared with the measured value of the device for this purpose. The difference between the two values can then be used to decide whether the measurement performance is sufficient or whether the device should be readjusted based on the laboratory value.

The device has four wizards to facilitate this process. After starting each wizard, you are guided through the necessary work steps.

Performing the basic settings for the adjustment:

1. **Commissioning** wizard

Adusting the measured value based on the reference value:

2. **1 - Take a sample** wizard
3. **2 - Enter lab value** wizard
4. **3 - Perform adjustment** wizard

Adjustment can be carried out directly via local operation of the device or via the web server.

The process using the wizards is essentially the same for both operation methods, but more options and a graphic display are available when operating via the web server in the **3 - Perform adjustment** wizard. Using the web server is therefore recommended.

Online information

	Further information on the procedure for performing an adjustment using wizards is also available online.

11.8.1 Performing the basic settings for the adjustment

The **Commissioning** wizard is called up via the main menu: Setup → Total solids adjustment → Commissioning

Commissioning

The **Commissioning** wizard is used to:
- set the system time (when using the wizard for the first time or after disconnecting the device from the supply voltage)
- set the unit for the solids content for the measured total solids and the lab value
- enter the solids density

11.8.2 Adjusting the measured value based on the reference value

- **All three wizards** must be run each time the device is adjusted.
- You can call up the wizard options via the operating menu or during local operation from the operational display by holding down the Enter key E for longer than 3 seconds→ 132.

Taking a sample

The **1 - Take a sample** wizard is used to:
- set the system time (if not already defined in the **Commissioning** wizard)
- have the total solids measured by the device
- calculate the value of the medium sample of the device

The calculated medium sample of the device is the average of the total solids measured by the device between the start and end of the wizard.

- perform a check as to whether the variability is within the permitted limits You can set the upper limit in the **Maximum variance** parameter.
- save the value of the sample calculated by the device (incl. system time and status).

- At the same time as the total solids in the device are measured, a sample must be taken manually for analysis in the laboratory.
- The installation of sampling points is recommended for taking samples of the medium → 24.

Entering the lab value

The **2 - Enter lab value** wizard is used to:
- select a unit for entering the sample of the medium taken manually.
- select the sample measured by the device that is to be used for the lab value
- enter the lab value of the sample of the medium taken manually
- check whether the lab value is within the value range
- save the lab value (incl. status and min./max. values if applicable)

Performing the adjustment

The **3 - Perform adjustment** wizard is used to:
- display the respective medium sample with the corresponding lab values and the number of adjustments performed.
- select whether a single-point adjustment or a multi-point adjustment is to be performed

- In the case of a single-point adjustment, the value of the most recent, valid sample taken is always selected automatically.
- In the case of a multi-point adjustment, the values of the last ten valid samples are always selected automatically.

- display the current and new factor and offset
- display the current and new value of the total solids
- display the time stamp of the completed process and confirm completion.

Each completed adjustment is documented: Diagnostics → Event logbook → Event list

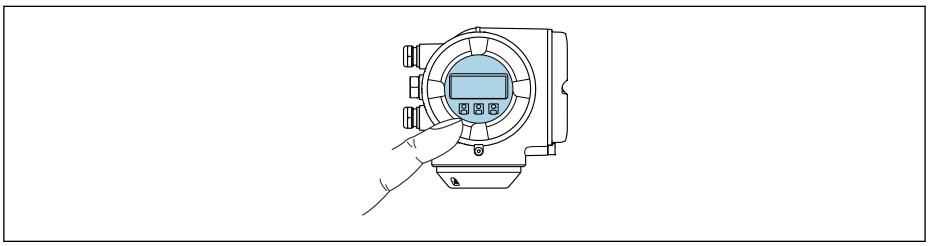
Extended functionality when running the wizard via the web server
In the web server, the samples of the medium are displayed in a table (max. 10 out of 32 stored samples). It is also possible to adjust the selection of samples used for the adjustment.
- In the case of a single-point adjustment, the value of the most recent, valid sample taken is always selected automatically. You can determine the most recent sample you want to use by deleting the most recent sample in the table.
- In the case of a multi-point adjustment, the values of the last ten valid samples taken are always automatically selected. You can determine the samples you want to use for the adjustment by deleting samples from the table.

11.8.3 Calling up wizards

- **Commissioning** wizard
  The wizard is called up via the main menu: Setup → Total solids adjustment → Commissioning
- **Take a sample** wizard, **Enter lab value** wizard and Assistent **Perform adjustment**:
  You can call up the wizard options via the operating menu or during local operation from the operational display by holding down the Enter key [E] for longer than 3 seconds.

Performing the adjustment process via local operation

1. Press the Enter key [E] for longer than 3 seconds.
   ↳



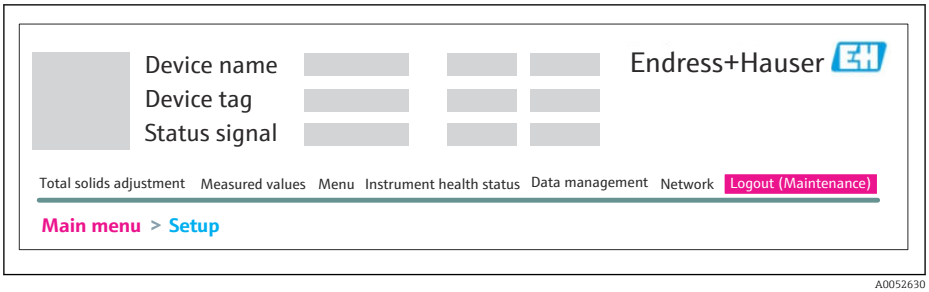
A0026785

   A selection field appears with adjustment options.
2. Confirm the desired adjustment option in the selection field.
   ↳ The available wizards are displayed.
3. Select the desired wizard and follow the instructions.

Performing the adjustment process via the web server

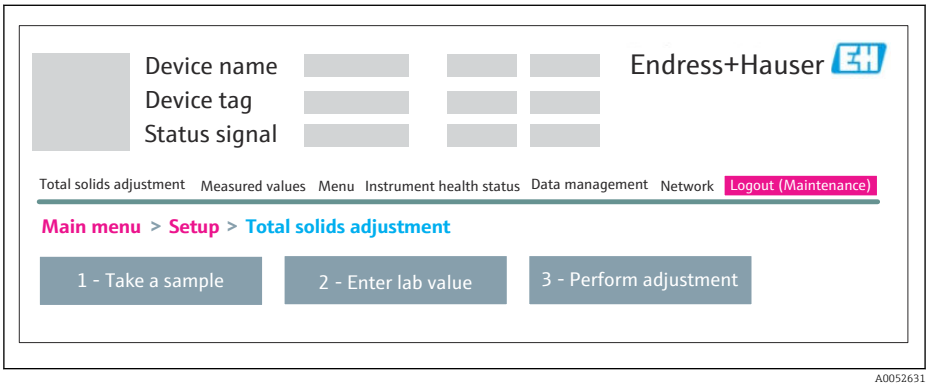
Access the operating menu via web browser - web server → 61.

1. After starting the web server, select **Main menu > Setup** .
   ↳



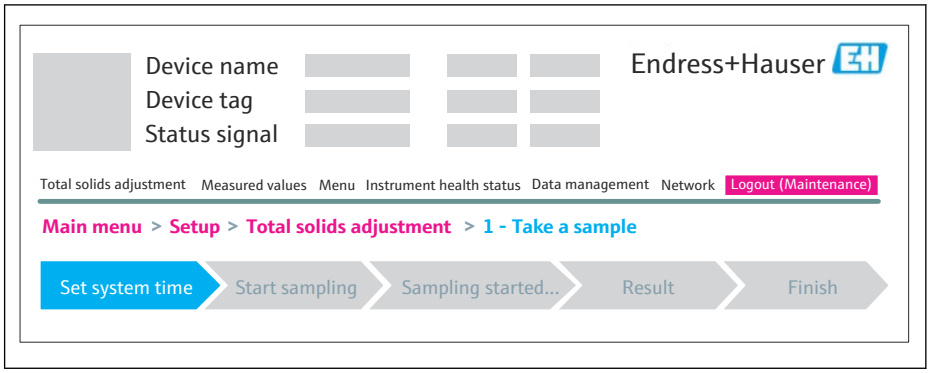
A0052630

2. Select **Total solids adjustment**.
   ↳ The available wizards are displayed.



A0052631

3. Select the desired wizard.
   ↳ The individual steps of the wizard are displayed.



A0053912

4. Follow the instructions provided by the wizard.
   ↳ The wizard guides you through the individual steps.

12 Diagnosis and troubleshooting

12.1 General troubleshooting

For local display

Fault	Possible causes	Remedial action
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display dark and no output signals	Supply voltage does not match the voltage specified on the nameplate.	Apply the correct supply voltage .
	Supply voltage has incorrect polarity.	Reverse polarity of supply voltage
	No contact between connection cables and terminals	Ensure electrical contact between the cable and the terminal.
	▪ Terminals are not plugged into the I/O electronics module correctly. ▪ Terminals are not plugged into the main electronics module correctly.	Check terminals.
	▪ I/O electronics module is defective. ▪ Main electronics module is defective.	Order spare part → 🖹 158.
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 → 🖹 158.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures → 🖹 145
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 (→ 🖹 105).
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	▪ Check the cable and the connector between the main electronics module and display module. ▪ Order spare part → 🖹 158.

For output signals

Fault	Possible causes	Remedial action
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 🖹 158.
Signal output outside the valid current range (< 3.6 mA or > 22 mA)	Main electronics module is defective. I/O electronics module is defective.	Order spare part → 🖹 158.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Parameter configuration error	Check and adjust parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".
Unexpected and significant difference with regard to the laboratory value	Formation of buildup on the antennas ℹ Buildup usually produces a positive difference with regard to the laboratory value.	1. Remove buildup. 2. Perform a new adjustment → 🖹 130. ℹ When removing the buildup, make sure that the measuring tube, the antennas and the temperature sensor are neither mechanically damaged nor chemically corroded.

For access

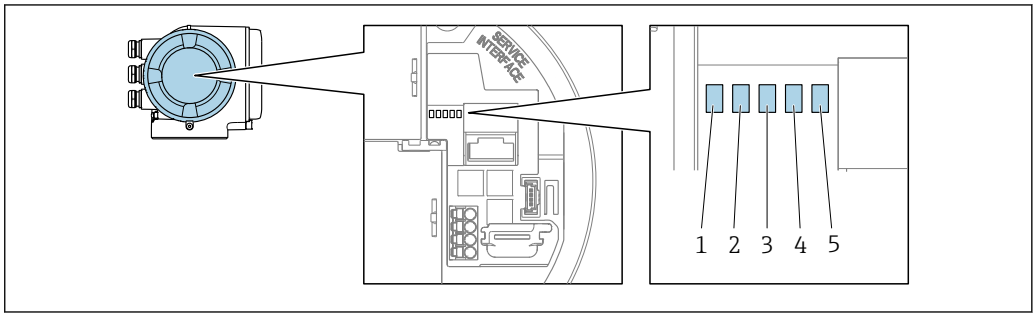
Fault	Possible causes	Remedial action
Write access to parameters is not possible.	Hardware write protection is enabled.	Set the write protection switch on the main electronics module to the **OFF** position → 🖹 117.
	Current user role has limited access authorization.	1. Check user role → 🖹 59. 2. Enter correct customer-specific access code → 🖹 60.
Connection via Modbus RS485 is not possible.	Modbus RS485 bus cable is connected incorrectly.	Check the terminal assignment .
	Modbus RS485 cable is incorrectly terminated.	Check terminating resistor → 🖹 43.
	Settings for the communication interface are incorrect.	Check the Modbus RS485 configuration → 🖹 83.
	Web server is disabled.	Using the "FieldCare" or "DeviceCare" operating tool, check whether the web server of the measuring device is enabled, and enable it if necessary → 🖹 66.
	The Ethernet interface on the PC is incorrectly configured.	▶ Check the properties of the Internet protocol (TCP/IP)→ 🖹 62. ▶ Check the network settings with the IT manager.
	The IP address on the PC is incorrectly configured.	Check the IP address: 192.168.1.212 → 🖹 62
	WLAN access data are incorrect.	▪ Check WLAN network status. ▪ Log on to the device again using WLAN access data. ▪ Check that WLAN is enabled on the measuring device and operating unit → 🖹 62.
	WLAN communication is disabled.	–
Unable to connect to web server, FieldCare or DeviceCare.	WLAN network is not available.	▪ Check if WLAN reception is present: LED on display module is lit blue. ▪ Check if WLAN connection is enabled: LED on display module flashes blue. ▪ Switch on instrument function.
Network connection not present or unstable	WLAN network is weak.	▪ Operating unit outside reception range: Check network status on operating unit. ▪ To improve network performance, use an external WLAN antenna.
	Parallel WLAN and Ethernet communication	▪ Check network settings. ▪ Temporarily enable only the WLAN as an interface.
Web browser frozen and operation no longer possible	Data transfer is active.	Wait until data transfer or current action is finished.
	Connection lost	▶ Check cable connection and power supply. ▶ Refresh the web browser and restart if necessary.
Display of web browser content is difficult to read or incomplete.	Web browser version used is not optimal.	▶ Use correct web browser version → 🖹 61. ▶ Empty the web browser cache. ▶ Restart the web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
Incomplete or no display of content in the web browser	▪ JavaScript is not enabled. ▪ JavaScript cannot be enabled.	▶ Enable JavaScript. ▶ Enter http://XXX.XXX.X.X.XX/servlet/basic.html as the IP address.

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

12.2 Diagnostic information via LEDs

12.2.1 Transmitter

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



A0029629

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

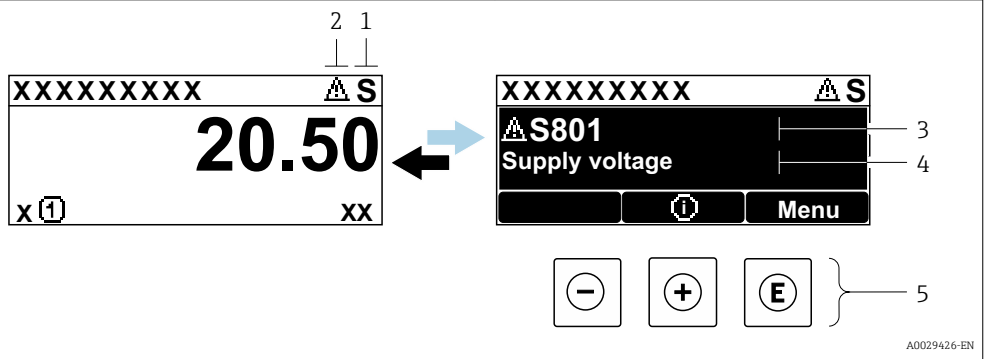
LED		Color/behavior	Meaning
1	Supply voltage	LED off	Supply voltage is off or too low.
		Green	Supply voltage is OK.
2	Device status (normal operation)	Off	Firmware error
		Green	Device status is OK.
		Flashing green	Device is not configured.
		Red	A diagnostic event with "Alarm" diagnostic behavior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

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

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

Operational display in alarm condition	Diagnostic message



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

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

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter → 149
- Via submenus → 149

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

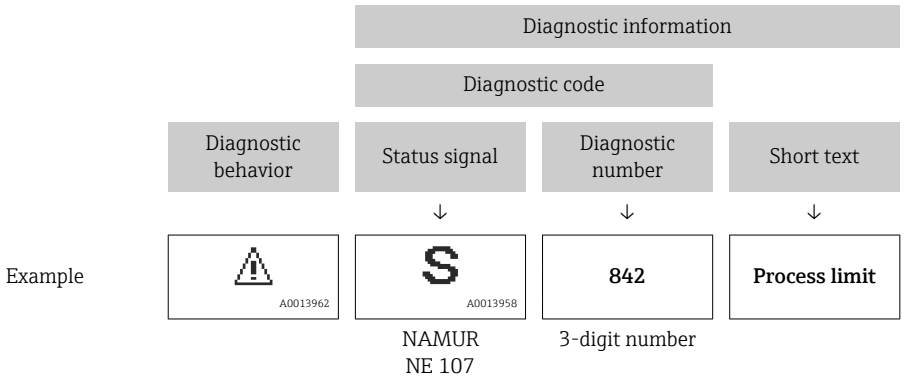
Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device is being operated: Outside its technical specification limits (e.g. outside the process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

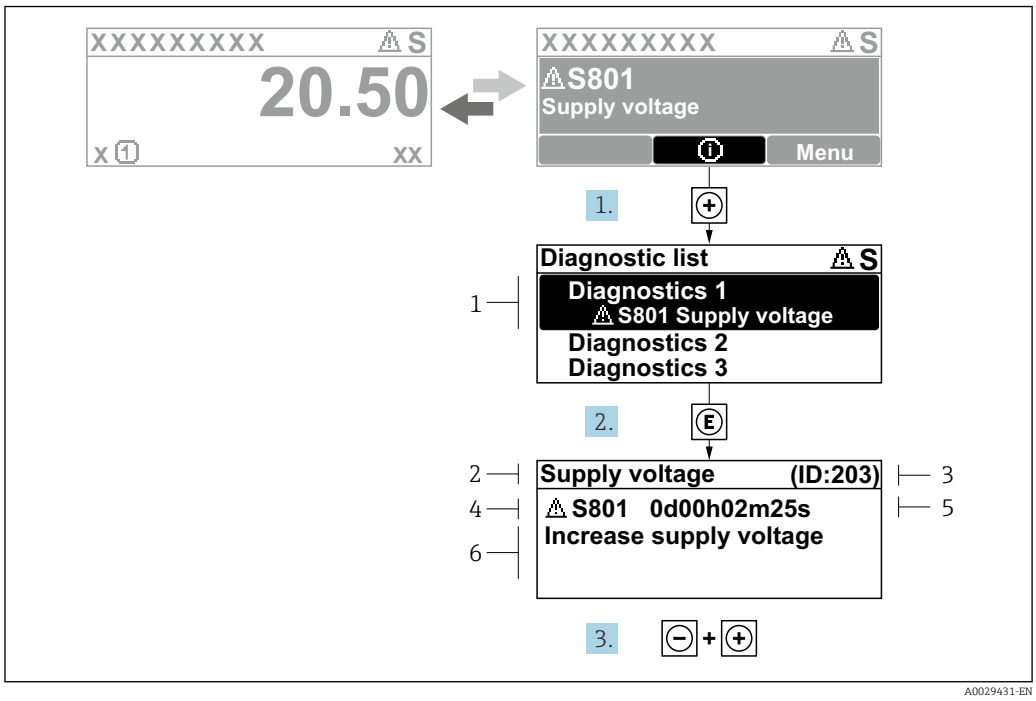
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



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. *If pressed > 3 seconds* Displays the available wizards.

12.3.2 Calling up remedial measures



27 *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.

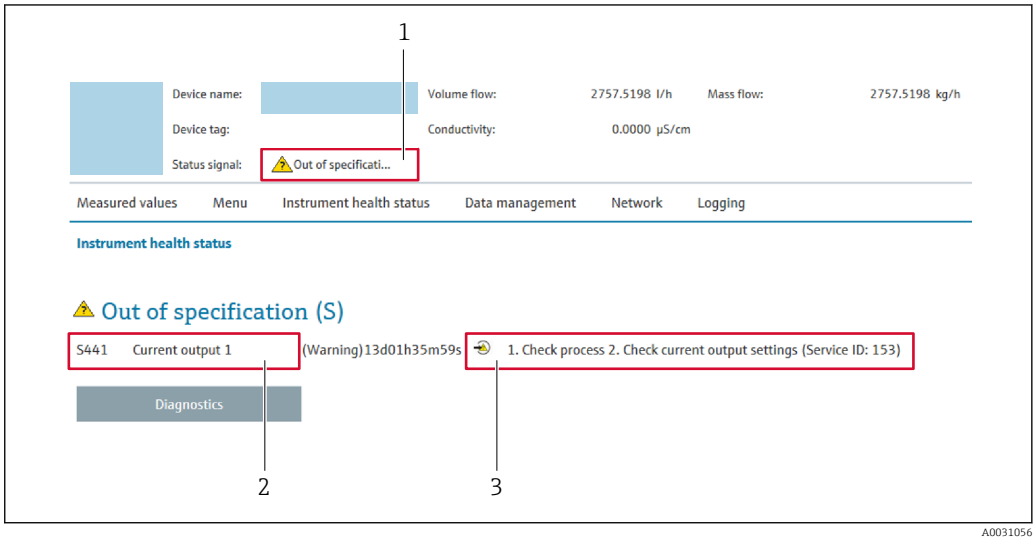
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

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 → 149
- Via submenu → 149

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.

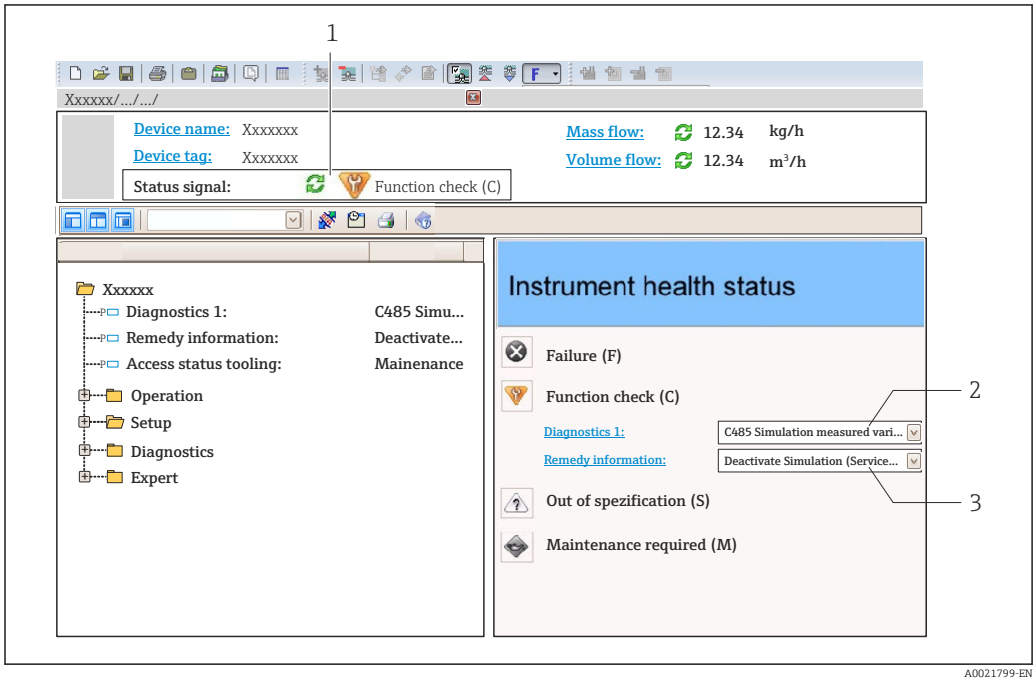
12.4.2 Calling up remedy information

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.

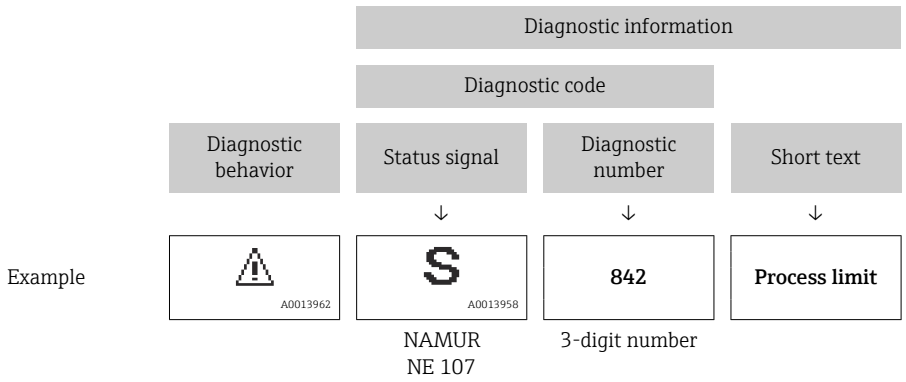


1 *Status area with status signal* → 🖹 *138*
2 *Diagnostic information* → 🖹 *139*
3 *Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 🖹 149
- Via submenu → 🖹 149

Diagnostic information

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



12.5.2 Calling up remedy information

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

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

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

12.6 Diagnostic information via communication interface

12.6.1 Reading out diagnostic information

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

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

For an overview of diagnostic events with diagnosis number and diagnosis code
→ 145

12.6.2 Configuring error response mode

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

Navigation path
Setup → Communication

Parameter overview with brief description

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

12.7 Adapting the diagnostic information

12.7.1 Adapting the diagnostic behavior

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

Expert → System → Diagnostic handling → Diagnostic behavior

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

Options	Description
Alarm	The device stops measurement. The measured value output via Modbus RS485 and the totalizers assume the defined alarm condition. A diagnostic message is generated. The background lighting changes to red.
Warning	The device continues to measure. The measured value output via Modbus RS485 and the totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is only displayed in the **Event logbook** submenu (**Event list** submenu) and is not displayed in alternating sequence with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.8 Overview of diagnostic information

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

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
022	Temperature sensor defective	1. Change main electronic module 2. Change sensor	F	Alarm
082	Data storage inconsistent	Check module connections	F	Alarm
083	Memory content inconsistent	1. Restart device 2. Restore S-DAT data 3. Replace S-DAT	F	Alarm
181	Antenna connection faulty	1. Check sensor cable and sensor 2. Perform Heartbeat Verification	F	Alarm
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
242	Firmware incompatible	1. Check firmware version 2. Flash or replace electronic module	F	Alarm
252	Module incompatible	1. Check electronic modules 2. Check if correct modules are available (e.g. NEx, Ex) 3. Replace electronic modules	F	Alarm
262	Module connection interrupted	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics 2. Check or replace ISEM or main electronics	F	Alarm
270	Main electronics defective	1. Restart device 2. Replace main electronic module	F	Alarm
271	Main electronics faulty	1. Restart device 2. Replace main electronic module	F	Alarm
272	Main electronics faulty	Restart device	F	Alarm
273	Main electronics defective	1. Pay attention to display emergency operation 2. Replace main electronics	F	Alarm
275	I/O module defective	Change I/O module	F	Alarm
276	I/O module faulty	1. Restart device 2. Change I/O module	F	Alarm
283	Memory content inconsistent	Restart device	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning [1)]
303	I/O 1 to n configuration changed	1. Apply I/O module configuration (parameter "Apply I/O configuration") 2. Afterwards reload device description and check wiring	M	Warning
311	Sensor electronics (ISEM) faulty	Maintenance required! Do not reset device	M	Warning
330	Flash file invalid	1. Update firmware of device 2. Restart device	M	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
331	Firmware update failed	1. Update firmware of device 2. Restart device	F	Warning
332	Writing in HistoROM backup failed	1. Replace user interface board 2. Ex d/XP: replace transmitter	F	Alarm
361	I/O module 1 to n faulty	1. Restart device 2. Check electronic modules 3. Change I/O module or main electronics	F	Alarm
372	Sensor electronics (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
373	Sensor electronics (ISEM) faulty	Transfer data or reset device	F	Alarm
375	I/O- 1 to n communication failed	1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules	F	Alarm
376	Sensor electronics (ISEM) faulty	1. Replace sensor electronic module (ISEM) 2. Turn off diagnostic message	F	Alarm
378	Supply voltage ISEM faulty	1. If available: Check connection cable between sensor and transmitter 2. Replace main electronic module 3. Replace sensor electronic module (ISEM)	F	Alarm
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	Reset device	F	Alarm
387	HistoROM data faulty	Contact service organization	F	Alarm
Diagnostic of configuration				
410	Data transfer failed	1. Retry data transfer 2. Check connection	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 to n required	Carry out trim	M	Warning
437	Configuration incompatible	1. Update firmware 2. Execute factory reset	F	Alarm
438	Dataset different	1. Check dataset file 2. Check device parameterization 3. Download new device parameterization	M	Warning
441	Current output 1 to n saturated	1. Check current output settings 2. Check process	S	Warning [1)]
442	Frequency output 1 to n saturated	1. Check frequency output settings 2. Check process	S	Warning [1)]
443	Pulse output 1 to n saturated	1. Check pulse output settings 2. Check process	S	Warning [1)]
444	Current input 1 to n saturated	1. Check current input settings 2. Check connected device 3. Check process	S	Warning [1)]
453	Flow override active	Deactivate flow override	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
484	Failure mode simulation active	Deactivate simulation	C	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
486	Current input 1 to n simulation active	Deactivate simulation	C	Warning
491	Current output 1 to n simulation active	Deactivate simulation	C	Warning
492	Frequency output 1 to n simulation active	Deactivate simulation frequency output	C	Warning
493	Pulse output simulation active	Deactivate simulation pulse output	C	Warning
494	Switch output 1 to n simulation active	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	C	Warning
496	Status input 1 to n simulation active	Deactivate status input simulation	C	Warning
520	I/O 1 to n hardware configuration invalid	1. Check I/O hardware configuration 2. Replace wrong I/O module	F	Alarm
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
594	Relay output 1 to n simulation active	Deactivate simulation switch output	C	Warning
Diagnostic of process				
803	Loop current 1 faulty	1. Check wiring 2. Change I/O module	F	Alarm
832	Electronics temperature too high	Reduce ambient temperature	S	Warning [1)]
833	Electronics temperature too low	Increase ambient temperature	S	Warning [1)]
834	Process temperature too high	Reduce process temperature	S	Warning [1)]
835	Process temperature too low	Increase process temperature	S	Warning [1)]
844	Total solids range exceeded	Check range limits	S	Warning [1)]
862	Partly filled pipe	1. Verify that the measuring tube is filled with the medium. 2. Verify that build-up does not interfere with antennas.	S	Warning [1)]
881	Signal to noise ratio too low	1. Check process conditions 2. Clean measuring tube 3. Replace sensor electronic module (ISEM)	S	Warning [1)]
882	Input signal faulty	1. Check input signal parameterization 2. Check external device 3. Check process conditions	F	Alarm
907	Permittivity out of specification	Check composition of the medium	S	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
908	Volume fraction out of specification	1. Perform adjustment 2. Remove build-up on antennas / temperature sensors 3. Check for gas in medium	S	Warning [1]
909	Conductivity out of specification	1. Check process conditions 2. Clean measuring tube 3. Replace sensor electronic module (ISEM)	S	Warning [1]
944	Monitoring failed	Check process conditions for Heartbeat Monitoring	S	Warning

1) Diagnostic behavior can be changed.

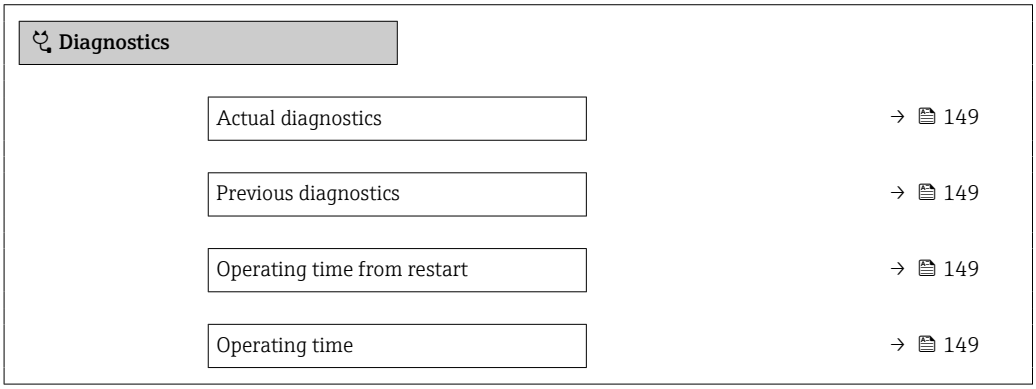
12.9 Pending diagnostic events

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

To call up the measures to rectify a diagnostic event:
- Via local display → 140
- Via web browser → 141
- Via "FieldCare" operating tool → 143
- Via "DeviceCare" operating tool → 143

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 149.

Navigation
"Diagnostics" menu



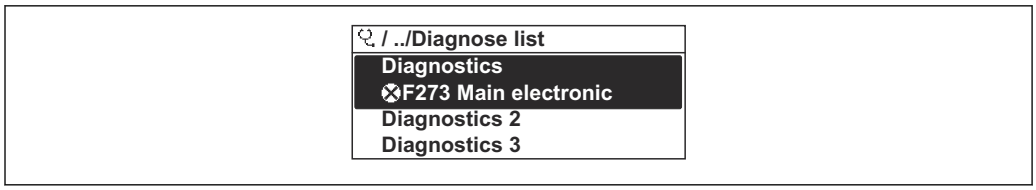
Parameter overview with brief description

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

12.10 Diagnostics list

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

Navigation path
Diagnostics → Diagnostic list



28 Using the example of the local display

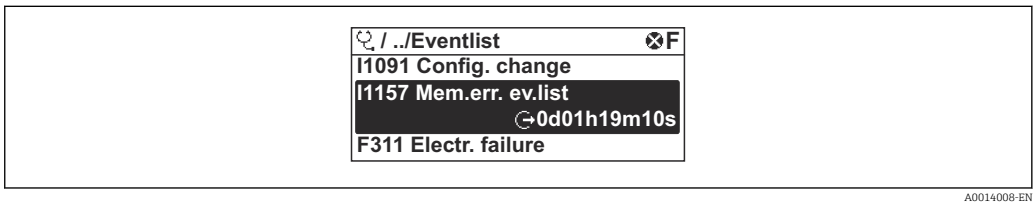
To call up the measures to rectify a diagnostic event:
- Via local display → 140
- Via web browser → 141
- Via "FieldCare" operating tool → 143
- Via "DeviceCare" operating tool → 143

12.11 Event logbook

12.11.1 Reading out the event logbook

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

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



29 *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 → 145
- Information events → 152

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 → 140
- Via web browser → 141
- Via "FieldCare" operating tool → 143
- Via "DeviceCare" operating tool → 143

For filtering the displayed event messages → 151

12.11.2 Filtering the event logbook

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

Navigation path
Diagnostics → Event logbook → Filter options

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

12.11.3 Overview of information events

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

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	HistoROM backup deleted
I11359	Temperature sensor defective
I11360	Temperature sensor defective
I11362	Total solids measurement adjusted
I1137	Electronics changed
I1151	History reset
I1155	Reset electronics temperature
I1156	Memory error trend
I1157	Memory error event list
I1256	Display: access status changed
I1264	Safety sequence aborted
I1278	I/O module restarted
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
I1450	Monitoring off
I1451	Monitoring on
I1457	Measurement error verification failed
I1459	I/O module verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off
I1618	I/O module 2 replaced
I1619	I/O module 3 replaced
I1621	I/O module 4 replaced

Info number	Info name
I1622	Calibration changed
I1624	All totalizers reset
I1625	Write protection activated
I1626	Write protection deactivated
I1627	Web server: login successful
I1628	Display: login successful
I1629	CDI: login successful
I1631	Web server access changed
I1632	Display: login failed
I1633	CDI: login failed
I1634	Reset to factory settings
I1635	Reset to delivery settings
I1639	Max. switch cycles number reached
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

12.12 Resetting the measuring device

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

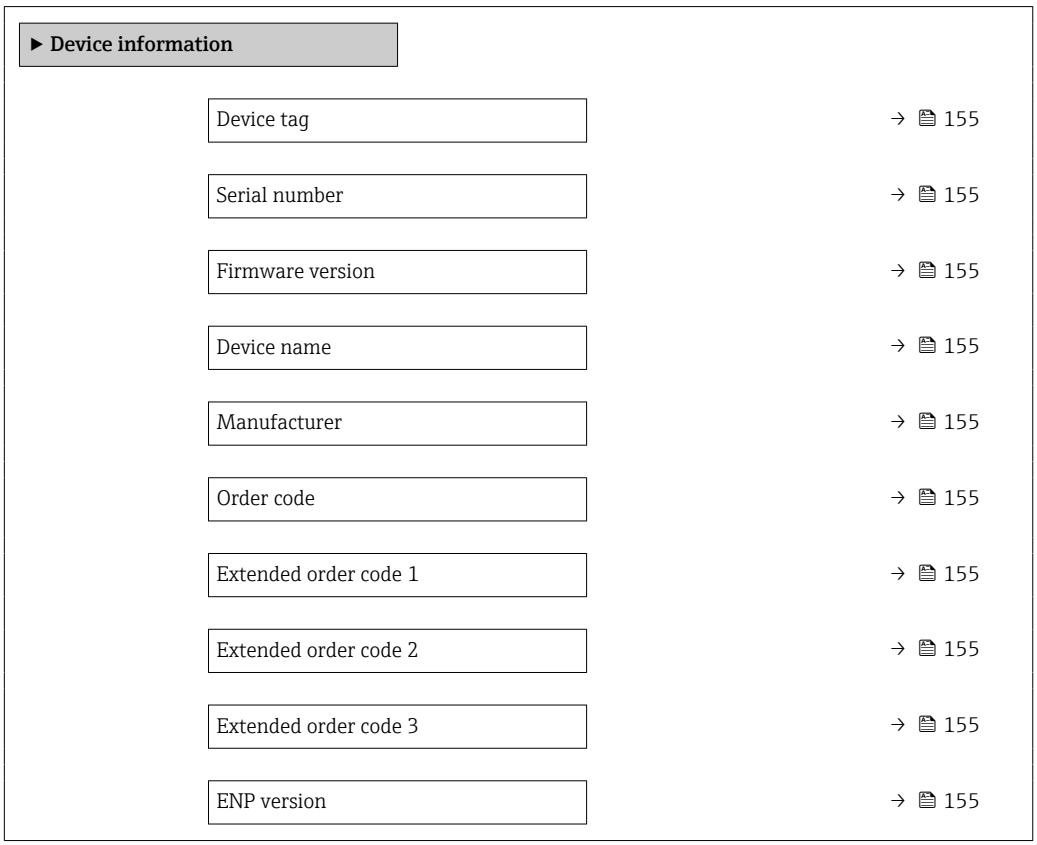
12.12.1 Function range of "Device reset" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to the customer-specific value. All other parameters are reset to the factory setting.
Restart device	The restart resets every parameter with data stored in volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restores the data that is saved on the S-DAT. Additional information: This function can be used to resolve the memory issue "083 Memory content inconsistent" or to restore the S-DAT data when a new S-DAT has been installed. This option is displayed only in an alarm condition.

12.13 Device information

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

Navigation
"Diagnostics" menu → Device information



Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Teqwave M
Serial number	Shows the serial number of the measuring device.	Max. 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	–
Device name	Shows the name of the transmitter. The name can be found on the nameplate of the transmitter.	Character string comprising numbers, letters and special characters	–
Manufacturer	Displays the manufacturer.	Character string comprising numbers, letters and special characters	Endress+Hauser
Order code	Shows the device order code.	Character string composed of letters, numbers and certain punctuation marks (e.g. /).	–
Extended order code 1	Shows the 1st part of the extended order code.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00

12.14 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware Changes	Documentation type	Documentation
03.2024	01.00.zz	Option **75**	Original firmware	Operating instructions	BA02321D/06/EN/03.24

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

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

The manufacturer's information is available:
- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 4W3B
    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 gaskets.

13.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as function checks at the place of manufacture, 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 (→ 155) 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.

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
Proline 300 transmitter	Transmitter for replacement Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software Order code: 4X3BXX Installation instructions EA01xxxD

Remote display and operating module DKX001	**Remote display and operating module DKX001**
	If ordered directly with the device:
	Order code for "Display; operation", option O "Remote display 4-line, illuminated; 10 m (30 ft) cable; touch control"
	If the device is ordered separately:
	Order code for "Display; operation", option M "None, prepared for remote display"
	If the remote display and operating module is ordered separately:
	Via the separate product structure DKX001
	Mounting bracket for DKX001
	▪ If ordered directly: order code for "Accessory enclosed", option RA "Mounting bracket, pipe 1/2"'
	▪ If ordered subsequently: order number: 71340960
	Optional connecting cable available
	Cable lengths available for order:
	▪ If the remote display and operating module DKX001 is ordered together with the device: 10 m (35 ft)
	▪ If the remote display and operating module is ordered separately: order code DKX001, option:
	  ▪ A: 5 m (15 ft)
	  ▪ B: 10 m (35 ft)
	  ▪ D: 20 m (30 ft)
	  ▪ E: 30 m (100 ft)
	For futher information on display and operating module DKX001, see Special Documentation SD01763D. → 188

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". Further information on the WLAN interface → 🖹 68 Order number: 71351317 Installation Instructions EA01238D
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Order number: 71343505 Installation Instructions EA01160D

15.1.2 For the sensor

Accessories	Description
Mounting kit	Consists of: ▪ Screws/mounting bolts ▪ Gaskets ▪ Washers ▪ Nuts Order number: DK4M

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 SMT70 tablet PC for device configuration enables mobile plant asset management in non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. ▪ Technical Information TI01342S ▪ Operating Instructions BA01709S ▪ 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 ▪ Graphic display of the calculation results ▪ Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator
Netilion	IIoT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem, Endress+Hauser enables you to optimize your plant's performance, digitize workflows, share knowledge and improve collaboration. Drawing on decades of experience in process automation, Endress+Hauser offers process industries an IIoT ecosystem that provides customers with data-driven insights. These insights can be used to optimize processes, thus leading to higher plant availability, efficiency and reliability - and ultimately to greater profitability. www.netilion.endress.com
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S
Retrofit kit for display/WLAN	Retrofitting the device with a display with WLAN The retrofit kit contains all the necessary parts. ▪ Order number: DKZ001 ▪ You must state the serial number of the device to be converted when placing the order.
Retrofit kit for inputs/outputs	▪ For subsequent switching of the functionality of inputs/outputs 2 and 3 using a serial number-based license code ▪ For subsequent hardware expansion of empty slots for inputs/outputs 2 and 3 using a serial number-based license code and hardware Order number: DKZ004

15.4 System components

Accessories	Description
Proline flowmeter Promag 400	To calculate the load rate, you need to know the volume flow of the medium. You can measure this value using a flowmeter, e.g. the Proline Promag W 400. The measured value can be read in as an input signal via the 4 to 20 mA current input from the Teqwave MW and used to calculate the load rate. The calculated load rate can be shown on the local display and output as an output signal. Technical Information Proline Promag W 400: TI01046D Order number Proline Promag W 400: 5W4C**-

16 Technical data

16.1 Application

The measuring device is suitable only for the measurement of solids in water-based liquids.

Depending on the version ordered, the measuring device can also measure potentially explosive media.

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

Microwave transmission

Total solids measurement via microwave transmission: The device measures the time of flight and absorption of microwave transmission between two antennas facing each other in the measuring tube. Based on these variables, the permittivity of the medium can be calculated, for example.

The temperature of the medium is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output signal.

The conductivity of the medium is derived from the change in amplitude and phase of the microwave signal.

Measuring system

The device consists of a transmitter and a sensor.

The device is available as a compact 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

- Total solids
- Electrical conductivity
- Medium temperature

Calculated measured variables

Load rate

The load rate can only be calculated with the volume flow of the medium. This measured value must be read in via a flowmeter→ 164.

Example of calculation:
- Volume flow read in by flowmeter: 100 l/min
- Total solids measured by Teqwave MW 300 : 10 g/l

Calculated load rate: 1 kg/min

Measuring range

Total solids

0 to 500 g/l (0 to 31 lb/ft^3), 0 to 50 %TS

Medium temperature

0 to 80 °C (32 to 176 °F)

Electrical conductivity

To ensure correct measurement, the electrical conductivity of the medium must not exceed the measuring range of the temperature-compensated electrical conductivity.

Measuring range for temperature-compensated electrical conductivity at 25 °C (77 °F)

Nominal diameter		Electrical conductivity
[mm]	[in]	[mS/cm]
50	2	0 to 100
80	3	0 to 85
100	4	0 to 50
150	6	0 to 20
200	8	0 to 14.5
250	10	0 to 14.5
300	12	0 to 14.5

Input signal

External measured values

To calculate the load rate, you need to know the volume flow of the medium. You can measure this value using a flowmeter, e.g. the Proline Promag W 400.

The volume flow can be read in as an input signal via the 4 to 20 mA current input from the Teqwave MW and used to calculate the load rate.

The Proline W Promag 400 flowmeter can be ordered from Endress+Hauser
→ 162.

Current input

Measured variables can be transferred from the automation system to the device via the current input → 164.

Digital communication

Measured variables can be transferred from the automation system to the device via the Modbus RS485.

Current input 4 to 20 mA

Order code	"Output; input 2" (021) or "Output; input 3" (022): Option I: 4 to 20 mA input
Current input	0/4 to 20 mA (active/passive)
Current range	▪ 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	Volume flow of the medium for calculating the load rate

Status input

Order code	"Output; input 2" (021) or "Output; input 3" (022): Option J: 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 (low): DC −3 to +5 V ▪ High signal (high): DC 12 to 30 V
Assignable functions	▪ Disable ▪ Flow override ▪ Reset totalizer (load rate)

16.4 Output

Output signal

Modbus RS485

Order code	"Output; input 1" (020): Option MA: Modbus RS485
Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Integrated, can be activated via DIP switches

Current output 4 to 20 mA

Order code	"Output; input 2" (021) or "Output; input 3" (022): Option B: 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 process variables	▪ Total solids ▪ Conductivity ▪ Temperature ▪ Electronics temperature ▪ Load rate

Pulse/frequency/switch output

Order code	"Output; input 2" (021) or "Output; input 3" (022): Option E: 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
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 process variables	Totalizer (load rate)
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 process variables	▪ Total solids ▪ Conductivity ▪ Temperature ▪ Electronics temperature ▪ Load rate
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 value:
	  ▪ Total solids
	  ▪ Conductivity
	  ▪ Temperature
	  ▪ Electronics temperature
	  ▪ Partially filled pipe
	  ▪ Totalizer (load rate)
	  ▪ Load rate

Relay output

Order code	"Output; input 2" (021) or "Output; input 3" (022): Option H: relay output
Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)

Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A

Assignable functions	▪ Off
	▪ On
	▪ Diagnostic behavior
	▪ Limit value:
	  ▪ Total solids
	  ▪ Conductivity
	  ▪ Temperature
	  ▪ Partially filled pipe
	  ▪ Totalizer (load rate)
	  ▪ Load rate

User-configurable input/output

Order code	"Output; input 2" (021) or "Output; input 3" (022): Option D: user-configurable input/output
Function	**One** specific input or output can be assigned to the user-configurable input/output (configurable I/O) when commissioning the device.
Possible assignment	▪ Current output 4 to 20 mA ▪ Pulse/frequency/switch output ▪ Current input 0/4 to 20 mA ▪ Status input
Technical values of the inputs and outputs	Correspond to the inputs and outputs described in this section

Signal on alarm

Modbus RS485

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

Current output 0/4 to 20 mA

4 to 20 mA

Failure mode	Choose from: ▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ▪ 4 to 20 mA in accordance with US ▪ Min. value: 3.59 mA ▪ Max. value: 22.5 mA ▪ 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:
  Modbus RS485
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

Plain text display	With information on cause and remedial measures

Web browser

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred Diagnostic information via light emitting diodes → 137

Load Output signal → 166

Ex connection data

Safety-related values

Order code for "Output; input 1"

Option	Output/input type	Safety-related values for output/input 1	
		26 (+)	27 (–)
MA	Modbus RS485	U_N = 30 V_{DC} U_M = 250 V_{AC}	

Order code for "Output; input 2" and "Output; input 3"

Option	Output/input type	Safety-related values for output/input			
		2		3	
		24 (+)	25 (–)	22 (+)	23 (–)
B	Current output 4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}			
D	User-configurable input/output	U_N = 30 V_{DC} U_M = 250 V_{AC}			
E	Pulse/frequency/switch output	U_N = 30 V_{DC} U_M = 250 V_{AC}			
H	Relay output	U_N = 30 V_{DC} I_N =100 mA_{DC}/500 mA_{AC} U_M = 250 V_{AC}			
I	Current input 0/4 to 20 mA	U_N = 30 V_{DC} U_M = 250 V_{AC}			
J	Status input	U_N = 30 V_{DC} U_M = 250 V_{AC}			

Galvanic isolation

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

Protocol-specific data

protocol-specific data

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

Supported baud rates	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transmission mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information, see the description of device parameters → 188.
System integration	Information regarding system integration → 72. ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

16.5 Power supply

Terminal assignment

→ 35

Available device plugs

Device plugs may not be used in hazardous areas!

Device plug for connecting to the service interface:
Order code for "Accessory mounted"
Option **NB**, RJ45 M12 adapter (service interface) → 172

Order code for "Accessory mounted", option NB "Adapter RJ45 M12 (service interface)"

Order code "Accessory mounted"	Cable entry/coupling	
	Cable entry 2	Cable entry 3
NB	Plug M12 × 1	–

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

- Totalizer stops at the last value measured.
- Depending on the device version, the configuration is retained in the device memory or in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Overcurrent protection element

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

Electrical connection

→ 🖹 33

Potential equalization

Requirements

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

Terminals

Spring-loaded terminals: Suitable for strands and strands with ferrules.
Conductor cross-section 0.2 to 2.5 mm^2 (24 to 12 AWG).

Cable entries

- Cable gland: M20 × 1.5 with cable ⌀ 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½"
  - M20

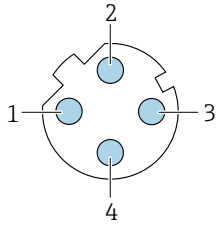
Optional: M12 device plug for connection to the service interface

Order code for "Accessories mounted", option NB: "Adapter RJ45 M12 (service interface)"→ 🖹 172

Pin assignment, device plug

Service interface for pin assignment, device plug

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



Pin	Assignment	
1	+	Tx
2	+	Rx
3	-	Tx
4	-	Rx
Coding		**Plug/socket**
D		Socket

Cable specification

→ 🖹 33

Overvoltage protection

Mains voltage fluctuations	→ 🖹 171
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

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

Accuracy	Max. ±50 ppm of the measured value (over the entire ambient temperature range)

Repeatability

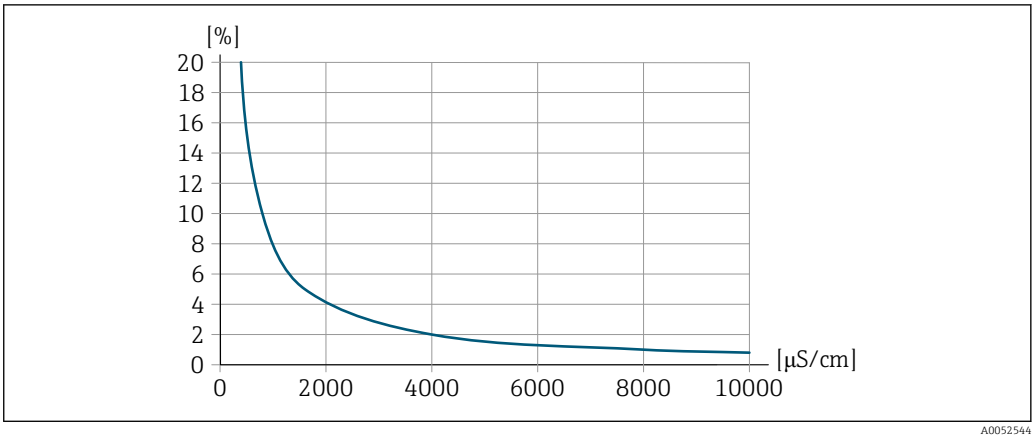
Total solids

Nominal diameter		Standard deviation of total solids
[mm]	**[in]**	**[%TS]**
50 to 80	2 to 3	0.02
100 to 300	4 to 12	0.01

Medium temperature

± 0.5 °C (± 0.9 °F)

Electrical conductivity



30 Repeatability in % of measured value - electrical conductivity [µS/cm]

Influence of ambient temperature

Current output

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect.

16.7 Mounting

Mounting requirements → 21

16.8 Environment

Ambient temperature range

Transmitter and sensor
−20 to +60 °C (−4 to +140 °F)

Readability of the display may be impaired at temperatures outside the temperature range.

If operating the device outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.
- Protect the display against impact.
- Protect the display from abrasion, e.g. caused by sand in desert areas.

A weather protection cover is available as an accessory.→ 160

Storage temperature

−20 to +60 °C (−4 to +140 °F)

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device.

Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 4 to 95%.

Operating height

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

Degree of protection

Measuring device
- 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

External WLAN antenna

IP67

Vibration and shock resistance

- Sinusoidal vibration according to IEC 60068-2-6
  - 2 to 8.4 Hz, 3.5 mm peak
  - 8.4 to 2 000 Hz, 1 g peak
- Broadband random vibration according to IEC 60068-2-64
  - 10 to 200 Hz, 0.003 g^2/Hz
  - 200 to 2 000 Hz, 0.001 g^2/Hz
  - Total: 1.54 g rms
- Half-sine shocks according to IEC 60068-2-27
  6 ms 30 g
- Rough handling shocks according to IEC 60068-2-31

Mechanical load

Transmitter housing:
- Protect against mechanical effects, such as shock or impact.
- Do not use as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

As per IEC/EN 61326

16.9 Process

Medium temperature range

0 to +80 °C (+32 to +176 °F)

Electrical conductivity

To ensure correct measurement, the electrical conductivity of the medium must not exceed the measuring range of the temperature-compensated electrical conductivity.

Measuring range for temperature-compensated electrical conductivity at 25 °C (77 °F)

Nominal diameter		Electrical conductivity
[mm]	[in]	[mS/cm]
50	2	0 to 100
80	3	0 to 85
100	4	0 to 50
150	6	0 to 20
200	8	0 to 14.5
250	10	0 to 14.5
300	12	0 to 14.5

Pressure/temperature ratings

For an overview of the pressure-temperature ratings for the process connections, see the Technical Information.→ 187

Flow velocity

If there is a risk of deposits building up in the measuring tube, as a result of grease for example, a flow velocity of >2 m/s (6.5 ft/s) is recommended.

Thermal insulation

→ 25

Static pressure

≥ 1.5 bar (21.8 psi), to avoid outgassing of the medium

Installation near pumps → 22

Vibrations

Information on the measuring system's resistance to vibration and shock → 175

16.10 Mechanical construction

Design, dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section .→ 187

Weight

All values: weight without packaging material

Device

Nominal diameter		Weight
[mm]	[in]	
50	2	10.6 kg (23.4 lb)
80	3	10.9 kg (24.0 lb)
100	5	12.6 kg (27.7 lb)
150	6	17.1 kg (37.8 lb)
200	8	23.9 kg (52.7 lb)
250	10	32.8 kg (72.3 lb)
300	12	37.8 kg (83.4 lb)

Materials

Transmitter

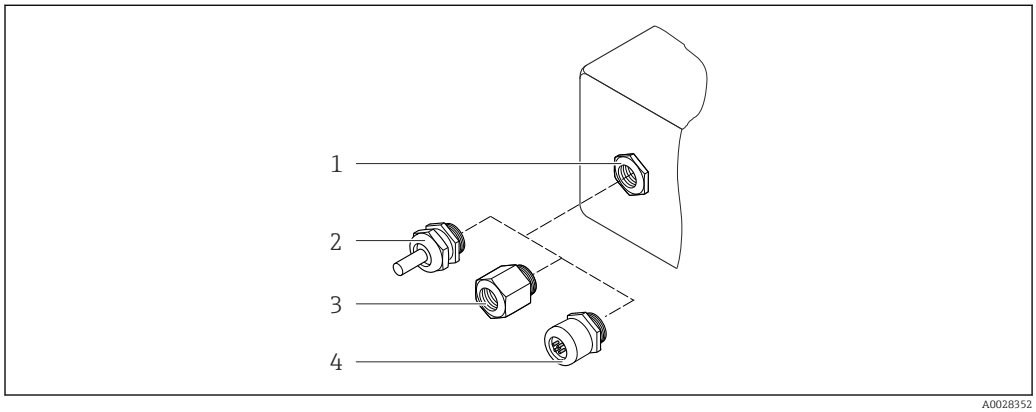
Housing

Order code for "Transmitter housing":
Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated

Window material

Order code for "Transmitter housing":
Option **A** "Aluminum, coated": glass

Cable entries/cable glands



31 Possible cable entries/cable glands

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

Cable entry/cable gland	Material
Compression fitting M20 × 1.5	Order code for "Housing", option A "Aluminum, coated": ▪ Non-Ex: plastic ▪ Z2, D2, Ex d/de: brass with plastic
	Order code for "Housing", option L "Casting, stainless": Stainless steel, 1.4404 (316L)
Adapter for cable entry with female thread G ½"	Nickel-plated brass
Adapter for cable entry with female thread NPT ½"	

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Measuring pipe

Stainless steel: 1.4408 as per DIN EN 10213 (CF3M as per ASME A351)

Antennas

- Parts in contact with medium: ceramic
- Antenna bracket: stainless steel: 1.4435 (316L)

Temperature sensor

Stainless steel: 1.4435 (316L)

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

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

Mounting kit

For installing the sensor
- Screws/mounting bolts, nuts and washers: stainless steel, 1.4301/304, 1.4306/1.4307
- Gaskets: aramid fibers, with NBR binder

Remote display and operating module DKX001

Housing material: AlSi10Mg, coated

16.11 Display and user interface

Operation concept

Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnosis
- Expert level

Quick and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief descriptions of the individual parameter functions
- Access to the device via web server
- WLAN access to the device via mobile handheld terminal, tablet or smart phone

Reliable operation
- Operation in local language
- Uniform operating philosophy applied to device and operating tools
- Guided menus (wizards) for adjusting the device using medium samples
- If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostics increase measurement reliability
- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Languages

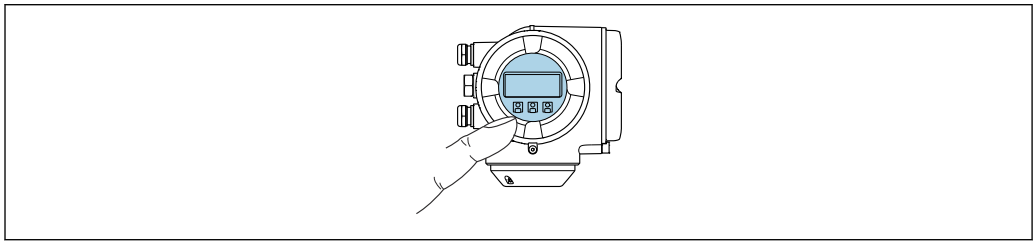
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Czech, Swedish
- Via web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish,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

Local operation

Via display module

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

Information about WLAN interface → 68



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32 *Operation with touch control*

Display elements

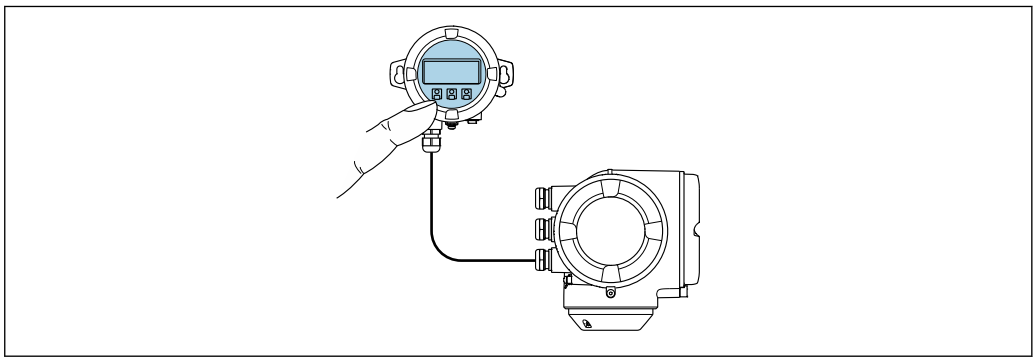
- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

Operating elements

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

Via remote display and operating module DKX001

- The remote display and operating module DKX001 is available as an optional extra .
- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



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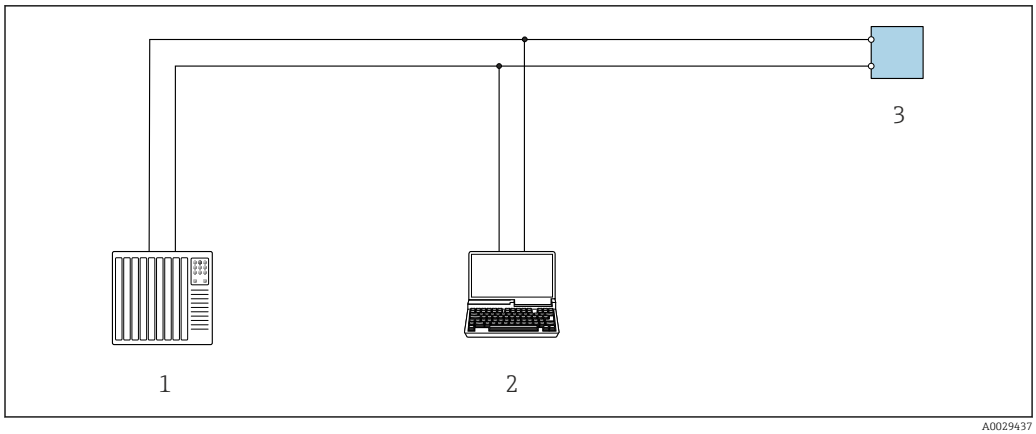
33 *Operation via remote display and operating module DKX001*

Display and operating elements	The display and operating elements correspond to those of the display module .
Housing material	→ 177
Cable entry	Corresponds to the selection of the transmitter housing, order code for "Electrical connection"
Connecting cable	
Dimensions	Information on the dimensions: "Mechanical construction" section of the "Technical Information" document.

Remote operation

Via Modbus RS485 protocol

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



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

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

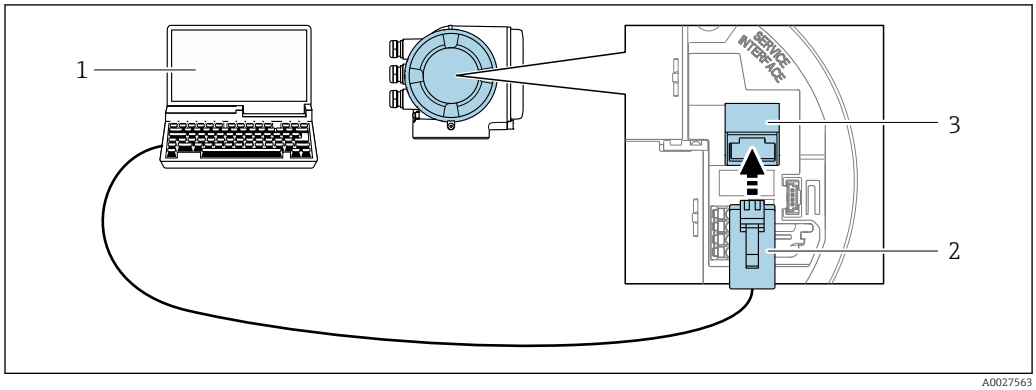
Service interface

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.

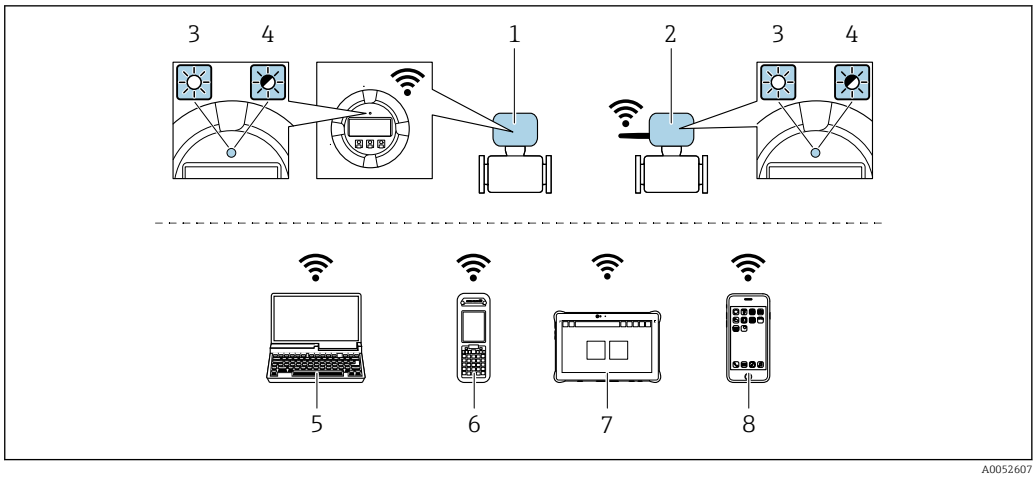


35 *Connection via service interface (CDI-RJ45)*

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

Via WLAN interface

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



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1 *Transmitter with integrated WLAN antenna*
2 *Transmitter with external WLAN antenna*
3 *LED lit constantly: WLAN reception is enabled on measuring device*
4 *LED flashing: WLAN connection established between operating unit and measuring device*
5 *Computer with WLAN interface and web browser (e.g. Microsoft Edge) for accessing the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare)*
6 *Field Xpert SFX350 or SFX370*
7 *Field Xpert SMT70*
8 *Smartphone or tablet with WLAN interface and web browser (e.g. Microsoft Edge) for accessing the integrated device web server or with operating tool (e.g. FieldCare, DeviceCare)*

Function	WLAN: IEEE 802.11 b/g (2.4 GHz) ▪ Access point with DHCP server (factory setting) ▪ Network
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. Available as an accessory . Only one antenna active in each case!
Range	▪ Internal antenna: typically 10 m (32 ft) ▪ External antenna: typically 50 m (164 ft)
Materials (external antenna)	▪ Antenna: ASA plastic (acrylonitrile-styrene-acrylic ester) 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__300_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.

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 the device → 188
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	Service-specific accessories → 162 Sources for obtaining device descriptions www.endress.com → Download-Area
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	Service-specific accessories → 162 Sources for obtaining device descriptions www.endress.com → Download-Area

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

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

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

Web server

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

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	▪ 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 ▪ 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 exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

Manual

Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:

- Data backup function
  Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
- Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

Data transmission

Manual

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

Event list

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

Data logging

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

16.12 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

CE mark	The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
UKCA marking	The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark. Contact address Endress+Hauser UK: Endress+Hauser Ltd. Floats Road Manchester M23 9NF United Kingdom www.uk.endress.com
RCM marking	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex-approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
Modbus RS485 certification	The measuring device meets all the requirements of the MODBUS RS485 conformity test and has the "MODBUS RS485 Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.

Radio approval	The measuring device has radio approval. For detailed information on the radio approval, see the Special Documentation → 188
Pressure Equipment Directive	Devices with pressure measuring device approval (Pressure Equipment Directive, PED Cat. I/II/III) are optionally available: order code for "Additional approval", option LK
Additional certification	**Canadian Registration Number (CRN) approval** Devices with Canadian Registration Number (CRN) approval are optionally available: order code for "Additional approval", option LD. **Tests and certificates** ▪ EN10204-3.1 Material certificate, wetted parts and sensor housing ▪ Pressure test, internal procedure, inspection certificate ▪ EN10204-2.1 Confirmation of compliance with the order and EN10204-2.2 test report
Other standards and guidelines	▪ EN 60529 Degrees of protection provided by enclosures (IP code) ▪ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements ▪ EN 61326-1/-2-3 EMC requirements for electrical equipment for measurement, control and laboratory use ▪ ETSI EN 301 489-1/-17 Guidelines for 2.4 GHz radio components ▪ IEC/EN 60068-2-6 Environmental influences: Test procedure - Test Fc: vibration (sinusoidal) ▪ IEC/EN 60068-2-27 Environmental influences: Test procedure - Test Ea: shocks ▪ IEC/EN 60068-2-64 Environmental influences: Test Fh: vibration, broadband random (digital control) ▪ IEC/EN 60068-2-31 Environmental influences: Test procedure - Test Ec: rough handling shocks, primarily for devices ▪ NAMUR NE 32 Data retention in the event of a power failure in field and control instruments with microprocessors ▪ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal ▪ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics ▪ NAMUR NE 105 Specifications for integrating fieldbus devices in engineering tools for field devices ▪ NAMUR NE 107 Self-monitoring and diagnosis of field devices ▪ NAMUR NE 131 Requirements for field devices for standard applications

16.13 Application packages

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

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

Diagnostic functionality

Order code for "Application package", option EA "Extended HistoROM"

Comprises extended functions concerning the event log and the activation of the measured value memory.

Event log:
Memory volume is extended from 20 message entries (standard version) to up to 100 entries.

Data logging (line recorder):
- Memory capacity for up to 1000 measured values is activated.
- 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user.
- Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

The application package can also be ordered subsequently: order number DK4009.

Heartbeat Technology

Order code for "Application package", option EB "Heartbeat Verification"

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

For detailed information, see the Special Documentation for the device → 188

The application package can also be ordered subsequently: order number DK4009.

16.14 Supplemental documentation

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

Standard documentation

Technical information

Device	Documentation code
Proline Teqwave MW 300	TI01763D

Brief Operating Instructions

Brief Operating Instructions for the sensor

Sensor	Documentation code
Proline Teqwave MW	KA01671D

Brief Operating Instructions for the transmitter

Transmitter	Documentation code
Proline 300 Modbus RS485	KA01311D

Description of device parameters

Device	Documentation code
Proline Teqwave M 300 Modbus RS485	GP01212D

Supplementary device-dependent documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX: II3G, IECEx: Zone 2	XA03186D
cCSAus: Class I Zone 2, Class I Division 2	XA03188D

Special documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
Heartbeat Verification application package	SD03169D
Remote display and operating module DKX001	SD01763D

Installation instructions

Contents	Note
Installation instructions for spare part sets and accessories	▪ Call up an overview of all available spare part sets available using *Device Viewer*: www.endress.com/deviceviewer ▪ Accessories available for order with Installation Instructions → 160

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