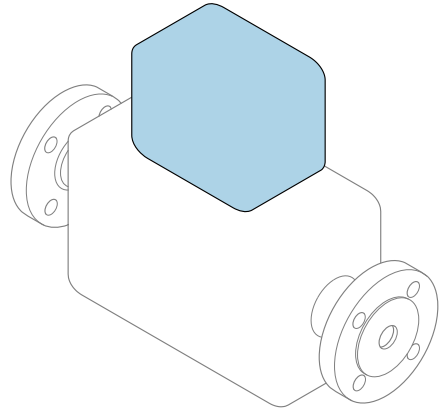
KA01738D/06/EN/01.25-00
71714730
2025-11-11

Brief Operating Instructions **Flowmeter Proline 200**

Transmitter with vortex flow sensor
Modbus TCP

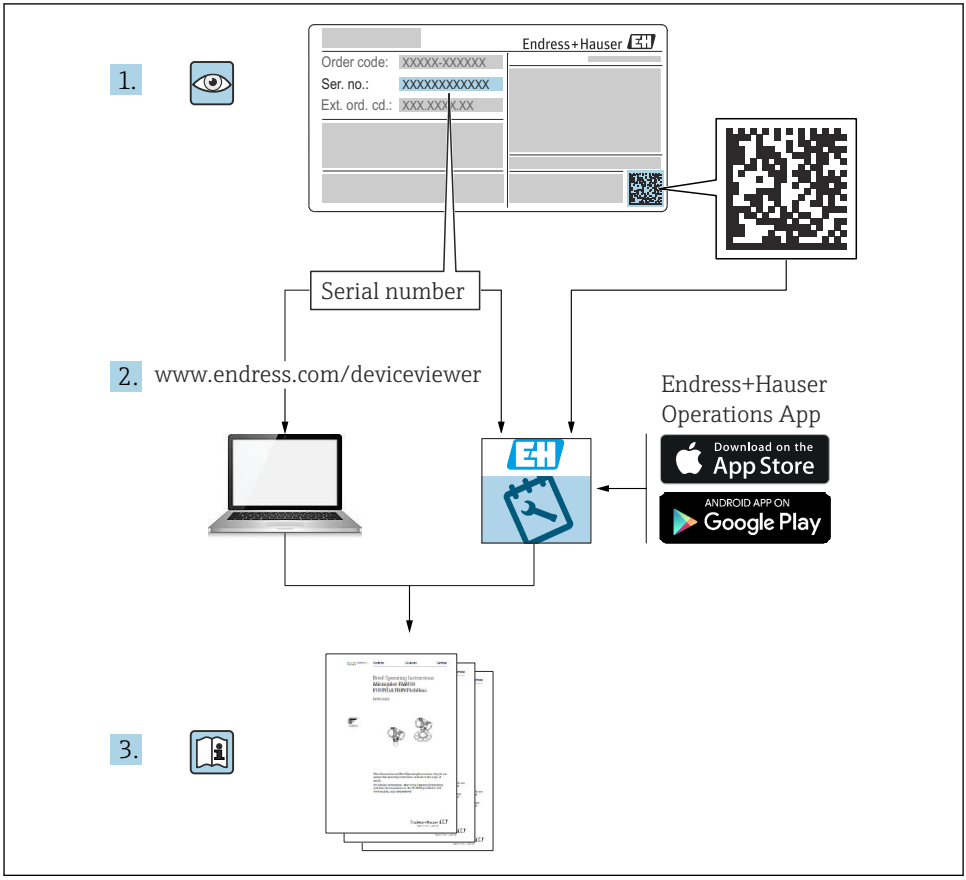


These instructions are Brief Operating Instructions; they are **not** a substitute for the Operating Instructions pertaining to the device.

Brief Operating Instructions part 2 of 2: Transmitter
Contain information about the transmitter.

Brief Operating Instructions part 1 of 2: Sensor → 3

Endress+Hauser
People for Process Automation


1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXX-XXX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the
App Store
ANDROID APP ON
Google Play
3.

A0023555

Brief operating instructions Flowmeter

The device consists of a transmitter and a sensor.

The process of commissioning these two components is described in two separate manuals which together form the Brief Operating Instructions for the flowmeter:
- Brief Operating Instructions Part 1: Sensor
- Brief Operating Instructions Part 2: Transmitter

Please refer to both parts of the Brief Operating Instructions when commissioning the device, as the contents of the manuals complement one another:

Brief Operating Instructions Part 1: Sensor
The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device.
- Incoming acceptance and product identification
- Storage and transport
- Mounting procedure

Brief Operating Instructions Part 2: Transmitter
The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value).
- Product description
- Mounting procedure
- Electrical connection
- Operation options
- System integration
- Commissioning
- Diagnostic information

Additional device documentation

These Brief Operating Instructions are **Brief Operating Instructions Part 2: Transmitter**.

The "Brief Operating Instructions Part 1: Sensor" are available via:
- Internet: www.endress.com/deviceviewer
- Smartphone/tablet: *Endress+Hauser Operations app*

Detailed information about the device can be found in the Operating Instructions and the other documentation:
- Internet: www.endress.com/deviceviewer
- Smartphone/tablet: *Endress+Hauser Operations app*

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Protective cover	SD00333F
Modbus TCP system integration	SD03409D

Table of contents

1 About this document

1.1 Symbols

1.1.1 Safety symbols

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

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

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

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

1.1.2 Symbols for certain types of information

Symbol	Meaning	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	1., 2., 3...	Series of steps
	Result of a step		Visual inspection

1.1.3 Electrical symbols

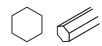
Symbol	Meaning	Symbol	Meaning
	Direct current		Alternating current
	Direct current and alternating current		**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Symbol	Meaning
	**Potential equalization connection (PE: Protective earth)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: potential equalization connection is connected to the supply network. ▪ Exterior ground terminal: device is connected to the plant grounding system.

1.1.4 Communication-specific symbols

Symbol	Meaning	Symbol	Meaning
	**LED** LED is on.		**LED** LED is off.
	**LED** LED flashing.		

1.1.5 Tool symbols

Symbol	Meaning	Symbol	Meaning
	Torx screwdriver		Flat-blade screwdriver
	Phillips screwdriver		Allen key
	Open-end wrench		

1.1.6 Symbols in graphics

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

2 Safety requirements

2.1 Requirements for the personnel

The personnel must fulfill the following requirements for its tasks:
- 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.

2.2 Intended use

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

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

To ensure that the measuring instrument remains in proper condition during the operating time:
- Only use the measuring instrument in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Using the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring instrument 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 instrument permanently against corrosion from environmental influences.

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

⚠ WARNING

Danger of breakage due to corrosive or abrasive fluids and ambient conditions!
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all wetted materials during the process.
- Keep within the specified pressure and temperature range.

NOTICE

Verification for borderline cases:

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

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.

2.3 Workplace safety

For work on and with the device:

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

2.4 Operational safety

Damage to the device!

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

2.5 Product safety

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

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

2.6 IT security

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

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

2.7 Device-specific IT security

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

For detailed information on device-specific IT security, see the Operating Instructions for the device.

2.7.1 Protecting access via a password

A password can be used to protect against write access to the device parameters.

This controls write access to the device parameters via the local display or other operating tools (e.g. FieldCare, DeviceCare) and, in terms of functionality, corresponds to hardware write protection. If the CDI service interface is used, read access is only possible by first entering the password.

User-specific access code

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

3 Product description

The device consists of a transmitter and a sensor.

Two device versions are available:
- Compact version – transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

For detailed information on the product description, see the Operating Instructions for the device → 3

4 Installation

For detailed information about mounting the sensor, see the Sensor Brief Operating Instructions → 3

4.1 Installing the transmitter of the remote version

NOTICE

Ambient temperature too high!

Danger of electronics overheating and housing deformation.
- ▶ Do not exceed the permitted maximum ambient temperature.
- ▶ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

NOTICE

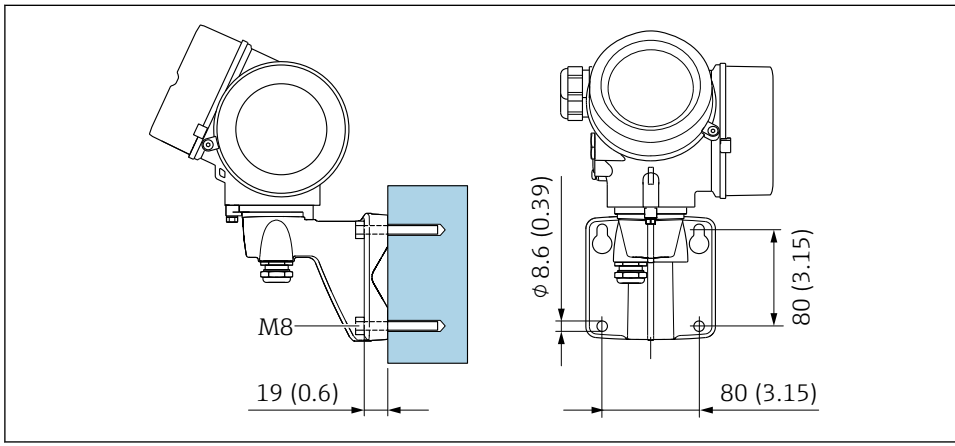
Excessive force can damage the housing!

- ▶ Avoid excessive mechanical stress.

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

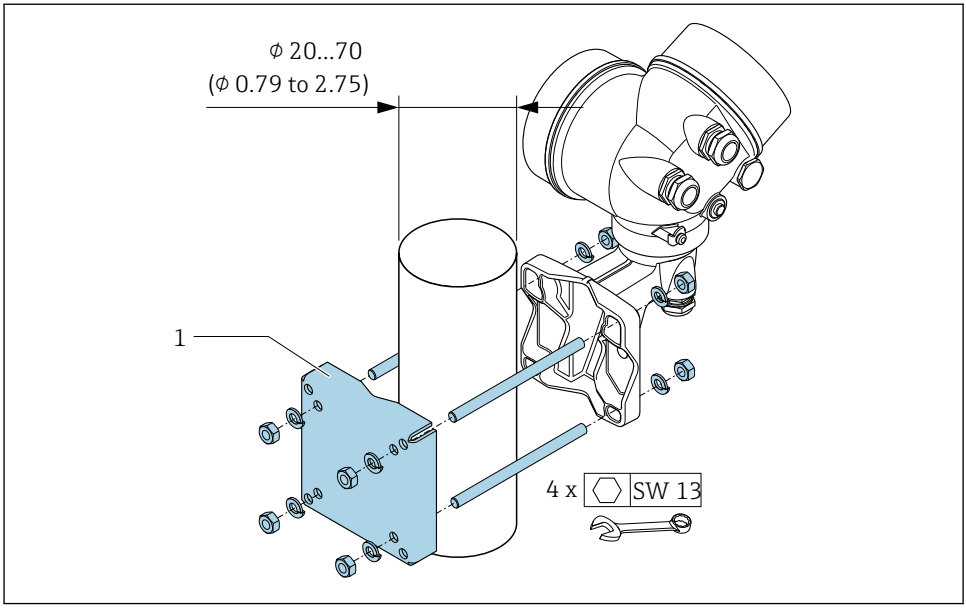
- Wall mounting
- Pipe mounting

4.1.1 Wall mounting



1 *mm (in)*

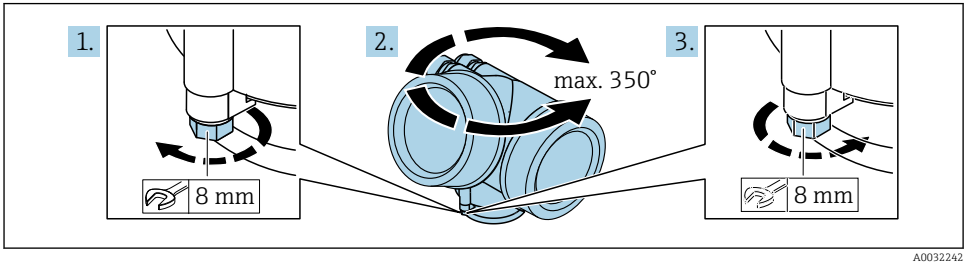
4.1.2 Pipe mounting



2 *mm (in)*

4.2 Turning the transmitter housing

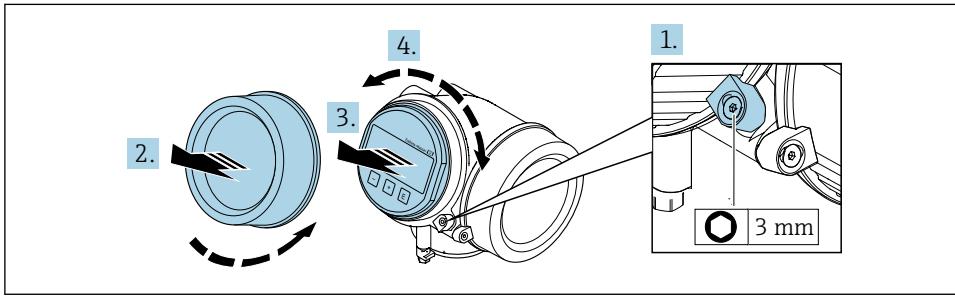
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



1. Loosen the securing screw.
2. Turn the housing to the desired position.
3. Firmly tighten the securing screw.

4.3 Turning the display module

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



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1. Loosen the securing clamp of the electronics compartment cover using an Allen key.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Optional: pull out the display module with a gentle rotational movement.
4. Turn the display module to the desired position: Max. 8 × 45 ° in each direction.
5. Without display module pulled out:
   Allow display module to engage at desired position.
6. With display module pulled out:
   Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.
7. Reassemble the transmitter in the reverse order.

4.4 Transmitter post-installation check

The post-installation check must always be performed after the following tasks:
- Turning the transmitter housing
- Turning the display module

Is the device undamaged (visual inspection)?	❑
Are the securing screw and securing clamp tightened securely?	❑

5 Electrical connection

5.1 Electrical safety

In accordance with applicable national regulations.

5.2 Connection requirements

5.2.1 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)

5.2.2 Requirements for connection cable

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

Permitted temperature range

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

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
- Plug-in spring terminals for device version without integrated overvoltage protection: wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

5.2.3 Connecting cable for remote version

Connecting cable (standard)

Standard cable	2 × 2 × 0.5 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85 %
Cable length	5 m (15 ft), 10 m (30 ft), 20 m (60 ft), 30 m (90 ft)
Continuous 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)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (armored)

Cable, armored	2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) and additional steel-wire braided sheath [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Strain relief and reinforcement	Steel-wire braid, galvanized
Cable length	10 m (30 ft), 20 m (60 ft), 30 m (90 ft)
Continuous 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)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (option "mass pressure-/temperature-compensated")

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB, DC, DD

Standard cable	[(3 × 2) + 1] × 0.34 mm² (22 AWG) PVC cable with common shield (3 pairs, pair-stranded) [1]
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Cable length	10 m (30 ft), 30 m (90 ft)
Continuous 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)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

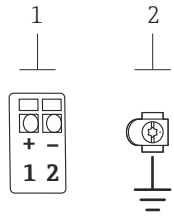
5.2.4 Signal cable

Shielded twisted-pair cable. Cable type A is recommended.

See https://www.profibus.com Ethernet-APL White Paper "

5.2.5 Terminal assignment

Transmitter



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Maximum number of terminals	*Maximum number of terminals for order code for "Accessory mounted", option NA "Overvoltage protection"*

1 Output 1 (passive): supply voltage and signal transmission
2 Ground terminal for cable shield

Order code for "Output"	Terminal numbers					
	Output 1		Output 2		Input	
	1 (+)	2 (-)	3 (+)	4 (-)	5 (+)	6 (-)
Option **T**	Modbus TCP over Ethernet-APL/SPE, 10 Mbit/s		-		-	

Connecting cable for remote version

Transmitter and sensor connection housing

In the case of the remote version, the sensor and transmitter are mounted separately from on another and connected by a connecting cable. Connection is performed via the sensor connection housing and the transmitter housing.

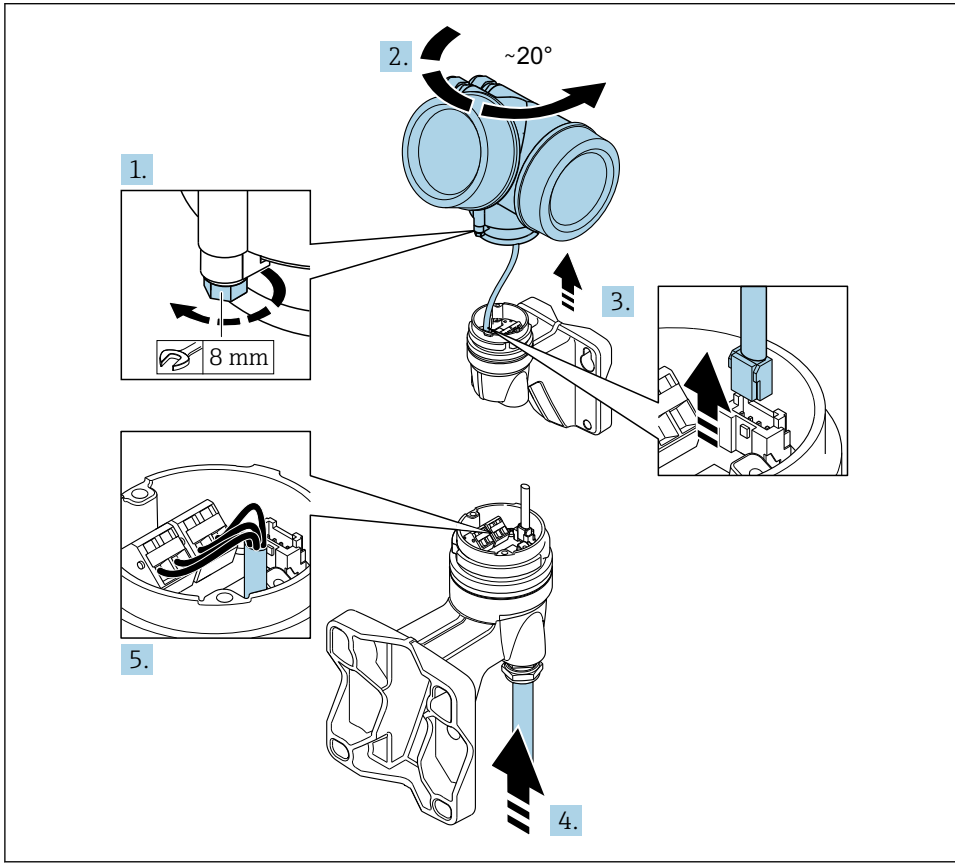
How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable

In the following versions, an M12 device connector is used for connection in the transmitter housing:
- All other approvals
- Use of connecting cable (standard)

Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connection via terminals



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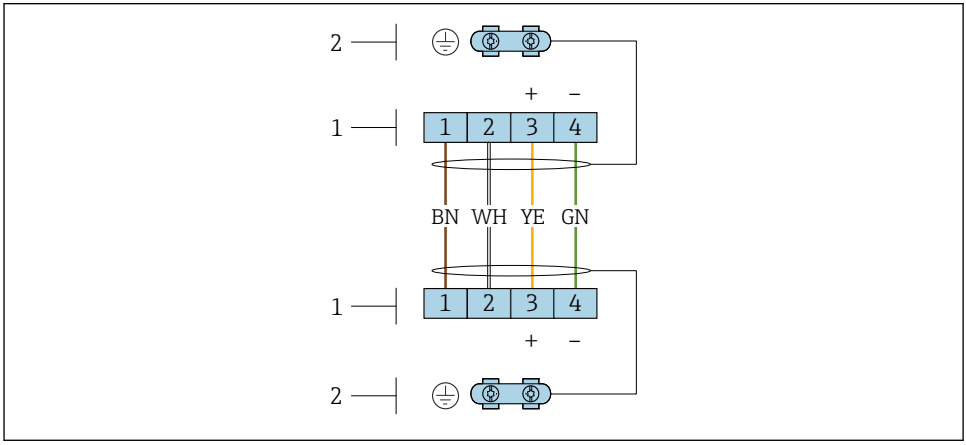
1. Loosen the securing clamp of the transmitter housing.
2. Turn the transmitter housing clockwise by approx. 20°.
3. NOTICE

   The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!
   ▶ Pay attention to the signal cable when lifting the transmitter housing!

   Lift the transmitter housing, plug the signal cable out of the connection board of the wall holder and remove the transmitter housing.
4. Release the cable gland and insert the connecting cable (use the shorter stripped end of the connecting cable).
5. Wire the connecting cable → 3, 18→ 4, 19.

6. Reverse the removal procedure to reassemble the transmitter housing.
7. Firmly tighten the cable gland.

Connecting cable (standard, reinforced)



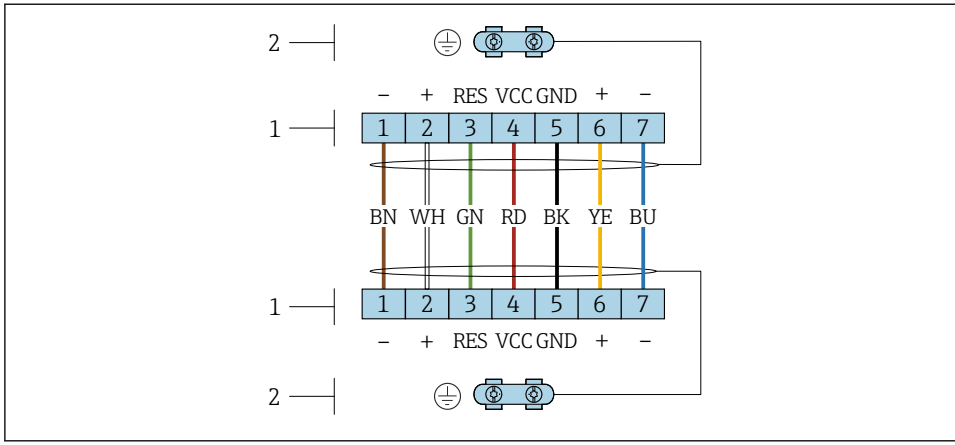
3 *Terminals for connection compartment in the transmitter wall holder and the sensor connection housing*

1 Terminals for connecting cable
2 Grounding via the cable strain relief

Terminal number	Assignment	Cable color Connecting cable
1	Supply voltage	Brown
2	Grounding	White
3	RS485 (+)	Yellow
4	RS485 (–)	Green

Connecting cable (option "mass pressure-/temperature-compensated")

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB, DC, DD

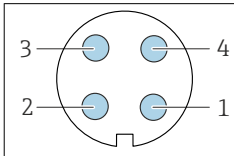


4 *Terminals for connection compartment in the transmitter wall holder and the sensor connection housing*

1 Terminals for connecting cable
2 Grounding via the cable strain relief

Terminal number	Assignment	Cable color Connecting cable
1	RS485 (-) DPC	Brown
2	RS485 (+) DPC	White
3	Reset	Green
4	Supply voltage	Red
5	Grounding	Black
6	RS485 (+)	Yellow
7	RS485 (–)	Blue

5.2.6 Modbus TCP over Ethernet-APL 10 Mbit/s



Pin	Assignment	Coding	Plug/ socket
1	Ethernet-APL signal -	A	Socket
2	Ethernet-APL signal +		
3	Cable shield[1]		
4	Not used		
Metal plug housing	Cable shield		
[1] If a cable shield is used			

5.2.7 Shielding and grounding

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

1. To ensure optimal EMC protection, connect the shield to the reference ground as often as possible.
2. For reasons concerning explosion protection, it is recommended that grounding be dispensed with.

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

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

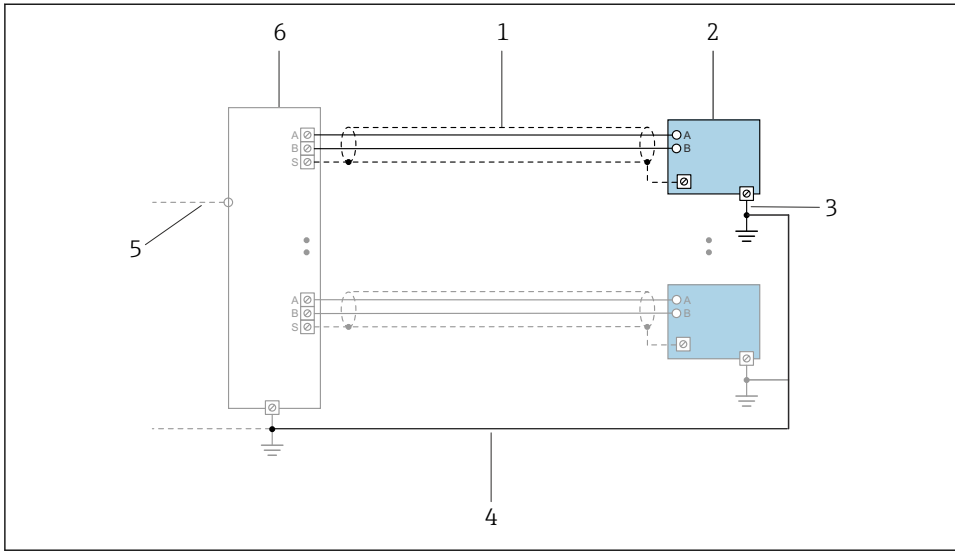
1. Observe national installation requirements and guidelines during installation.
2. Where there are large differences in potential between the individual grounding points, connect only one point of the shielding directly to the reference ground.
3. In systems without potential equalization,
   the cable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

NOTICE

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

Damage to the bus cable shield.

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



5 Connection example for PROFINET over Ethernet-APL

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

5.2.8 Requirements for the supply unit

Supply voltage

Transmitter

Supply voltage for a compact version

Order code for "Output; input"	Minimum Terminal voltage	Maximum Terminal voltage
Option **T** : Modbus TCP over Ethernet-APL/ SPE, 10 Mbit/s	≥ DC 9 V	DC 30 V

Transient overvoltage: Up to overvoltage category I

5.2.9 Preparing the measuring instrument

Carry out the steps in the following order:

1. Mount the sensor and transmitter.

2. Sensor connection housing: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect cable for supply voltage.

NOTICE

Insufficient sealing of the housing!
Operational reliability of the measuring device could be compromised.
- ▶ Use suitable cable glands corresponding to the degree of protection.

1. Remove dummy plug if present.
2. If the measuring instrument is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring instrument is supplied with cable glands:
   Observe requirements for connecting cables → 14.

5.3 Connecting the device

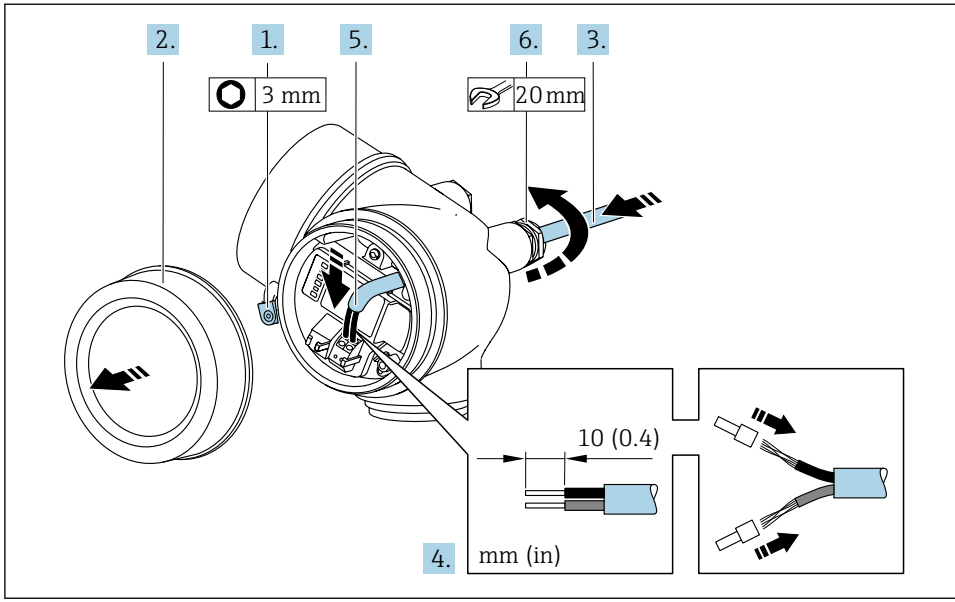
NOTICE

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.
- ▶ The power unit must be safety-approved (e.g. SELV/PELV Class 2 limited power).

5.3.1 Connecting the compact version

Connecting the transmitter

Connection via terminals



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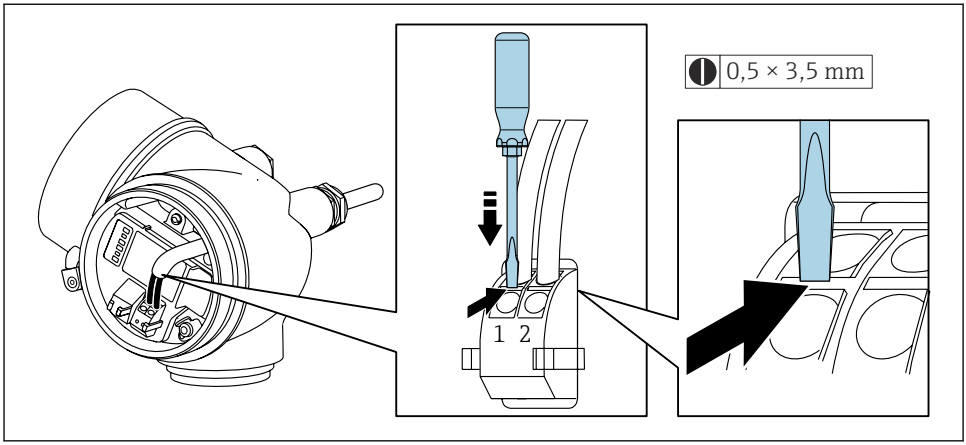
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit wire end ferrules.
5. NOTICE

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

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

   Firmly tighten the cable glands.
6. Reassemble the transmitter in the reverse order.

Removing a cable



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

5.3.2 Connecting the remote version

NOTICE

Risk of damaging the electronic components!

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

The following sequence of steps is recommended for the remote version:

1. Mount the sensor and transmitter.
2. Connect the connecting cable of the remote version.

3. Connect the transmitter.

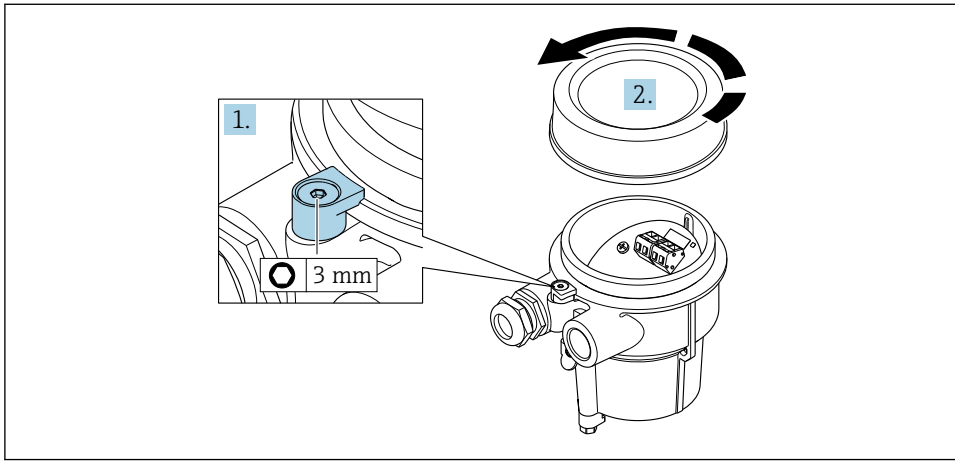
How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable

In the following versions, an M12 device connector is used for connection in the transmitter housing:
- All other approvals
- Use of connecting cable (standard)

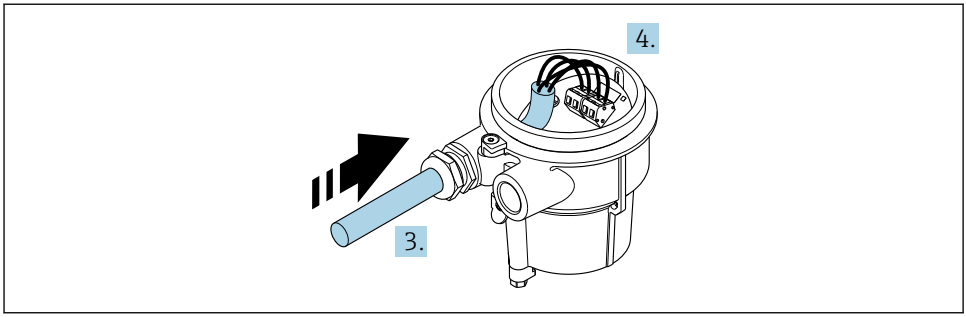
Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connecting the sensor connection housing



A0034167

1. Loosen the securing clamp.
2. Unscrew the housing cover.



6 Sample graphic

Connecting cable (standard, reinforced)

3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
4. Wire the connecting cable:
   ↳ Terminal 1 = brown cable
   Terminal 2 = white cable
   Terminal 3 = yellow cable
   Terminal 4 = green cable
5. Connect the cable shield via the cable strain relief.
6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
7. Reverse the removal procedure to reassemble the connection housing.

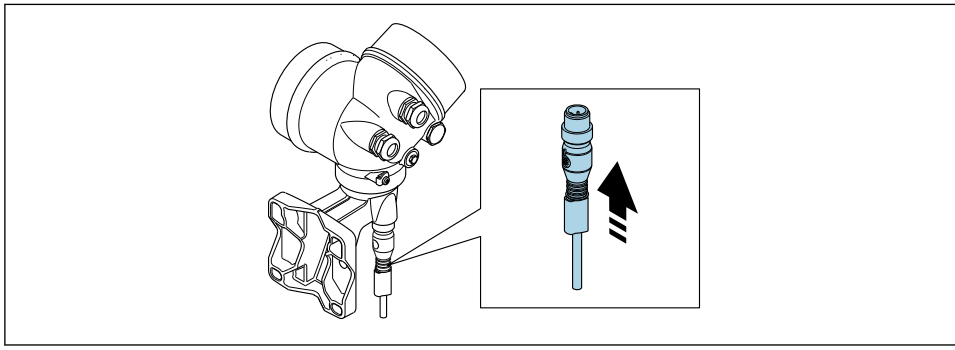
Connecting cable (option "mass pressure-/temperature-compensated")

3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
4. Wire the connecting cable:
   ↳ Terminal 1 = brown cable
   Terminal 2 = white cable
   Terminal 3 = green cable
   Terminal 4 = red cable
   Terminal 5 = black cable
   Terminal 6 = yellow cable
   Terminal 7 = blue cable
5. Connect the cable shield via the cable strain relief.
6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.

7. Reverse the removal procedure to reassemble the connection housing.

Connecting the transmitter

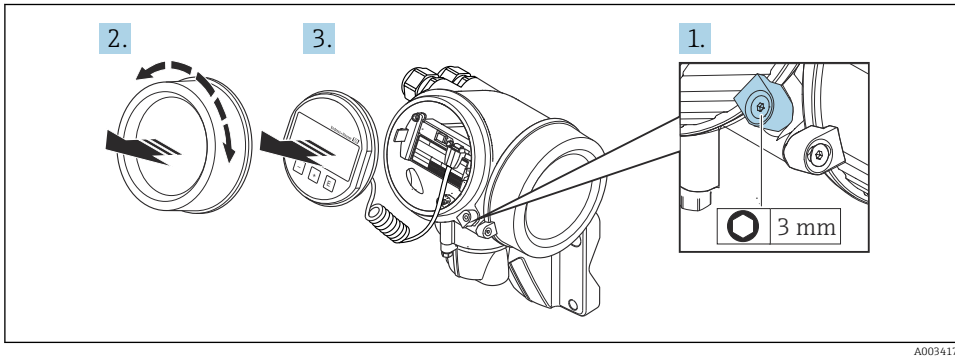
Connecting transmitter via plug



A0034172

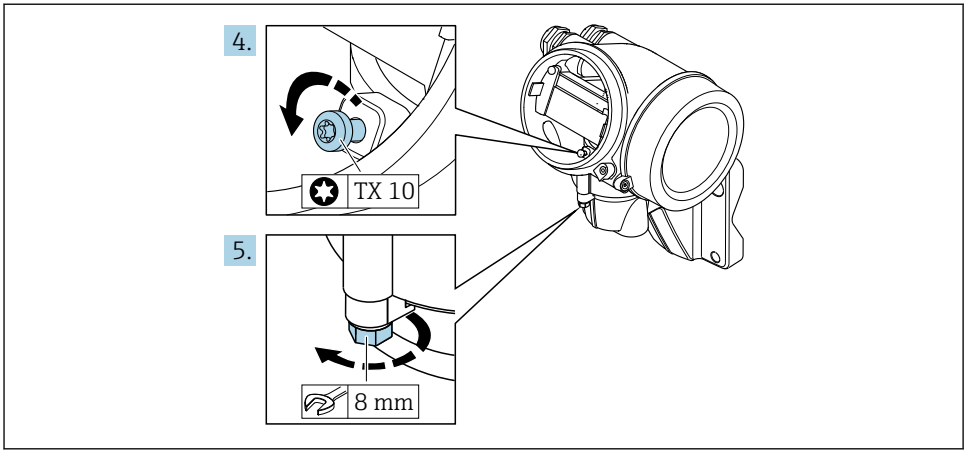
▶ Connect the plug.

Connecting transmitter via terminals



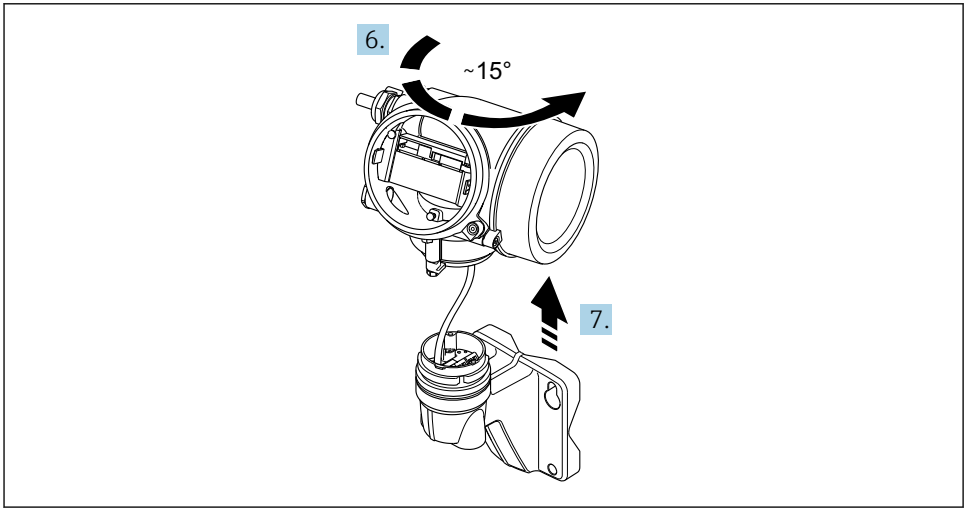
A0034173

1. Loosen the securing clamp of the electronics compartment cover.
2. Unscrew the electronics compartment cover.
3. Pull out the display module with a gentle rotational movement. To make it easier to access the lock switch, attach the display module to the edge of the electronics compartment.



A0034174

4. Loosen the locking screw of the transmitter housing.
5. Loosen the securing clamp of the transmitter housing.



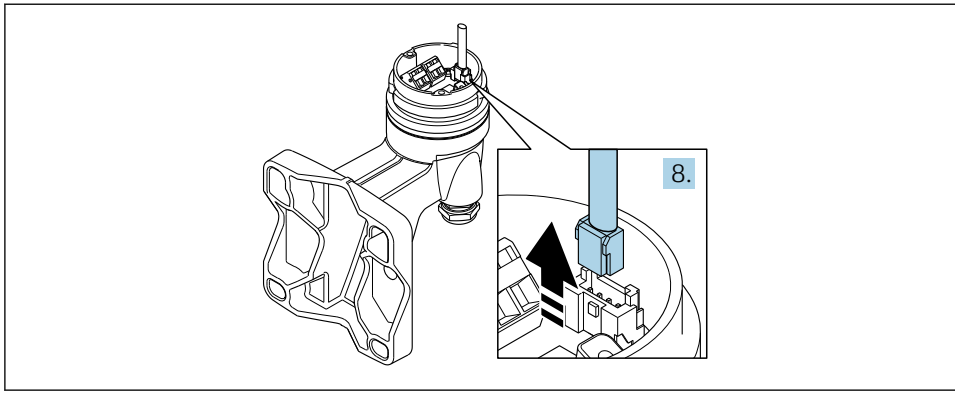
A0034175

7 *Sample graphic*

6. Turn the transmitter housing to the right until it reaches the marking.
7. **NOTICE**

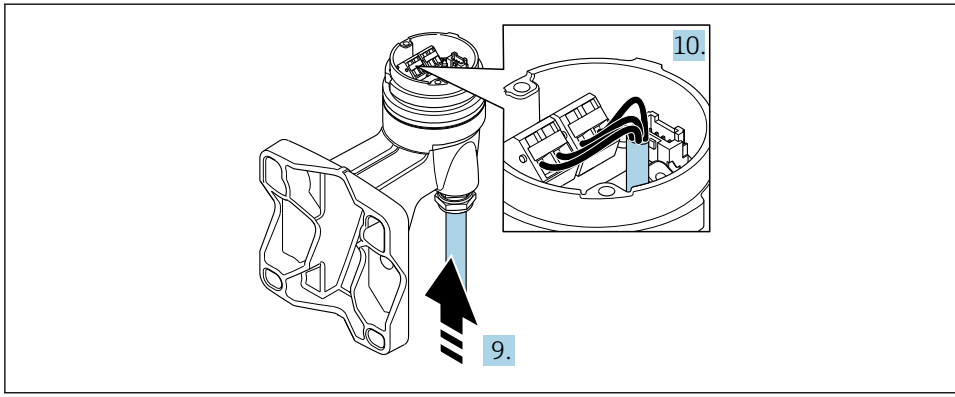
   The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!
   ▶ Pay attention to the signal cable when lifting the transmitter housing!

   Lift the transmitter housing.



A0034176

8 Sample graphic



A0034177

9 Sample graphic

Connecting cable (standard, reinforced)

8. Disconnect the signal cable from the connection board of the wall housing . by pressing in the locking clip on the connector. Remove the transmitter housing.
9. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
10. Wire the connecting cable:
    ↳ Terminal 1 = brown cable
    Terminal 2 = white cable
    Terminal 3 = yellow cable
    Terminal 4 = green cable

11. Connect the cable shield via the cable strain relief.
12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
13. Reverse the removal procedure to reassemble the transmitter housing.

Connecting cable (option "mass pressure-/temperature-compensated")

8. Disconnect both signal cables from the connection board of the wall housing. by pressing in the locking clip on the connector. Remove the transmitter housing.
9. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
10. Wire the connecting cable:
    ↳ Terminal 1 = brown cable
    Terminal 2 = white cable
    Terminal 3 = green cable
    Terminal 4 = red cable
    Terminal 5 = black cable
    Terminal 6 = yellow cable
    Terminal 7 = blue cable
11. Connect the cable shield via the cable strain relief.
12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
13. Reverse the removal procedure to reassemble the transmitter housing.

5.4 Potential equalization

5.4.1 Requirements

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

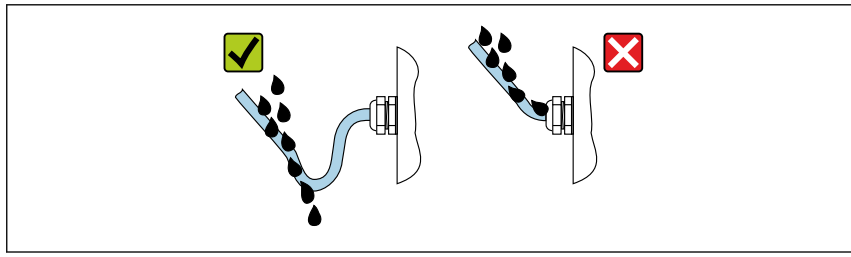
5.5 Ensuring the degree of protection

The measuring instrument 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 the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.

3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.
5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").
   ↳



A0029278

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

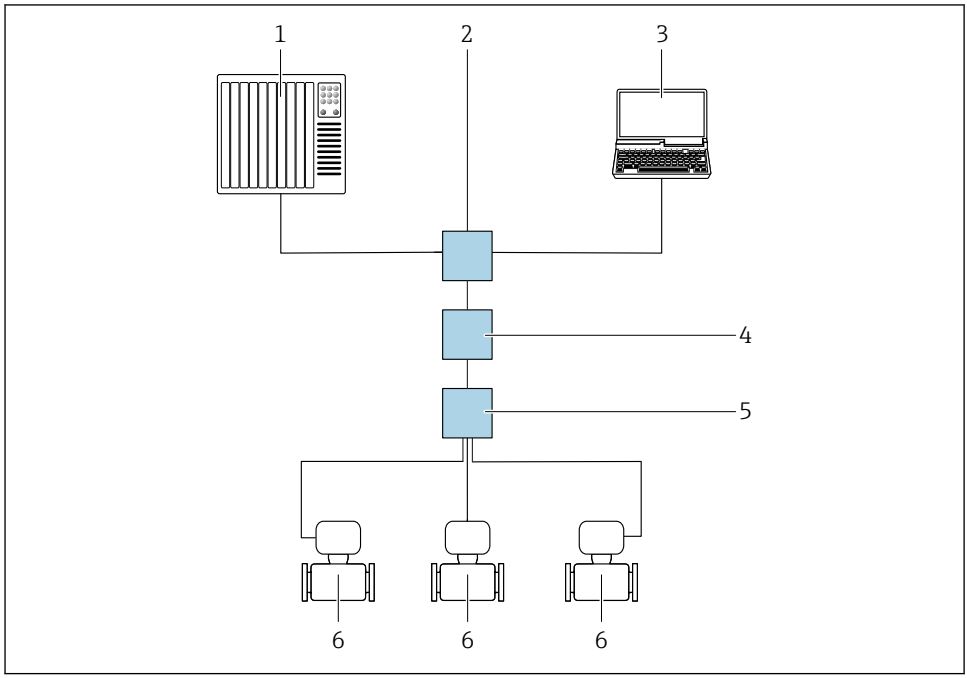
Type 4X is not provided if pressure measuring cell is used.

5.6 Post-connection check

Are the device and cable undamaged (visual inspection)?	❑
Do the cables used comply with the requirements → 🖹 14?	❑
Are the mounted cables strain relieved?	❑
Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" → 🖹 30?	❑
Depending on the device version: are all the device plugs firmly tightened → 🖹 22?	❑
Only for remote version: ▪ Is the sensor connected to the right transmitter? ▪ Check the serial number on the nameplate of the sensor and transmitter.	❑
Does the supply voltage match the specifications on the transmitter nameplate ?	❑
Is the terminal assignment correct ?	❑
If supply voltage is present, do values appear on the display module?	❑
Are all housing covers installed and firmly tightened?	❑
Is the securing clamp securely tightened?	❑
Have the screws for the cable strain relief been tightened using the correct tightening torque→ 🖹 24?	❑

6 Operation options

6.1 Overview of operation options

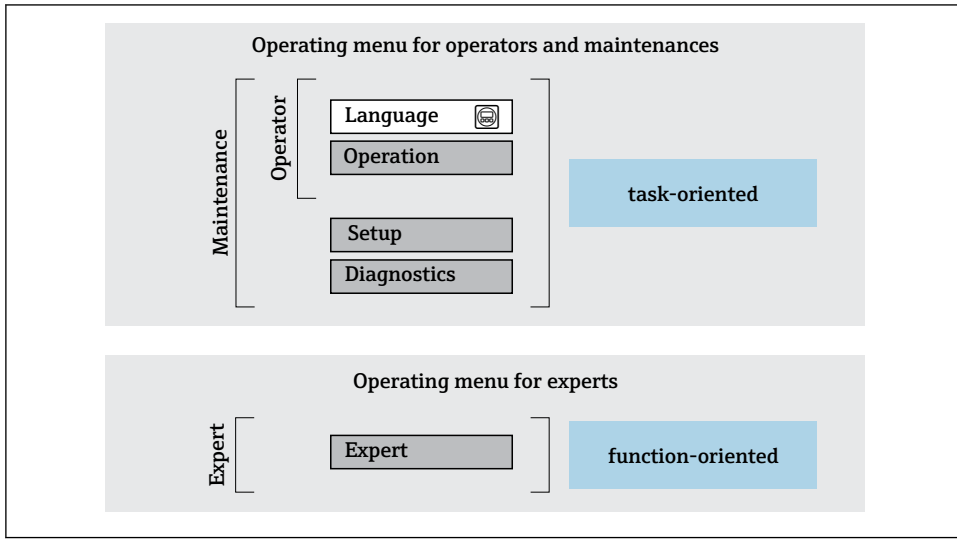


A0046117

1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Standard Ethernet switch, e.g. Scalance X204 (Siemens)*
3 *Computer with web browser or with operating tool (e.g FieldCare, DeviceCare, SIMATIC PDM)*
4 *APL power switch (optional)*
5 *APL field switch*
6 *Measuring instrument*

6.2 Structure and function of the operating menu

6.2.1 Structure of the operating menu



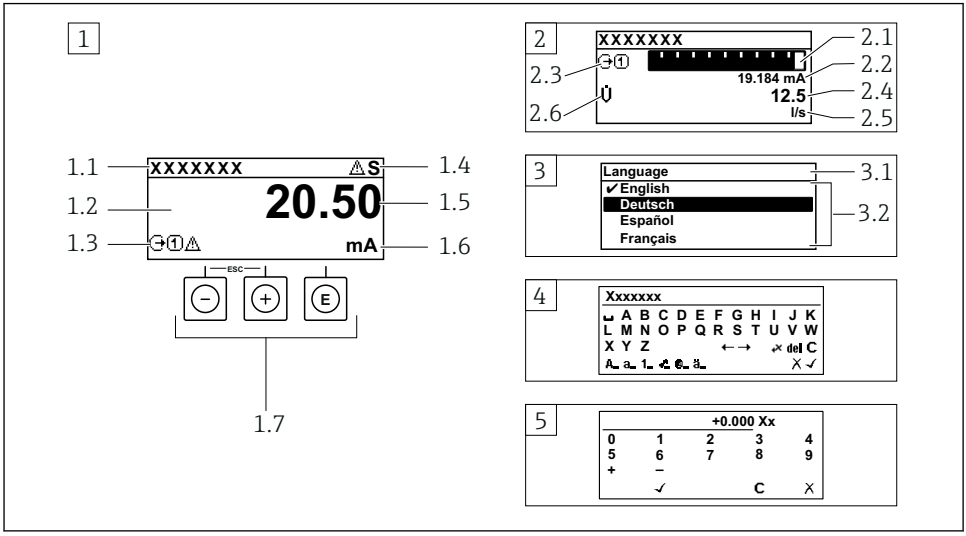
10 *Schematic structure of the operating menu*

6.2.2 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.

For detailed information on the operating philosophy, see the Operating Instructions for the device. → 3

6.3 Access to operating menu via local display



A0014013

1 Operational display with measured value shown as "1 value, max." (example)
1.1 Device tag
1.2 Display area for measured values (4-line)
1.3 Explanatory symbols for measured value: Measured value type, measuring channel number, symbol for diagnostic behavior
1.4 Status area
1.5 Measured value
1.6 Unit for the measured value
1.7 Operating elements
2 Operational display with measured value shown as "1 bar graph + 1 value" (example)
2.1 Bar graph display for measured value 1
2.2 Measured value 1 with unit
2.3 Explanatory symbols for measured value 1: measured value type, measuring channel number
2.4 Measured value 2
2.5 Unit for measured value 2
2.6 Explanatory symbols for measured value 2: measured value type, measuring channel number
3 Navigation view: picklist of a parameter
3.1 Navigation path and status area
3.2 Display area for navigation: ✔ designates the current parameter value
4 Editing view: text editor with input mask
5 Editing view: numeric editor with input mask

6.3.1 Operational display

Explanatory symbols for the measured value	Status area

▪ Depends on the device version, e.g.:
  ▪ U̇: Volume flow
  ▪ ṁ: Mass flow
  ▪ Ρ: Density
  ▪ **G**: Conductance
  ▪ 🌡: Temperature
▪ Σ: Totalizer
▪ ⊖: Output
▪ ⊕: Input
▪ ①..④: Measurement channel number [1]
▪ Diagnostic behavior [2]
  ▪ ⊗: Alarm
  ▪ ⚠: Warning
	The following symbols appear in the status area of the operational display at the top right:
	▪ Status signals
	  ▪ **F**: Failure
	  ▪ **C**: Function check
	  ▪ **S**: Out of specification
	  ▪ **M**: Maintenance required
	▪ Diagnostic behavior
	  ▪ ⊗: Alarm
	  ▪ ⚠: Warning
	▪ 🔒: Locking (locked via hardware))
	▪ ⇆: Communication via remote operation is active.

1) If there is more than one channel for the same measured variable type (totalizer, output etc.).
2) For a diagnostic event that concerns the displayed measured variable.

6.3.2 Navigation view

Status area	Display area

The following appears in the status area of the navigation view in the top right corner:
▪ In the submenu
  ▪ The direct access code for the parameter you are navigating to (e.g. 0022-1)
  ▪ If a diagnostic event is present, the diagnostic behavior and status signal
▪ In the wizard
If a diagnostic event is present, the diagnostic behavior and status signal
	▪ Icons for menus
	  ▪ : Operation
	  ▪ : Setup
	  ▪ : Diagnostics
	  ▪ : Expert
	▪ ▸: Submenus
	▪ : Wizard
	▪ : Parameters within a wizard
	▪ : Parameter locked

6.3.3 Editing view

Text editor		Text correction symbols under ✕C←	
✓	Confirms selection.	C	Clears all entered characters.
✕	Exits the input without applying the changes.	→	Moves the input position one position to the right.
C	Clears all entered characters.	←	Moves the input position one position to the left.
✕C←	Switches to the selection of the correction tools.	✕	Deletes one character immediately to the left of the input position.
Aa1@	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters		

Numeric editor			
✓	Confirms selection.	←	Moves the input position one position to the left.
X	Exits the input without applying the changes.	·	Inserts decimal separator at the cursor position.
−	Inserts minus sign at the cursor position.	C	Clears all entered characters.

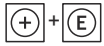
6.3.4 Operating elements

Operating key	Meaning
⊖	**Minus key** *In menu, submenu* Moves the selection bar upwards in a picklist *In wizards* Goes to previous parameter *In the text and numeric editor* In the input screen, moves the selection bar to the left (backwards)
⊕	**Plus key** *In menu, submenu* Moves the selection bar downwards in a picklist *In wizards* Goes to the next parameter *In the text and numeric editor* In the input screen, moves the selection bar to the right (forwards)

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

Operating key	Meaning

	**Escape key combination (press keys simultaneously)**
	In menu, submenu
	▪ Pressing the key briefly:
	  ▪ Exits the current menu level and takes you to the next higher level.
	  ▪ If help text is open, closes the help text of the parameter.
	▪ Pressing the key for 2 s returns you to the operational display ("home position").
	In wizards
	Exits the wizard and takes you to the next higher level
	In the text and numeric editor
	Closes the text or numeric editor without applying changes.

	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
	**Minus/Plus/Enter key combination (press the keys simultaneously)** *In the operational display* Enables or disables the keypad lock (only SD02 display module).

6.3.5 Further information

Further information on the following subjects:
- Calling up help text
- User roles and related access authorization
- Disabling write protection via access code
- Enabling and disabling the keypad lock

Operating instructions for the device → 3

6.4 Access to the operating menu via the operating tool

For detailed information on access via FieldCare and DeviceCare, see the Operating Instructions for the device → 3

7 Modbus TCP system integration

For detailed information on system integration, see the Special Documentation for the Modbus TCP system integration with the device:
→ 4

8 Commissioning

8.1 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→ 🖹 13
- Checklist for "Post-connection check" → 🖹 31

8.2 Switching on the measuring device

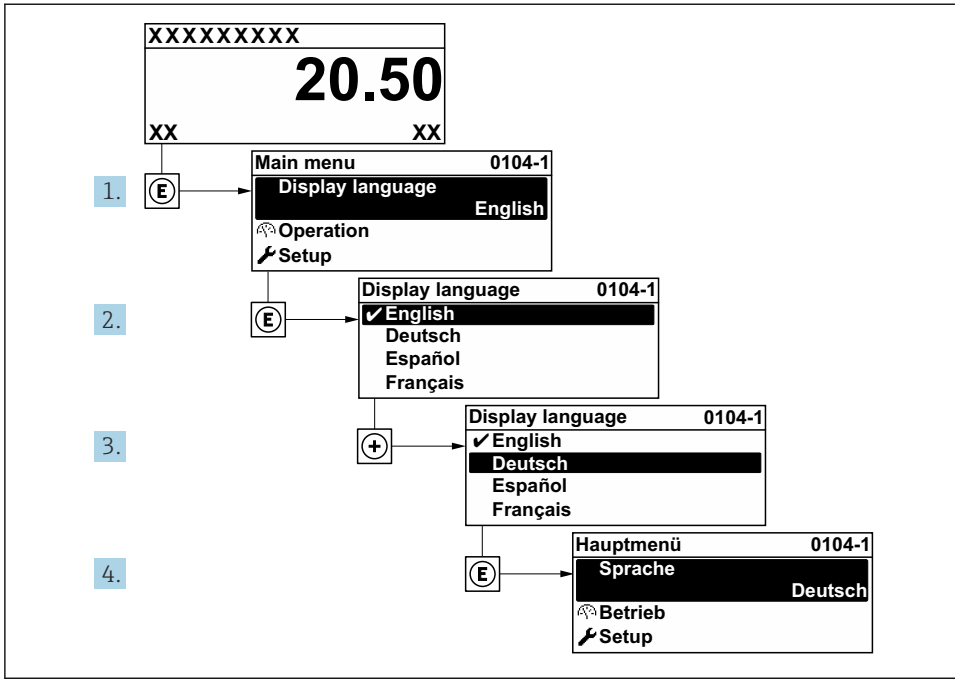
▶ Switch on the device upon successful completion of the post-mounting and post-connection check.

↳ 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 a diagnostic message is displayed, refer to the Operating Instructions for the device → 🖹 3

8.3 Setting the operating language

Factory setting: English or ordered local language



11 *Taking the example of the local display*

8.4 Configuring the device

The **Setup** menu with its **System units** submenu and various guided wizards enable fast commissioning of the measuring device.

The desired units can be selected in the **System units** submenu. The wizards systematically guide the user through all the parameters required for configuration, such as parameters for measurement or outputs.

The wizards available in the particular device can vary on account of the device version (e.g. sensor).

Wizard	Meaning
System units	Configure the units for all measured variables
Medium selection	Define the medium
Display	Configure the measured value display

Wizard	Meaning
Low flow cut off	Configure the low flow cut off
Advanced setup	Additional parameters for configuration: ▪ Medium properties ▪ External compensation ▪ Sensor adjustment ▪ Totalizer 1 to n ▪ Heartbeat ▪ Configuration backup display ▪ Administration

8.5 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
- Protect access to local operation via key locking
- Protect access to measuring device via write protection switch

For detailed information on protecting settings against unauthorized access, see the Operating Instructions for the device. → 3

8.6 Application-specific commissioning

8.6.1 Steam application

Select medium

Navigation:

Setup → Medium selection

1. Open the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Steam** option.
3. When pressure measured value is read in [1]:
   In the **Steam calculation mode** parameter, select the **Automatic (p-/T-compensated)** option.
4. If pressure measured value is not read in:
   In the **Steam calculation mode** parameter, select the **Saturated steam (T-compensated)** option.

1) Sensor version option "Mass (integrated pressure and temperature measurement)", Pressure read in via

5. In the **Steam quality value** parameter, enter the steam quality present in the pipe.
   ↳ Without Wet Steam Detection/Measurement application package: Measuring instrument uses this value to calculate the mass flow of the steam.
   With Wet Steam Detection/Measurement application package: Measuring instrument uses this value if the steam quality cannot be calculated (steam quality is not compliant with basic conditions).

Configuring the external compensation

6. With Wet Steam Detection/Measurement application package:
   In the **Steam quality** parameter, select the **Calculated value** option.

For detailed information on the basic conditions for wet steam applications, see the Special Documentation.

8.6.2 Liquid application

User-specific liquid, e. g. heat carrier oil

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Liquid** option.
3. In the **Liquid type** parameter, select the **User-specific liquid** option.
4. In the **Enthalpy type** parameter, select the **Heat** option.
   ↳ **Heat** option: Non-flammable liquid that serves as a heat carrier.
   Calorific value option: Flammable liquid whose combustion energy is calculated.

Configuring fluid properties

Navigation:

Setup → Advanced setup → Medium properties

5. Call up the **Medium properties** submenu.
6. In the **Reference density** parameter, enter the reference density of the fluid.
7. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
8. In the **Linear expansion coefficient** parameter, enter the expansion coefficient of the fluid.
9. In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.
10. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid.

8.6.3 Gas applications

For accurate mass or corrected volume measurement, it is recommended to use the pressure-/temperature-compensated sensor version. If this sensor version is not available, read in the pressure via the . If neither of these two options is possible, the pressure can also be entered as a fixed value in the **Fixed process pressure** parameter.

Flow computer available only with the order code for "Sensor version", option "mass" (integrated temperature measurement)" or option "mass (integrated pressure/ temperature measurement)".

Single gas

Combustion gas, e. g. methane CH_4

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Gas** option.
3. In the **Select gas type** parameter, select the **Single gas** option.
4. In the **Gas type** parameter, select the **Methane CH4** option.

Configuring medium properties

Navigation:

Setup → Advanced setup → Medium properties

5. Open the **Medium properties** submenu.
6. In the **Reference combustion temperature** parameter, enter the reference combustion temperature of the medium.

Configuring medium properties

Navigation:

Setup → Advanced setup → Medium properties

7. Open the **Medium properties** submenu.
8. In the **Reference combustion temperature** parameter, enter the reference combustion temperature of the medium.

Gas mixture

Forming gas for steel mills and rolling mills, e. g. N_2/H_2

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Gas** option.
3. In the **Select gas type** parameter, select the **Gas mixture** option.

Configuring gas composition

Navigation:

Setup → Advanced setup → Medium properties → Gas composition

4. Call up the **Gas composition** submenu.
5. In the **Gas mixture** parameter, select the **Hydrogen H2** option and the **Nitrogen N2** option.
6. In the **Mol% H2** parameter, enter the quantity of hydrogen.
7. In the **Mol% N2** parameter, enter the quantity of nitrogen.
   ↳ All quantities must add up to 100 %.
   The density is determined according to NEL 40.

Configuring optional fluid properties for output of corrected volume flow

Navigation:

Setup → Advanced setup → Medium properties

8. Call up the **Medium properties** submenu.
9. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
10. In the **Reference temperature** parameter, enter the reference temperature of the fluid.

Air

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Gas** option.
3. In the **Select gas type** parameter, select the **Air** option.
   ↳ The density is determined according to NEL 40.
4. Enter the value in the **Relative humidity** parameter.
   ↳ The relative humidity is entered as a %. The relative humidity is converted internally to absolute humidity and is then factored into the density calculation according to NEL 40.
5. In the **Fixed process pressure** parameter, enter the value of the process pressure present.

Configuring fluid properties

Navigation:

Setup → Advanced setup → Medium properties

6. Call up the **Medium properties** submenu.
7. In the **Reference pressure** parameter enter the reference pressure for calculating the reference density.
   ↳ Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.
8. In the **Reference temperature** parameter enter the temperate for calculating the reference density.

Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries .

Natural gas

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Gas** option.
3. In the **Select gas type** parameter, select the **Natural gas** option.
4. In the **Fixed process pressure** parameter, enter the value of the process pressure present.
5. In the **Enthalpy calculation** parameter, select one of the following options:
   ↳ AGA5
   ISO 6976 option (contains GPA 2172)
6. In the **Density calculation** parameter, select one of the following options.
   ↳ AGA Nx19
   ISO 12213- 2 option (contains AGA8-DC92)
   ISO 12213- 3 option (contains SGERG-88, AGA8 Gross Method 1)

Configuring fluid properties

Navigation:

Setup → Advanced setup → Medium properties

7. Call up the **Medium properties** submenu.
8. In the **Calorific value type** parameter, select one of the options.
9. n the **Reference gross calorific value** parameter, enter the reference gross calorific value of the natural gas.

10. In the **Reference pressure** parameter enter the reference pressure for calculating the reference density.
    ↳ Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.
11. In the **Reference temperature** parameter enter the temperate for calculating the reference density.
12. In the **Relative density** parameter, enter the relative density of the natural gas.

Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries .

Ideal gas

The unit "corrected volume flow" is often used to measure industrial gas mixtures, in particular natural gas. To do so, the calculated mass flow is divided by a reference density. To calculate the mass flow, knowledge of the exact composition of the gas is essential. In practice, however, this information is often not available (e. g. as it varies over time). In this case, it can be useful to regard the gas as an ideal gas. This means that only the operating temperature and operating pressure variables as well as the reference temperature and reference pressure variables are needed to calculate the corrected volume flow. The error resulting from this assumption (typically 1 to 5 %) is often considerably smaller than the error caused by inaccurate composition data. This method should not be used for condensing gases (e. g. saturated steam).

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Gas** option.
3. In the **Select gas type** parameter, select the **User-specific gas** option.
4. For non-flammable gas:
   In the **Enthalpy type** parameter, select the **Heat** option.

Configuring fluid properties

Navigation:

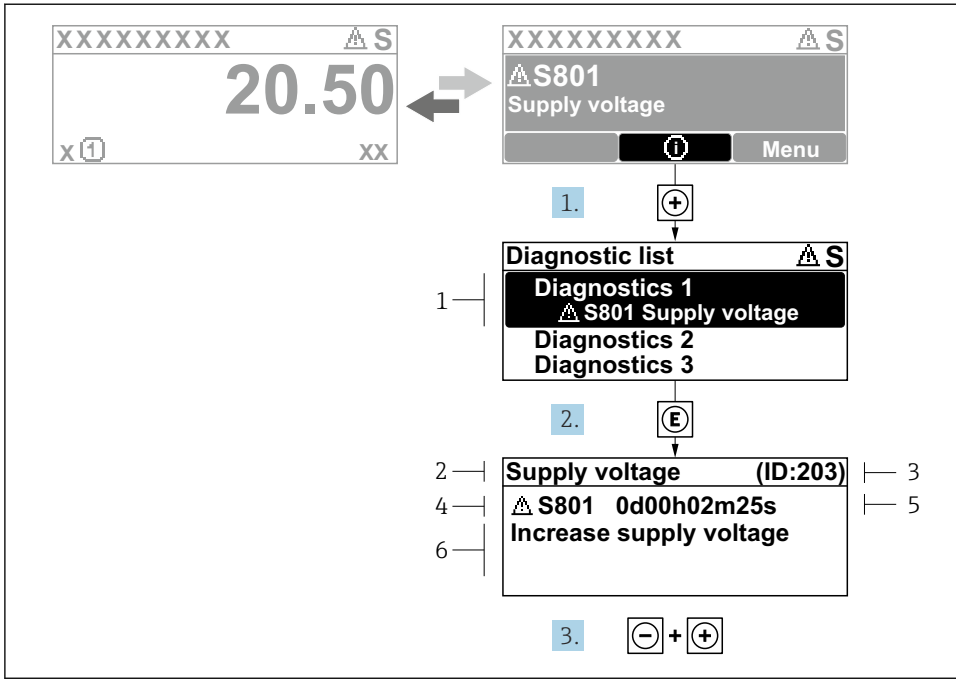
Setup → Advanced setup → Medium properties

5. Call up the **Medium properties** submenu.
6. In the **Reference density** parameter, enter the reference density of the fluid.
7. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
8. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
9. In the **Reference Z-factor** parameter, enter the value **1**.

10. If specific heat capacity is to be measured:
    In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.
11. In the **Z-factor** parameter, enter the value **1**.
12. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid under operating conditions.

9 Diagnostic information

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display. The message about remedial measures can be called up from the diagnostic message, and contains important information on the fault.



12 *Message for remedial actions*

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

1. The user is in the diagnostic message.
   Press ⊞ (ⓘ 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.

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