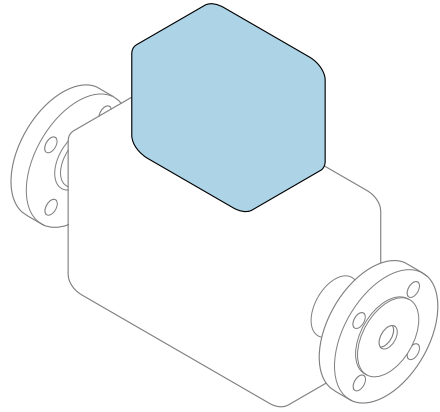
KA01418D/06/EN/02.21
71541970
2022-02-01

Brief Operating Instructions **Flowmeter Proline 400**

EtherNet/IP transmitter
with electromagnetic sensor

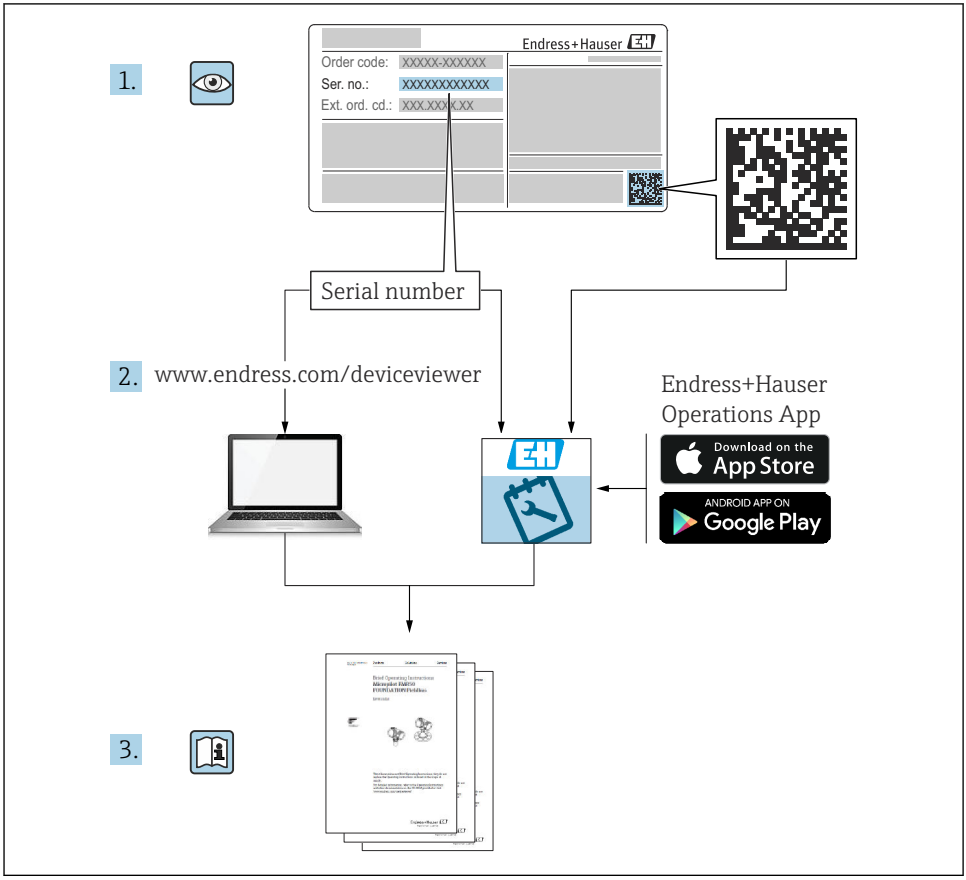


These instructions are Brief Operating Instructions; they are **not** a substitute for the Operating Instructions pertaining to the device.

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 for flowmeter

The device consists of a transmitter and a sensor.

The process of commissioning these two components is described in two separate manuals that 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
- Installation

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
- Installation
- 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
- Smart phone/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
- Smart phone/tablet: *Endress+Hauser Operations App*

Table of contents

1 About this document

1.1 Symbols used

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 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.

1.1.2 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
	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protectiv earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

1.1.4 Communication symbols

Symbol	Meaning	Symbol	Meaning
	**Wireless Local Area Network (WLAN)** Communication via a wireless, local network.		Promag 10, 400, 800 **Bluetooth** Wireless data transmission between devices over a short distance.
	Promag 800 **Cellular radio** Bidirectional data exchange via cellular network.		**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.		**LED** Light emitting diode is flashing.

1.1.5 Tool symbols

Symbol	Meaning	Symbol	Meaning
	Torx screwdriver		Flat blade screwdriver
	Cross-head screwdriver		Allen key
	Open-ended 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 instructions

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 Designated use

Application and media
The measuring device described in this manual is intended only for the flow measurement of liquids with a minimum conductivity of 5 µS/cm.

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

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

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

The measuring device is optionally tested in accordance with OIML R49: 2006 and has an EC type-examination certificate according to Measuring Instruments Directive 2004/22/EC (MID) for service subject to legal metrological control ("custody transfer") for cold water (Annex MI-001).

The permitted medium temperature in these applications is 0 to +50 °C (+32 to +122 °F).

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

⚠ WARNING

If the temperature of the media or electronics unit is high or low, this may cause the surfaces of the device to become hot or cold. This poses a risk of burns or frostbite!
- ▶ In the case of hot or cold medium temperatures, install appropriate protection against contact.

2.3 Workplace safety

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

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

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

2.4 Operational safety

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

2.5 Product safety

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

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

Furthermore, 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

2.6 IT security

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

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

2.7 Device-specific IT security

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

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

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.

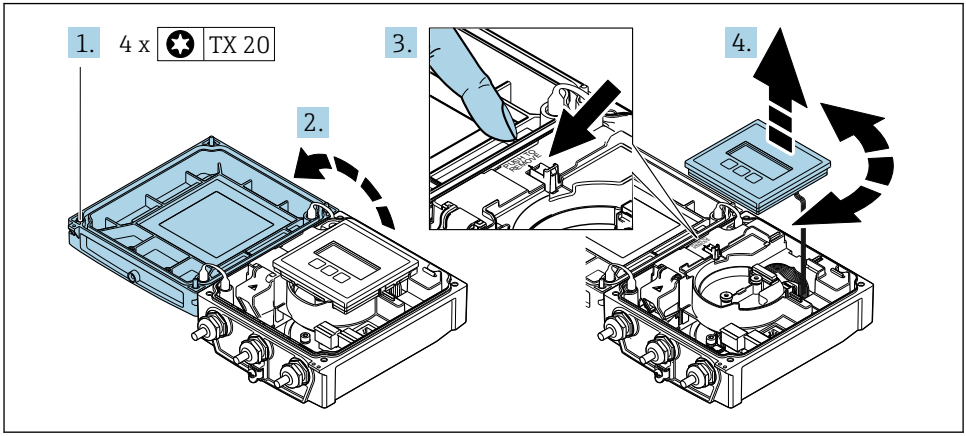
For detailed information on the product description, see the Operating Instructions for the device → 3

4 Installation

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

4.1 Turning the display module

4.1.1 Opening the transmitter housing and turning the display module



1. Loosen the fixing screws of the housing cover.
2. Open the housing cover.
3. Unlock the display module.
4. Pull out the display module and turn it to the desired position in increments of 90°.

4.1.2 Mounting the transmitter housing

WARNING

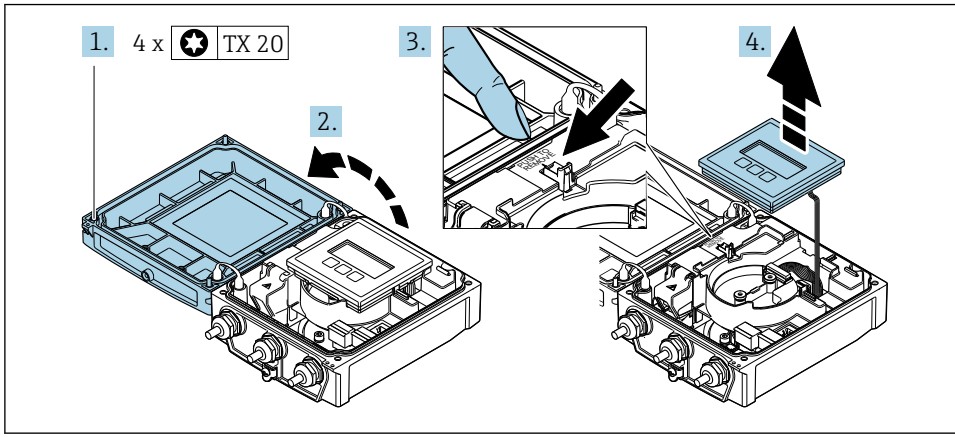
Excessive tightening torque applied to the fixing screws!
Damage to the transmitter.
► Tighten the fixing screws with the specified torques.

1. Insert the display module and lock it when doing so.
2. Close the housing cover.
3. Tighten the fixing screws of the housing cover: tightening torque for aluminum housing 2.5 Nm (1.8 lbf ft) – plastic housing 1 Nm (0.7 lbf ft).

4.2 Turning the transmitter housing: Promag D

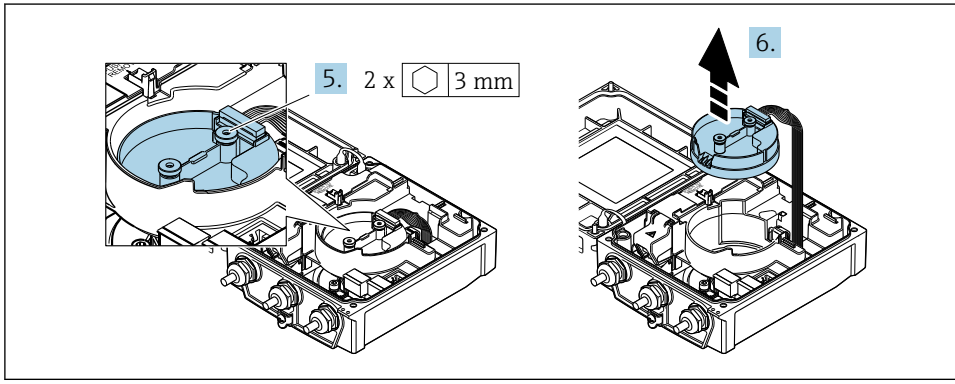
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.

4.2.1 Disassembling and turning the transmitter housing



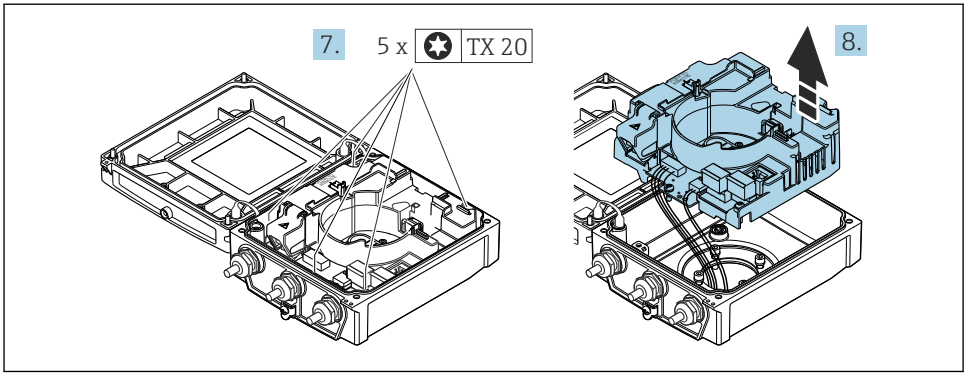
A0032086

1. Loosen the fixing screws of the housing cover.
2. Open the housing cover.
3. Unlock the display module.
4. Remove the display module.



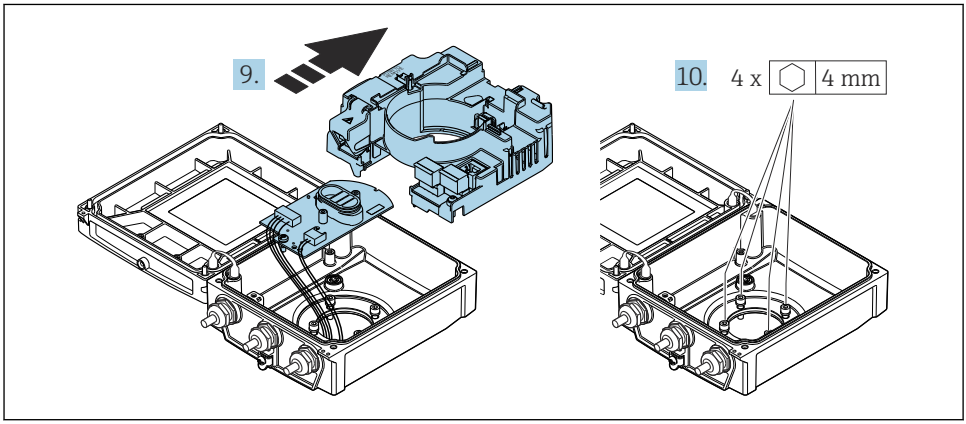
A0032087

5. Loosen the fixing screws of the intelligent sensor electronics module.
6. Remove the intelligent sensor electronics module.



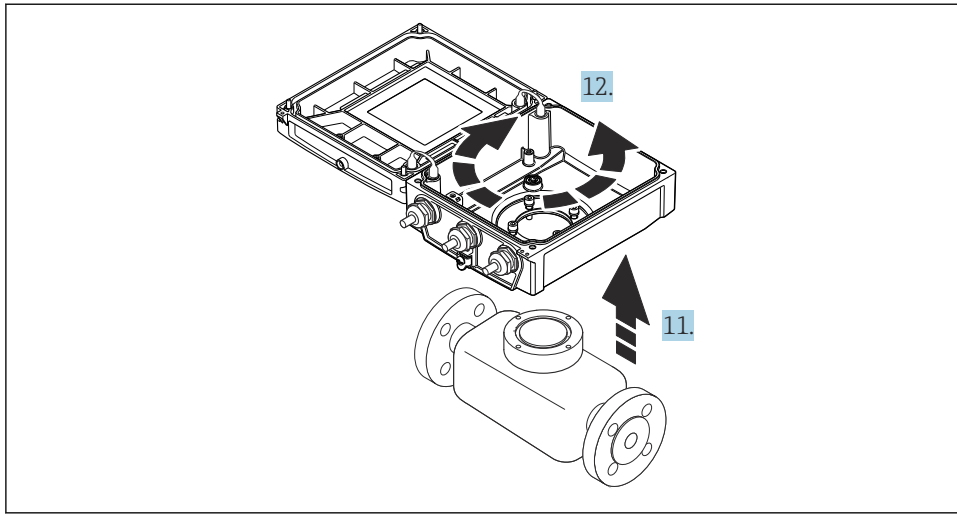
A0032130

7. Loosen the fixing screws of the main electronics module.
8. Remove the main electronics module.



A0032131

9. Remove the electronics module from the main electronics module.
10. Loosen the fixing screws of the transmitter housing (when reassembling, pay attention to the tightening torque.



A0032132

11. Lift the transmitter housing.
12. Turn the housing to the desired position in increments of 90°.

4.2.2 Mounting the sensor housing

NOTICE

Incorrect routing of the connecting cables between the sensor and transmitter in the transmitter housing!
This can interfere with the measuring signal.
► Route the connecting cables directly at the level of the plugs.

⚠ WARNING

Excessive tightening torque applied to the fixing screws!
Damage to the transmitter.
► Tighten the fixing screws with the specified tightening torques.

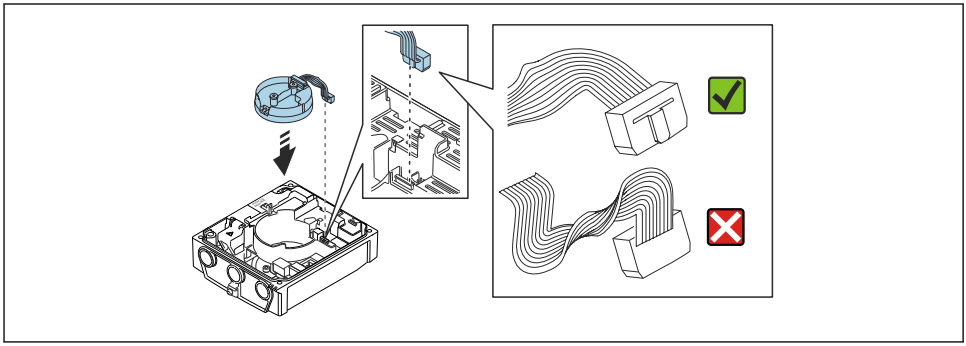
1. Fit the transmitter housing.
2. Tighten the fixing screws of the transmitter housing: tightening torque 5.5 Nm (4.1 lbf ft).
3. Slide the electronics module into the main electronics module.
4. Insert the main electronics module.
5. Tighten the fixing screws of the main electronics module: tightening torque 1.5 Nm (1.1 lbf ft).

NOTICE

Plug of the smart sensor electronics module connected incorrectly!

No measuring signal is output.

► Plug in the plug of the smart sensor electronics module as per the coding.



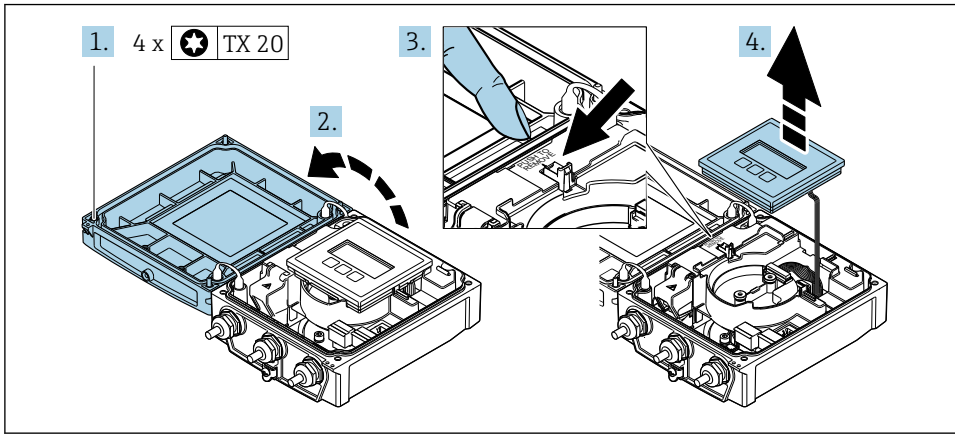
A0021585

6. Plug in the intelligent sensor electronics module: pay attention to the coding!
7. Tighten the fixing screws of the intelligent sensor electronics module: tightening torque 0.6 Nm (0.4 lbf ft).
8. Insert the display module and lock it when doing so.
9. Close the housing cover.
10. Tighten the fixing screws of the main electronics module: tightening torque for aluminum housing 2.5 Nm (1.8 lbf ft) – tightening torque for plastic housing 1 Nm (0.7 lbf ft).

4.3 Turning the transmitter housing: Promag L and W

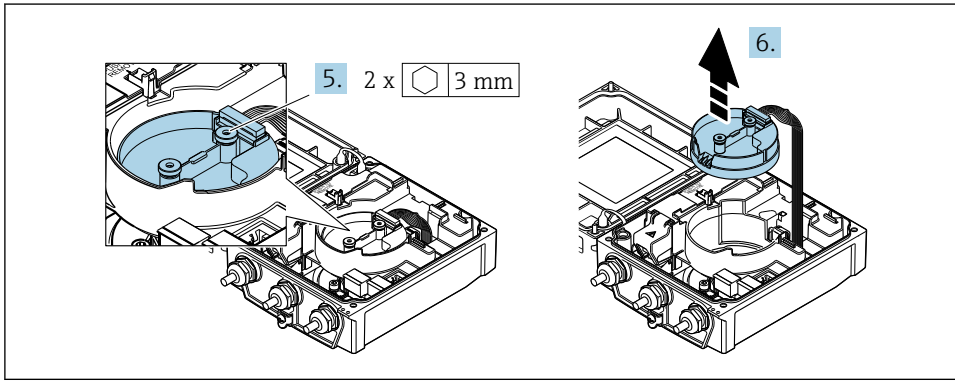
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.

4.3.1 Disassembling and turning the transmitter housing



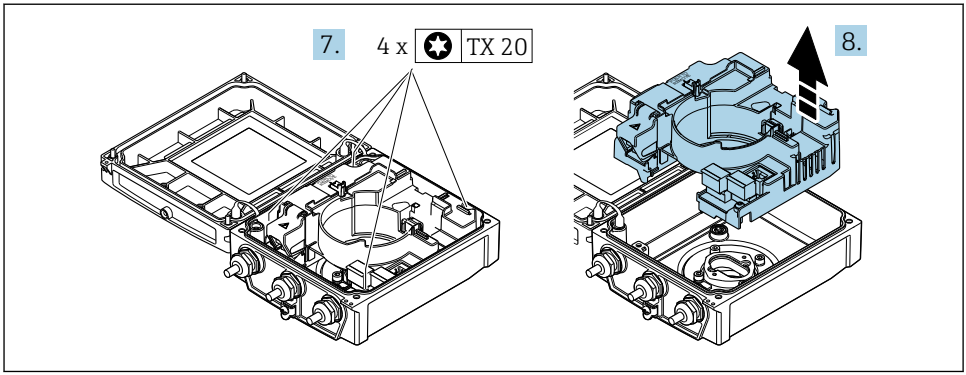
A0032086

1. Loosen the fixing screws of the housing cover.
2. Open the housing cover.
3. Unlock the display module.
4. Remove the display module.



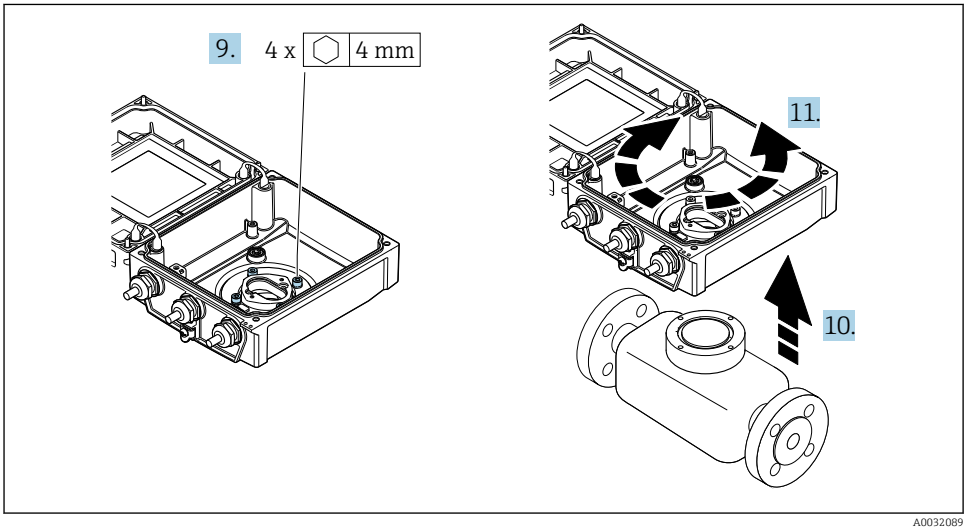
A0032087

5. Loosen the fixing screws of the intelligent sensor electronics module.
6. Remove the intelligent sensor electronics module.



A0032088

7. Loosen the fixing screws of the main electronics module.
8. Remove the main electronics module.



A0032089

9. Loosen the fixing screws of the transmitter housing (when reassembling, pay attention to the tightening torque.
10. Lift the transmitter housing.
11. Turn the housing to the desired position in increments of 90°.

4.3.2 Mounting the sensor housing

⚠ WARNING

Excessive tightening torque applied to the fixing screws!

Damage to the transmitter.

► Tighten the fixing screws with the specified tightening torques.

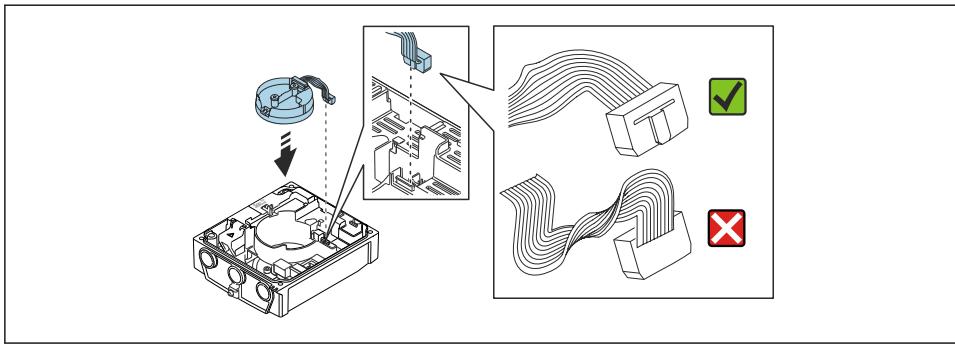
1. Fit the transmitter housing.
2. Tighten the fixing screws of the transmitter housing: tightening torque 5.5 Nm (4.1 lbf ft).
3. Insert the main electronics module.
4. Tighten the fixing screws of the main electronics module: tightening torque 1.5 Nm (1.1 lbf ft).

NOTICE

Plug of the smart sensor electronics module connected incorrectly!

No measuring signal is output.

► Plug in the plug of the smart sensor electronics module as per the coding.



A0021585

5. Plug in the intelligent sensor electronics module: pay attention to the coding!
6. Tighten the fixing screws of the intelligent sensor electronics module: tightening torque 0.6 Nm (0.4 lbf ft).
7. Insert the display module and lock it when doing so.
8. Close the housing cover.
9. Tighten the fixing screws of the main electronics module: tightening torque for aluminum housing 2.5 Nm (1.8 lbf ft) – for plastic housing 1 Nm (0.7 lbf ft).

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)?	❑
Turning the transmitter housing: ▪ Is the fixing screw firmly tightened? ▪ Is the connection compartment cover screwed on tightly? ▪ Is the securing clamp firmly tightened?	❑
Turning the display module: ▪ Is the connection compartment cover screwed on tightly? ▪ Is the securing clamp firmly tightened?	❑

5 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

- ▶ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
- ▶ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 16 A) should be integrated into the system installation.

5.1 Electrical safety

In accordance with applicable national regulations.

5.2 Connection conditions

5.2.1 Required tools

- Torque wrench
- For cable entries: Use corresponding tools
- Wire stripper
- When using stranded cables: Crimper for wire end ferrule

5.2.2 Requirements for connecting 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.

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

Standard installation cable is sufficient.

Signal cable

EtherNet/IP

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of ODVA Organization

Connecting cable for remote version

In the case of the remote version, the sensor is connected to the transmitter via an electrode cable and a coil current cable.

For detailed information about the specification of the connecting cables, see the Operating Instructions for the device → 3

Operation in environments with strong electrical interference

Grounding is by means of the ground terminal provided for the purpose inside the connection housing. The stripped and twisted lengths of cable shield to the ground terminal must be as short as possible.

Cable diameter

- Cable glands supplied:
  - For standard cable: M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
  - For reinforced cable: M20 × 1.5 with cable ϕ 9.5 to 16 mm (0.37 to 0.63 in)
- (Plug-in) spring terminals for wire cross-sections 0.5 to 2.5 mm^2 (20 to 14 AWG)

5.2.3 Terminal assignment

In addition to the inputs and outputs available, information on the terminal assignment for the electrical connection can be found on the connection nameplate on the main electronics module.

For detailed information on the terminal assignment, see the Operating Instructions for the device → 3

5.2.4 Preparing the measuring device

Carry out the steps in the following order:

1. Mount the sensor and transmitter.
2. Connection housing, sensor: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect signal cable and cable for supply voltage.

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

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

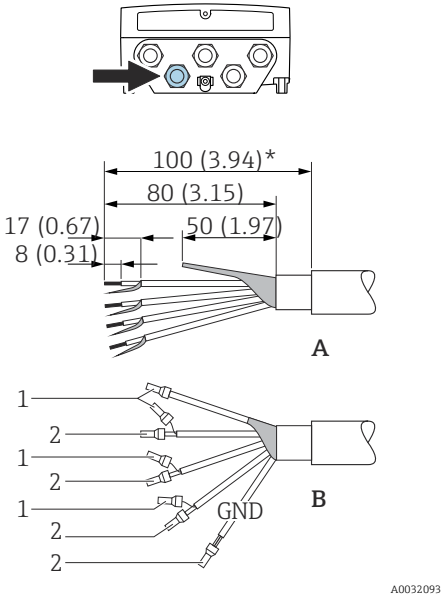
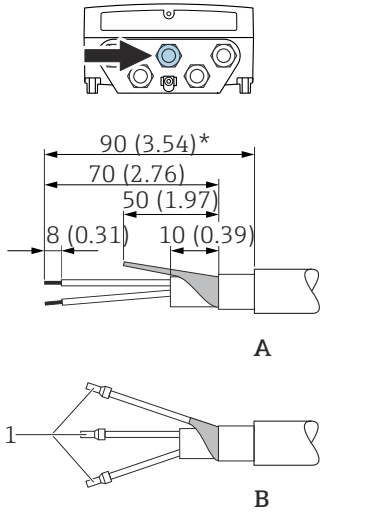
1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 19.

5.2.5 Preparing the connecting cable for the remote version

When terminating the connecting cable, pay attention to the following points:

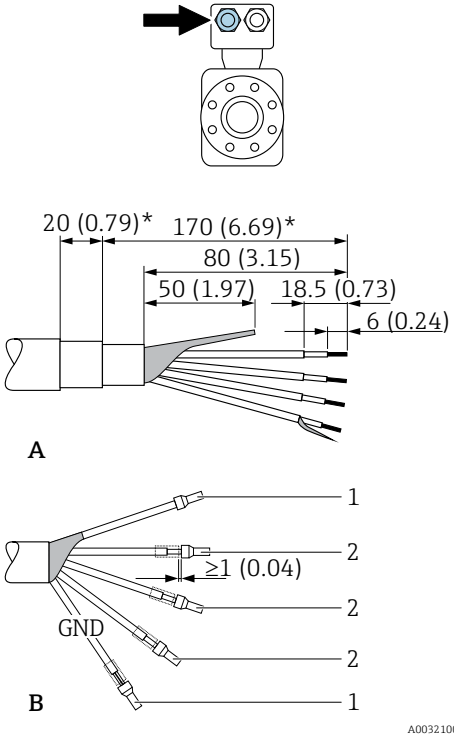
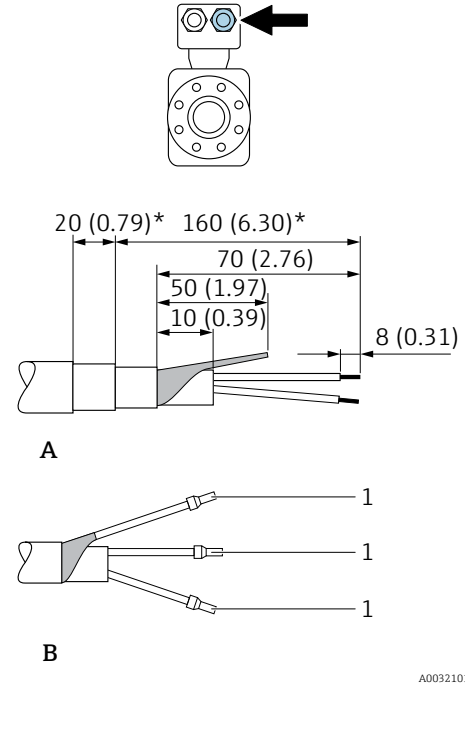
1. In the case of the electrode cable:
   Make sure that the ferrules do not touch the core shields on the sensor side. Minimum distance = 1 mm (exception: green “GND” cable)
2. In the case of the coil current cable:
   Insulate one core of the three-core cable at the level of the core reinforcement. You only require two cores for the connection.
3. For cables with fine-wire cores (stranded cables):
   Fit the cores with ferrules.

Transmitter

Electrode cable	Coil current cable
	
1 *Engineering unit mm (in)*	2 *Engineering unit mm (in)*

A = Termination of the cables
B = Termination of the fine-wire cores with ferrules
1 = Red ferrules, ϕ 1.0 mm (0.04 in)
2 = White ferrules, ϕ 0.5 mm (0.02 in)
* = Stripping only for reinforced cables

Sensor

Electrode cable	Coil current cable
	

A = Termination of the cables
B = Termination of the fine-wire cores with ferrules
1 = Red ferrules, ⌀ 1.0 mm (0.04 in)
2 = White ferrules, ⌀ 0.5 mm (0.02 in)
* = Stripping only for reinforced cables

5.3 Connecting the measuring device

⚠ WARNING

Risk of electric shock! Components carry dangerous voltages!

- Have electrical connection work carried out by correspondingly trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Observe grounding concept of the plant.
- Never mount or wire the measuring device while it is connected to the supply voltage.
- Before the supply voltage is applied, connect the protective ground to the measuring device.

5.3.1 Connecting the remote version

⚠ WARNING

Risk of damaging the electronic components!

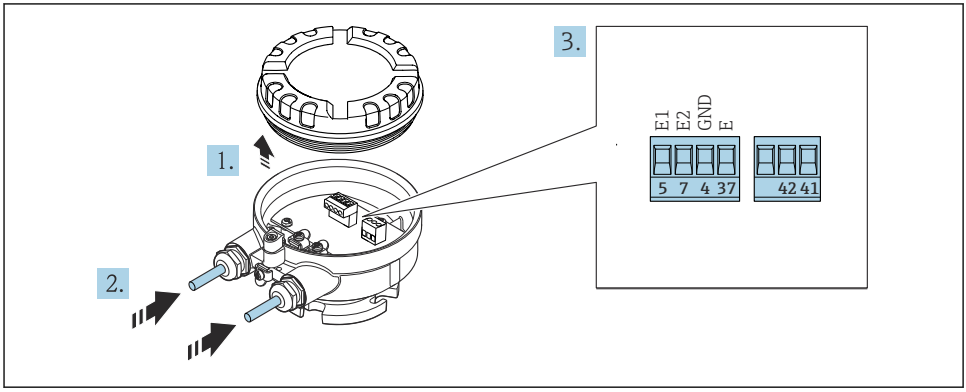
- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.
- Ground the connection housing of the sensor via the external screw terminal.

The following procedure (in the action sequence given) is recommended for the remote version:

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

Connecting the connecting cable to the sensor connection housing

Promag D



3 Sensor: connection module

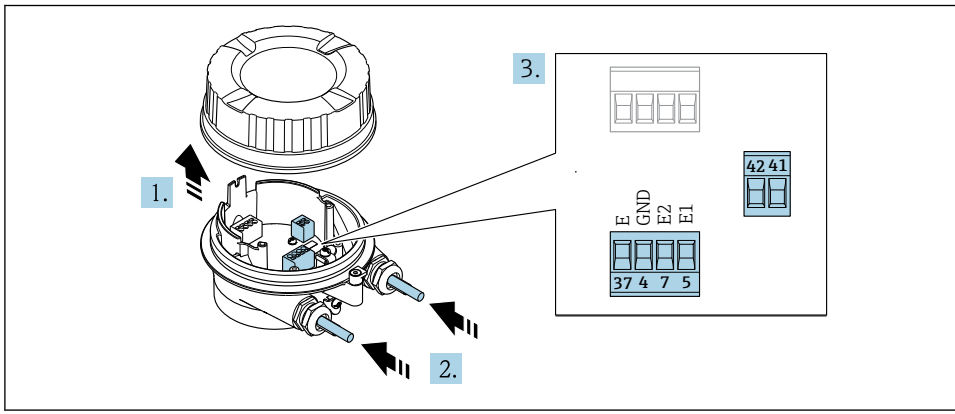
1. Loosen the securing clamp of the housing cover.

2. Unscrew and lift off the housing 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 ferrules → 21.
5. Connect the cable in accordance with the terminal assignment .
6. Firmly tighten the cable glands.
7. **WARNING**

   Housing degree of protection may be 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.

   Reverse the procedure to reassemble the sensor.

Promag L and W



4 *Sensor: connection module*

1. Loosen the securing clamp of the housing cover.
2. Unscrew and lift off the housing cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. **NOTICE**

   For conduit extensions:
   - Fit O-ring on cable and push it back sufficiently. When inserting the cable, the O-ring must be located outside the conduit extension.

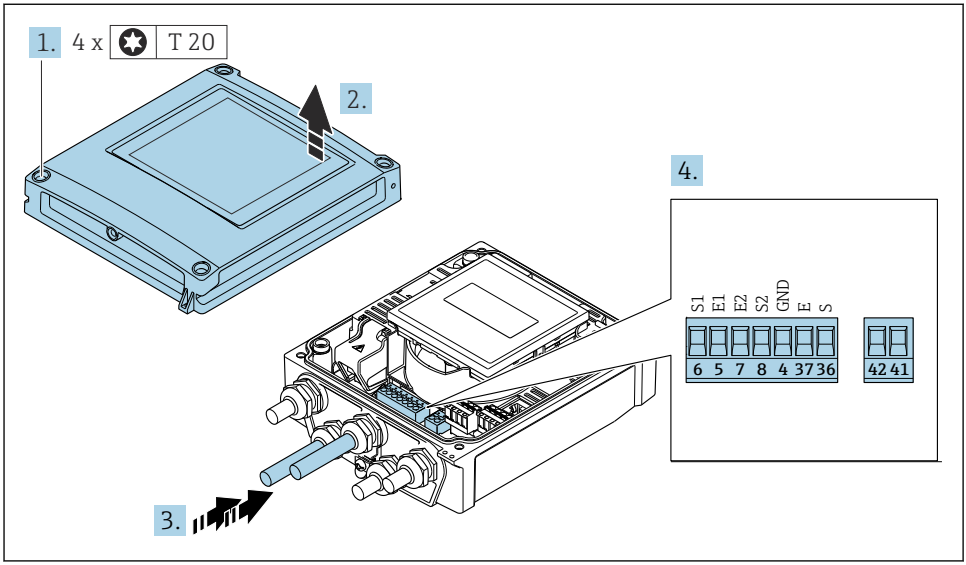
   Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.

5. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules → 21.
6. Connect the cable in accordance with the terminal assignment .
7. Firmly tighten the cable glands.
8. **WARNING**

   Housing degree of protection may be 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.

   Reverse the procedure to reassemble the sensor.

Connecting the connecting cable to the transmitter



5 *Transmitter: main electronics module with terminals*

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing 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 ferrules → 21.
5. Connect the cable in accordance with the terminal assignment .
6. Firmly tighten the cable glands.

7. **⚠ WARNING**

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

- ▶ Screw in the screw without using any lubricant.

Reverse the removal procedure to reassemble the transmitter.

5.3.2 Connecting the transmitter

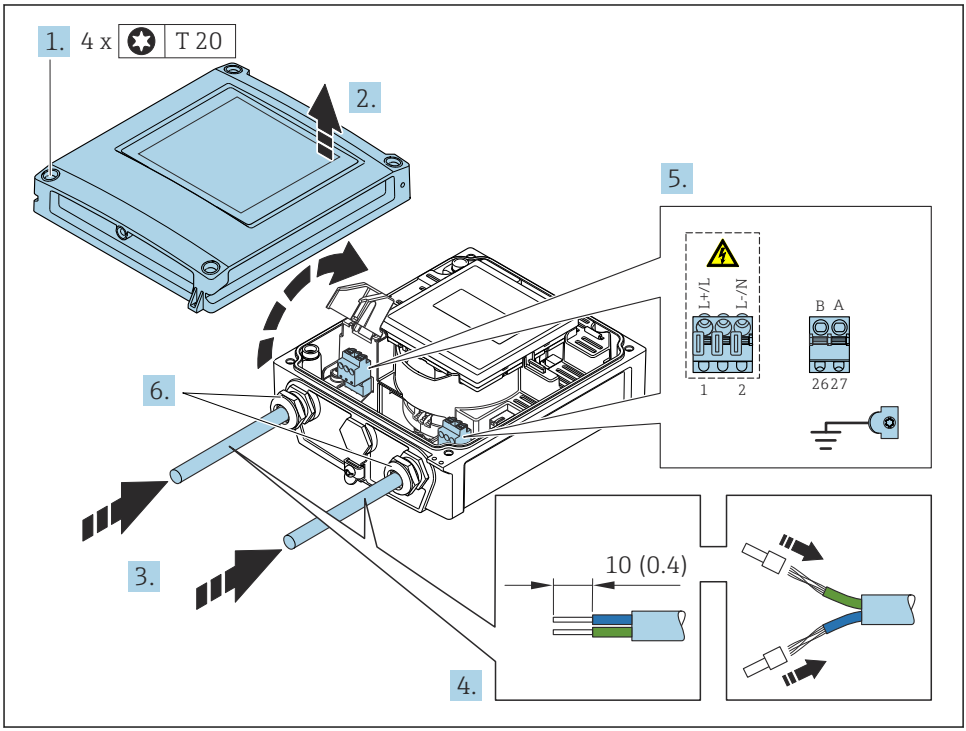
WARNING

Housing degree of protection may be 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.

Tightening torques for plastic housing

Housing cover fixing screw	1 Nm (0.7 lbf ft)
Cable entry	5 Nm (3.7 lbf ft)
Ground terminal	2.5 Nm (1.8 lbf ft)

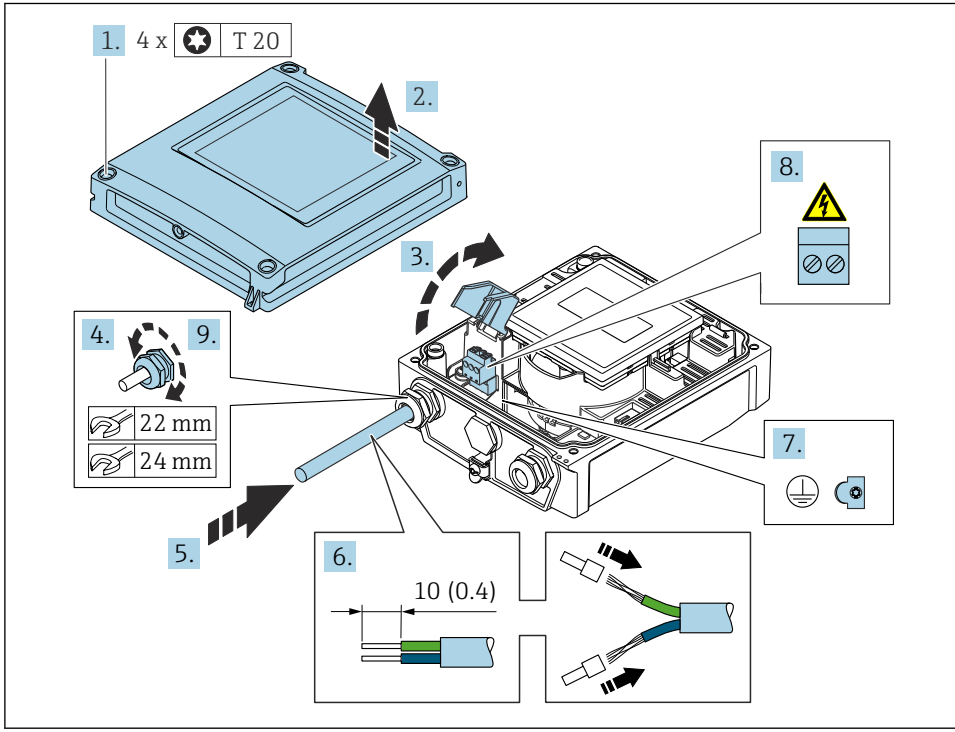


6 *Connecting the supply voltage and EtherNet/IP*

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing 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 ferrules.

5. Connect the cables according to the connection nameplate on the main electronics module, for supply voltage: open the shock protection cover.
6. Firmly tighten the cable glands.

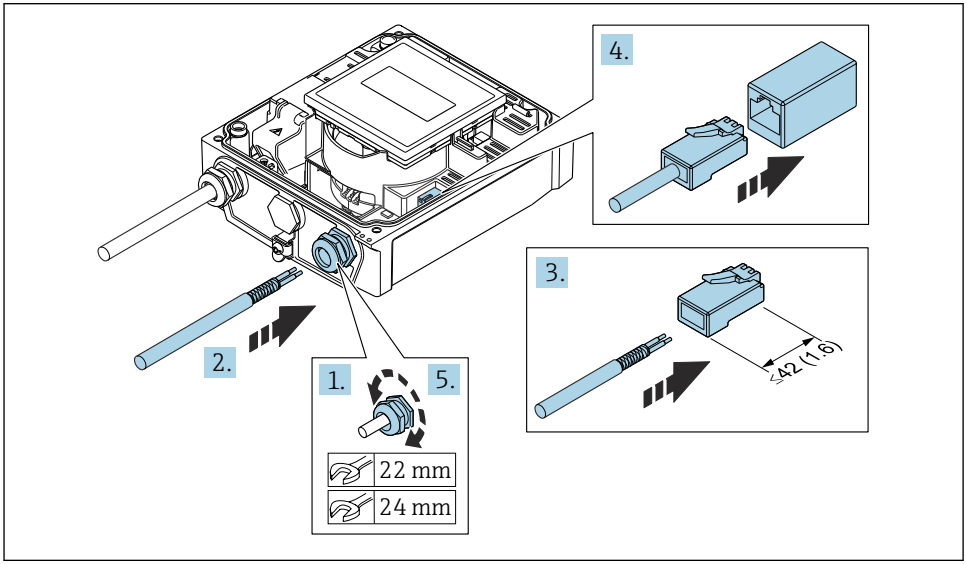
Connecting the supply voltage



A0038184

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Open the shock protection cover.
4. Release the cable gland.
5. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
6. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
7. Connect the protective ground.
8. Connect the cable in accordance with the terminal assignment .
9. Firmly tighten the cable gland.

Mounting the RJ45 connector



A0038185

1. Release the cable gland.
2. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
3. Strip the cable and cable ends and connect to the RJ45 connector.
4. Plug in the RJ45 connector.
5. Firmly tighten the cable gland.

Reassembling the transmitter

1. Close the shock protection cover.
2. Close the housing cover.
3. **⚠ WARNING**

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

   ▶ Screw in the screw without using any lubricant.

   Tighten the 4 fixing screws on the housing cover.

5.4 Ensuring potential equalization

5.4.1 Introduction

Correct potential equalization (equipotential bonding) is a prerequisite for stable and reliable flow measurement. Inadequate or incorrect potential equalization can result in device failure and present a safety hazard.

The following requirements must be observed to ensure correct, trouble-free measurement:
- The principle that the medium, the sensor and the transmitter must be at the same electrical potential applies.
- Take in-company grounding guidelines, materials and the grounding conditions and potential conditions of the pipe into consideration.
- Any necessary potential equalization connections must be established by ground cables with a minimum cross-section of 6 mm^2 (0.0093 in^2).
- In the case of remote device versions, the ground terminal in the example always refers to the sensor and not to the transmitter.

You can order accessories like the ground cable and ground disks from Endress+Hauser: Operating Instructions for the device → 3

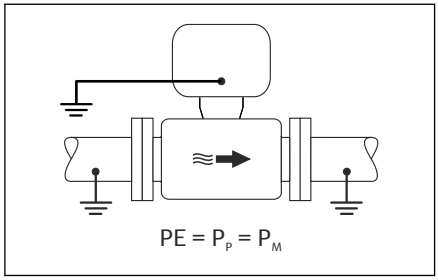
For devices intended for use in hazardous locations, please observe the instructions in the Ex documentation (XA) → 3

Abbreviations used
- PE (Protective Earth): potential at the protective earth terminals of the device
- P_P (Potential Pipe): potential of the pipe, measured at the flanges
- P_M (Potential Medium): potential of the medium

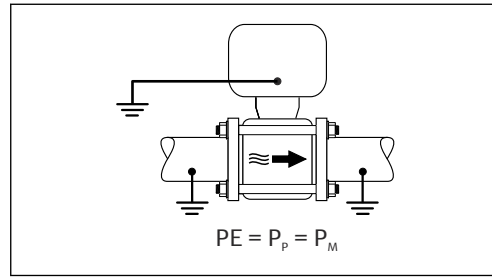
5.4.2 Connection examples for standard situations

Unlined and grounded metal pipe
- Potential equalization is via the measuring pipe.
- The medium is set to ground potential.

Starting conditions:
- Pipes are correctly grounded on both sides.
- Pipes are conductive and at the same electrical potential as the medium



7 *Promag L, W*



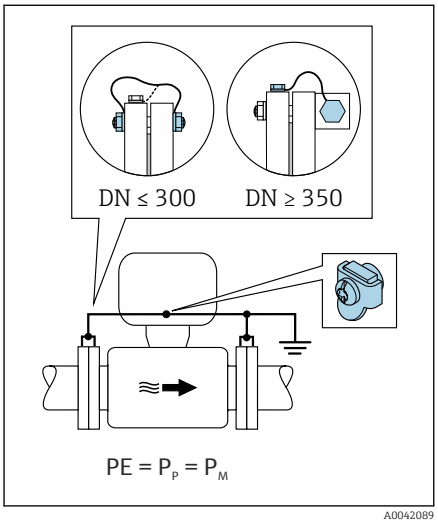
8 *Promag D*

- ▶ Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

Promag L, W: Metal pipe without liner

- Potential equalization is via the ground terminal and pipe flanges.
- The medium is set to ground potential.

Starting conditions:
- Pipes are not sufficiently grounded.
- Pipes are conductive and at the same electrical potential as the medium



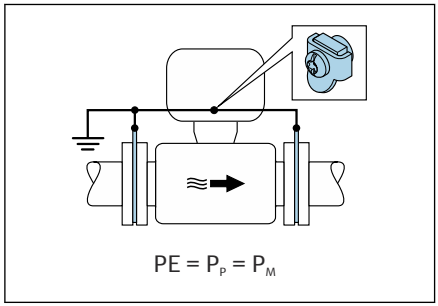
9 *Promag L, W*

1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.
3. If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
4. If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe the screw tightening torques: see the Brief Operating Instructions for the sensor.

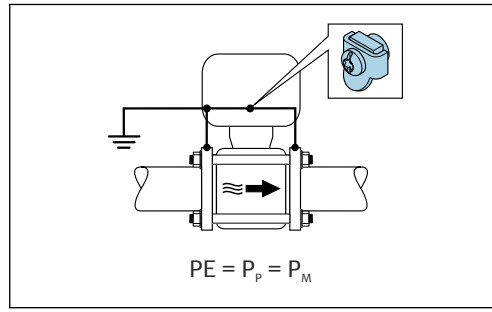
Plastic pipe or pipe with insulating liner

- Potential equalization is established via:
  - Promag D: Ground terminal and flanges
  - Promag L, W: Ground terminal and ground disks
- The medium is set to ground potential.

Starting conditions:
- The pipe has an insulating effect.
- Low-impedance medium grounding close to the sensor is not guaranteed.
- Equalizing currents through the medium cannot be ruled out.



10 *Promag L, W*



11 *Promag D*

Promag D

1. Connect flanges to the ground terminal of the transmitter's or sensor's connection housing via the ground cable.
2. Connect the connection to ground potential.

Promag L and W

1. Connect ground disks to the ground terminal of the transmitter's or sensor's connection housing via the ground cable.
2. Connect the connection to ground potential.

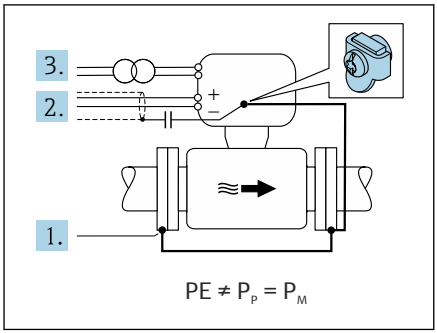
5.4.3 Connection example with the potential of the medium not equal to the protective ground

In these cases, the medium potential can differ from the potential of the device.

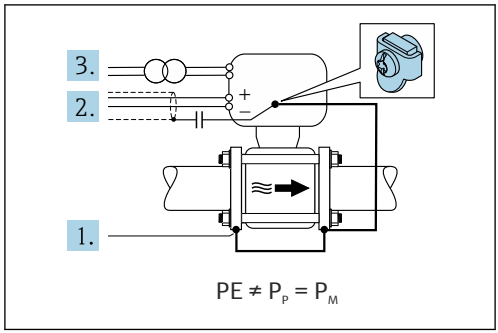
Metal, ungrounded pipe

The sensor and transmitter are installed in a way that provides electrical insulation from PE, e.g. applications for electrolytic processes or systems with cathodic protection.

Starting conditions:
- Unlined metal pipe
- Pipes with an electrically conductive liner



12 *Promag L, W*



13 *Promag D*

1. Connect the pipe flanges and transmitter via the ground cable.
2. Route the shielding of the signal lines via a capacitor (recommended value 1.5µF/50V).
3. Device connected to power supply such that it is floating in relation to the protective earth (isolation transformer). This measure is not required in the case of 24V DC supply voltage without PE (= SELV power unit).

5.4.4 Promag W: Connection examples with the potential of the medium not equal to the protective ground with the "Measurement isolated from ground" option

In these cases, the medium potential can differ from the potential of the device.

Introduction

The "Measurement isolated from ground" option enables the galvanic isolation of the measuring system from the device potential. This minimizes harmful equalizing currents caused by differences in potential between the medium and the device. The "Measurement isolated from ground" option is optionally available: order code for "Sensor option", option CV

Operating conditions for the use of the "Measurement isolated from ground" option

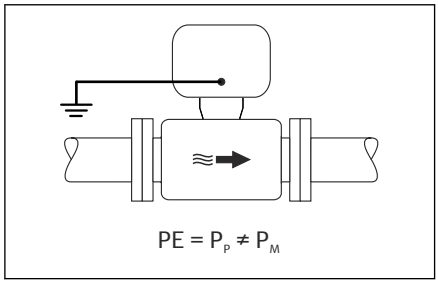
Device version	Compact version and remote version (Length of connecting cable ≤ 10 m)
Differences in voltage between medium potential and device potential	As small as possible, usually in the mV range
Alternating voltage frequencies in the medium or at ground potential (PE)	Below typical power line frequency in the country

- To achieve the specified conductivity measuring accuracy, a conductivity calibration is recommended when the device is installed.
- A full pipe adjustment is recommended when the device is installed.

Plastic pipe

Sensor and transmitter are correctly grounded. A difference in potential can occur between the medium and protective earth. Potential equalization between P_M and PE via the reference electrode is minimized with the "Measurement isolated from ground" option.

Starting conditions:
- The pipe has an insulating effect.
- Equalizing currents through the medium cannot be ruled out.



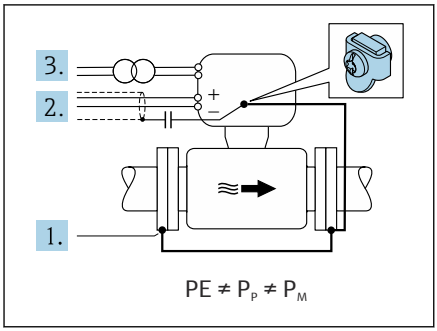
14 Promag W

1. Use the "Measurement isolated from ground" option, while observing the operating conditions for measurement isolated from ground.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

Metal, ungrounded pipe with insulating liner

The sensor and transmitter are installed in a way that provides electrical insulation from PE. The medium and pipe have different potentials. The "Measurement isolated from ground" option minimizes harmful equalizing currents between P_M and P_P via the reference electrode.

Starting conditions:
- Metal pipe with insulating liner
- Equalizing currents through the medium cannot be ruled out.



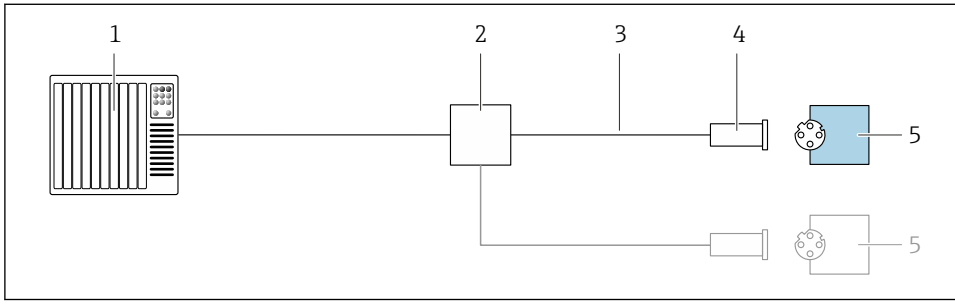
15 Promag W

1. Connect the pipe flanges and transmitter via the ground cable.
2. Route the shielding of the signal cables via a capacitor (recommended value 1.5µF/ 50V).
3. Device connected to power supply such that it is floating in relation to the protective earth (isolation transformer). This measure is not required in the case of 24V DC supply voltage without PE (= SELV power unit).
4. Use the "Measurement isolated from ground" option, while observing the operating conditions for measurement isolated from ground.

5.5 Special connection instructions

5.5.1 Connection examples

EtherNet/IP



16 *Connection example for EtherNet/IP*

1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications*
4 *Device plug*
5 *Transmitter*

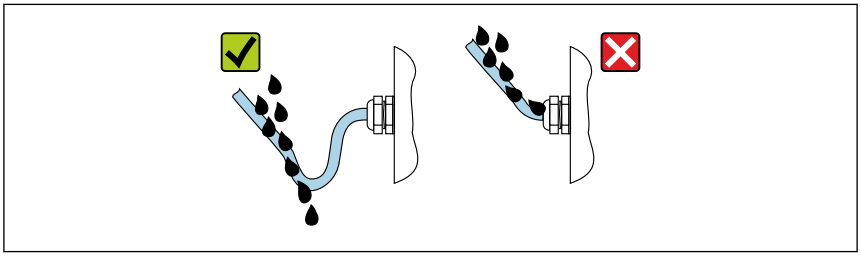
5.6 Ensuring the degree of protection

5.6.1 Degree of protection IP66/67, Type 4X enclosure

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

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

1. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
2. Tighten all housing screws and screw covers.
3. Firmly tighten the cable glands.
4. 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

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

NOTICE

Standard dummy plugs used for transportation do not have the appropriate degree of protection and can result in damage to the device!

▶ Use suitable dummy plugs corresponding to the degree of protection.

5.6.2 Degree of protection IP68, Type 6P enclosure, with "Cust-potted" option

Depending on the version, the sensor meets all the requirements of IP68 degree of protection, Type 6P enclosure and can be used as a remote version .

The degree of protection of the transmitter is always only IP66/67, Type 4X enclosure and the transmitter must therefore be treated accordingly → 38.

To guarantee IP68 degree of protection, Type 6P enclosure for the "Cust-potted" options, carry out the following steps after the electrical connection:

1. Firmly tighten the cable glands (torque: 2 to 3.5 Nm) until there is no gap between the bottom of the cover and the housing support surface.
2. Firmly tighten the union nut of the cable glands.
3. Pot the field housing with a potting compound.

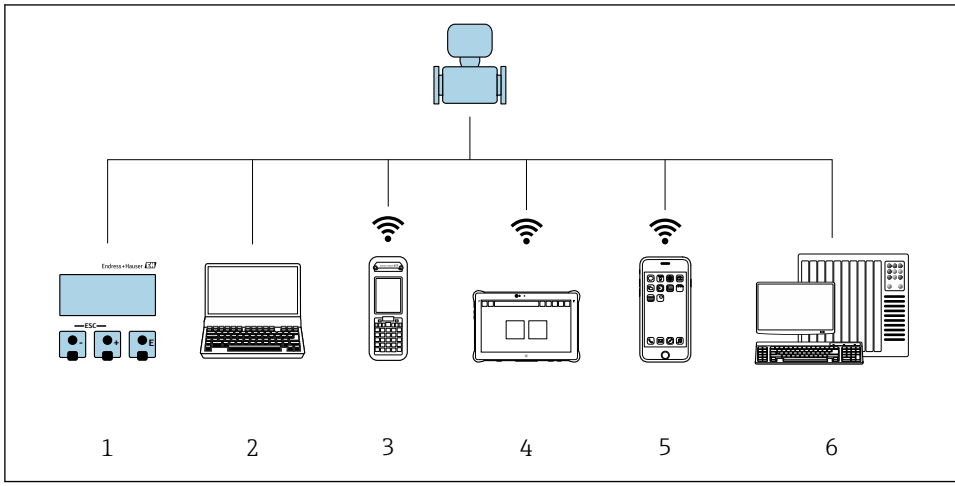
4. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
5. Tighten all housing screws and screw covers (torque: 20 to 30 Nm).

5.7 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used meet the requirements → 🖹 19?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 38?	❑
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 → 🖹 20?	❑
If supply voltage is present, do values appear on the display module?	❑
Is the potential equalization established correctly ?	❑
Are all housing covers installed and the screws tightened with the correct tightening torque?	❑

6 Operation options

6.1 Overview of operation methods



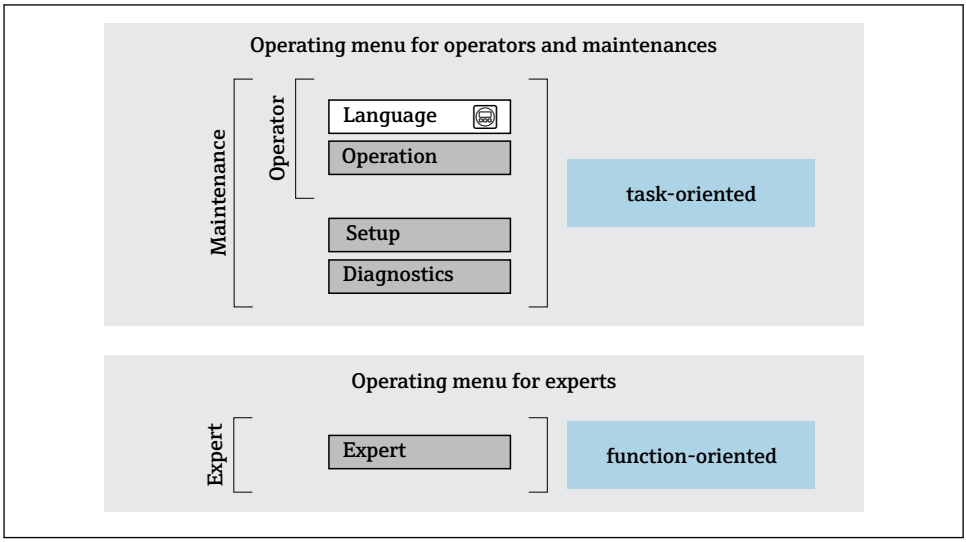
A0046501

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 *Field Xpert SFX350 or SFX370*
4 *Field Xpert SMT70*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

For custody transfer, once the device has been put into circulation or sealed, its operation is restricted.

6.2 Structure and function of the operating menu

6.2.1 Structure of the operating menu



17 *Schematic structure of the operating menu*

6.2.2 Operating philosophy

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

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

For custody transfer, once the device has been put into circulation or sealed, its operation is restricted.

6.3 Access to the operating menu via the Web browser

6.3.1 Function scope

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) . The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed, allowing users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

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

6.3.2 Prerequisites

Computer hardware

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

Computer software

Software	Interface	
	CDI-RJ45	**WLAN**

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

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

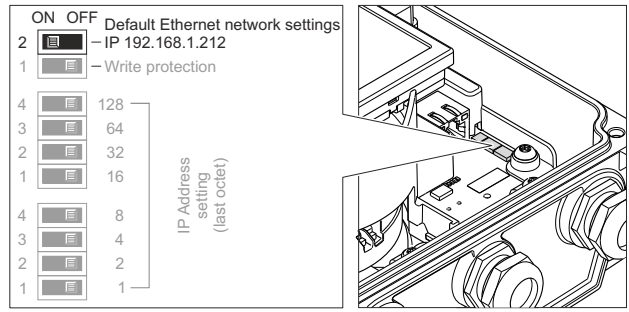
Computer settings

Settings	Interface	
	CDI-RJ45	**WLAN**
User rights	Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (for adjusting the IP address, subnet mask etc.).	
Proxy server settings of the Web browser	The Web browser setting *Use a Proxy Server for Your LAN* must be **deselected** .	
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser.	
Network connections	Only the active network connections to the measuring device should be used.	
	Switch off all other network connections such as WLAN.	Switch off all other network connections.

In the event of connection problems:

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
IP address	If the IP address of the device is not known: ▪ The IP address can be read out via local operation: Diagnostics → Device information → IP address ▪ Communication with the Web server can be established via the default IP address 192.168.1.212. The DHCP function is enabled in the device at the factory, i.e. the device expects an IP address to be assigned by the network. This function can be disabled and the device can be set to the default IP address 192.168.1.212: set DIP switch No. 2 from **OFF** → **ON**.

Device	CDI-RJ45 service interface
	 ▪ Once the DIP switch has been activated, the device must be restarted before the device uses the default IP address. ▪ If the default IP address is used (top DIP switch No. 2 = ON), there is no connection to the EtherNet/IP network.

Measuring device: via WLAN interface

Device	WLAN interface
Measuring device	The measuring device has a WLAN antenna: Transmitter with integrated WLAN antenna
Web server	Web server and WLAN must be enabled; factory setting: ON
IP address	If the IP address of the device is not known: ▪ The IP address can be read out via local operation: Diagnostics → Device information → IP address ▪ Communication with the Web server can be established via the default IP address 192.168.1.212. The DHCP function is enabled in the device at the factory, i.e. the device expects an IP address to be assigned by the network. This function can be disabled and the device can be set to the default IP address 192.168.1.212: set DIP switch No. 2 from **OFF** → **ON**. ▪ Once the DIP switch has been activated, the device must be restarted before the device uses the default IP address. ▪ If the default IP address is used (top DIP switch No. 2 = ON), there is no connection to the EtherNet/IP network.

6.3.3 Establishing a connection

Via service interface (CDI-RJ45)

Preparing the measuring device

Configuring the Internet protocol of the computer

The IP address can be assigned to the measuring device in a variety of ways:
- Dynamic Host Configuration Protocol (DHCP), factory setting:
  The IP address is automatically assigned to the measuring device by the automation system (DHCP server).
- Hardware addressing:
  The IP address is set via DIP switches .
- Software addressing:
  The IP address is entered via the **IP address** parameter .
- DIP switch for "Default IP address":
  To establish the network connection via the service interface (CDI-RJ45): the fixed IP address 192.168.1.212 is used .

The measuring device works with the Dynamic Host Configuration Protocol (DHCP), on leaving the factory, i.e. the IP address of the measuring device is automatically assigned by the automation system (DHCP server).

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

1. Via DIP switch 2, activate the default IP address 192.168.1.212: .
2. Switch on the measuring device.
3. Connect to the computer using a cable .
4. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
5. Close any open Internet browsers.
6. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

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

Via WLAN interface

Configuring the Internet protocol of the mobile terminal

NOTICE

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

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

NOTICE

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

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

Preparing the mobile terminal

- ▶ Enable WLAN reception on the mobile terminal.

Establishing a connection from the mobile terminal to the measuring device

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Promag__A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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

Disconnecting

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

Starting the Web browser

1. Start the Web browser on the computer.

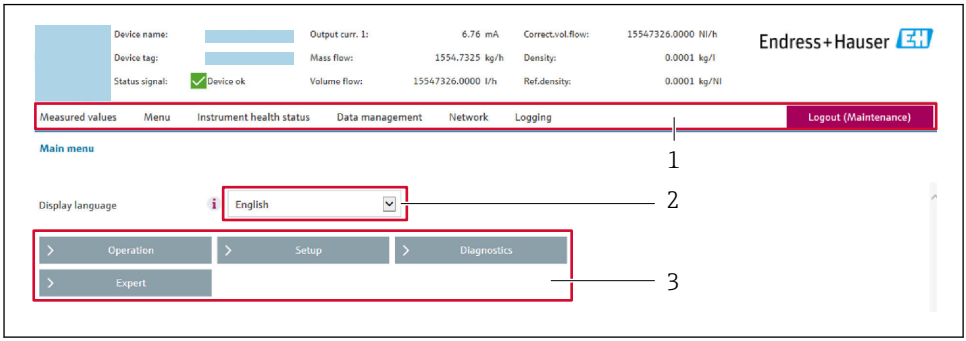
2. Enter the IP address of the Web server in the address line of the Web browser: 192.168.1.212
   ↳ The login page appears.

If a login page does not appear, or if the page is incomplete, see the Special Documentation for the Web server

6.3.4 Logging on

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

6.3.5 User interface



A0029418

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

Header

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

Function row

Functions	Meaning
Measured values	Displays the measured values of the device
Menu	▪ Access to the operating menu from the measuring device ▪ The structure of the operating menu is the same as for the local display For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device

Functions	Meaning
Device status	Displays the diagnostic messages currently pending, listed in order of priority

Data management	Data exchange between PC and measuring device:
	▪ Device configuration:
	  ▪ Load settings from the device (XML format, save configuration)
	  ▪ Save settings to the device (XML format, restore configuration)
	▪ Logbook - Export Event logbook (.csv file)
	▪ Documents - Export documents:
	  ▪ Export backup data record (.csv file, create documentation of the measuring point configuration)
	  ▪ Verification report (PDF file, only available with the "Heartbeat Verification" application package)
	▪ File for system integration - If using fieldbuses, upload device drivers for system integration from the measuring device:
	EtherNet/IP: EDS file

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

Navigation area

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

Working area

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

6.3.6 Disabling the Web server

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

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection
Web server functionality	Switch the Web server on and off.	▪ Off ▪ On

Function scope of the "Web server functionality" parameter

Option	Description
Off	▪ The web server is completely disabled. ▪ Port 80 is locked.
On	▪ The complete functionality of the web server is available. ▪ JavaScript is used. ▪ The password is transferred in an encrypted state. ▪ Any change to the password is also transferred in an encrypted state.

Enabling the Web server

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:
- Via local display
- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

6.3.7 Logging out

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

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. If no longer needed:
   Reset modified properties of the Internet protocol (TCP/IP) → 46.

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

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 System integration

For detailed information on system integration, see the Operating Instructions for the device → 3

A detailed description of how to integrate the device into an automation system (e.g. from Rockwell Automation) is available as a separate document:
www.endress.com→ Select your country → Solutions → Fieldbus planning → Fieldbus technologies → EtherNet/IP

8 Commissioning

8.1 Function check

Before commissioning the measuring device:

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

- "Post-installation check" checklist → 18
- "Post-connection check" checklist → 40

8.2 Switching on the measuring device

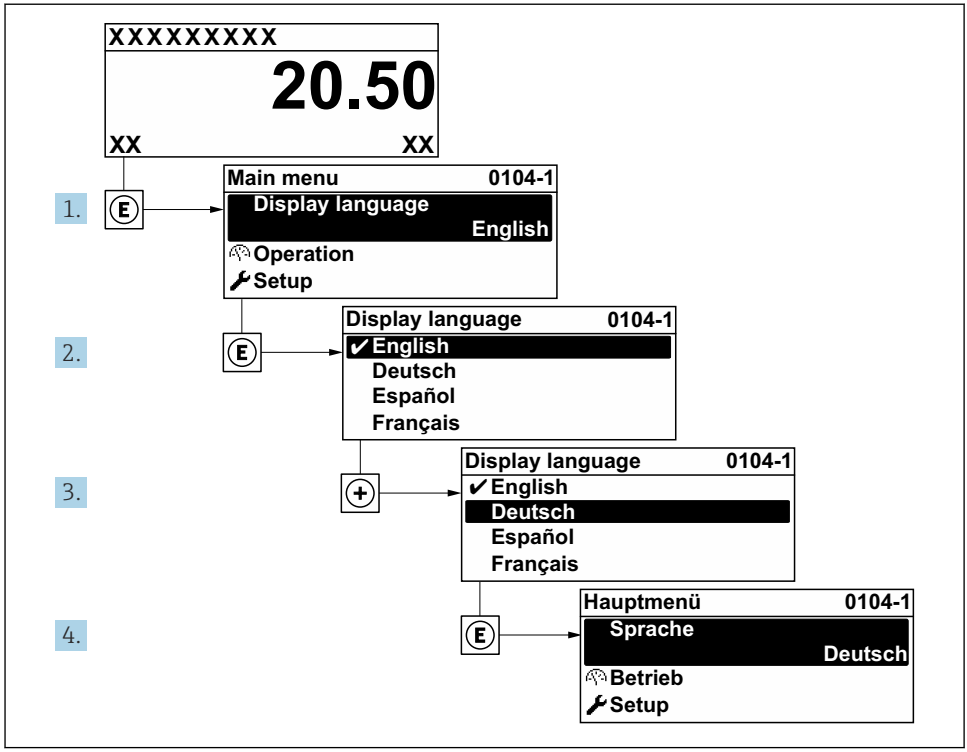
▶ After a successful function check, switch on the measuring device.

↳ After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the Operating Instructions for the device → 3

8.3 Setting the operating language

Factory setting: English or ordered local language



18 *Taking the example of the local display*

8.4 Configuring the measuring device

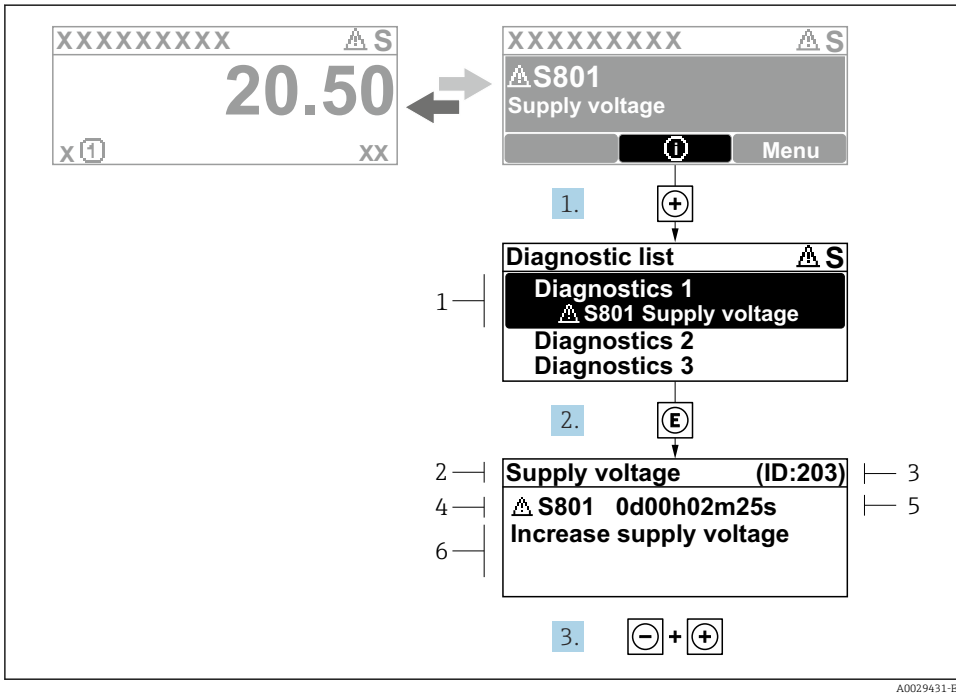
The **Setup** menu with its submenus is used to commission the measuring device quickly. The submenus contain all the parameters required for configuration, such as parameters for measurement or communication.

For detailed information on the parameters of the device, see the Description of Device Parameters → 3

Submenu	Configuration
System	Display, diagnostic settings, administration
Sensor	Measured values, system units, process parameters, external compensation, sensor adjustment, calibration
Communication	Configuration, WLAN settings
Application	Totalizer
Diagnostics	Diagnostics list, event logbook, device information, simulation

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.



19 *Message about remedial measures*

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

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

www.addresses.endress.com

Endress+Hauser

People for Process Automation