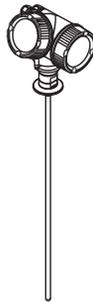


# Brief Operating Instructions Levelflex FMP53 HART

Guided wave radar

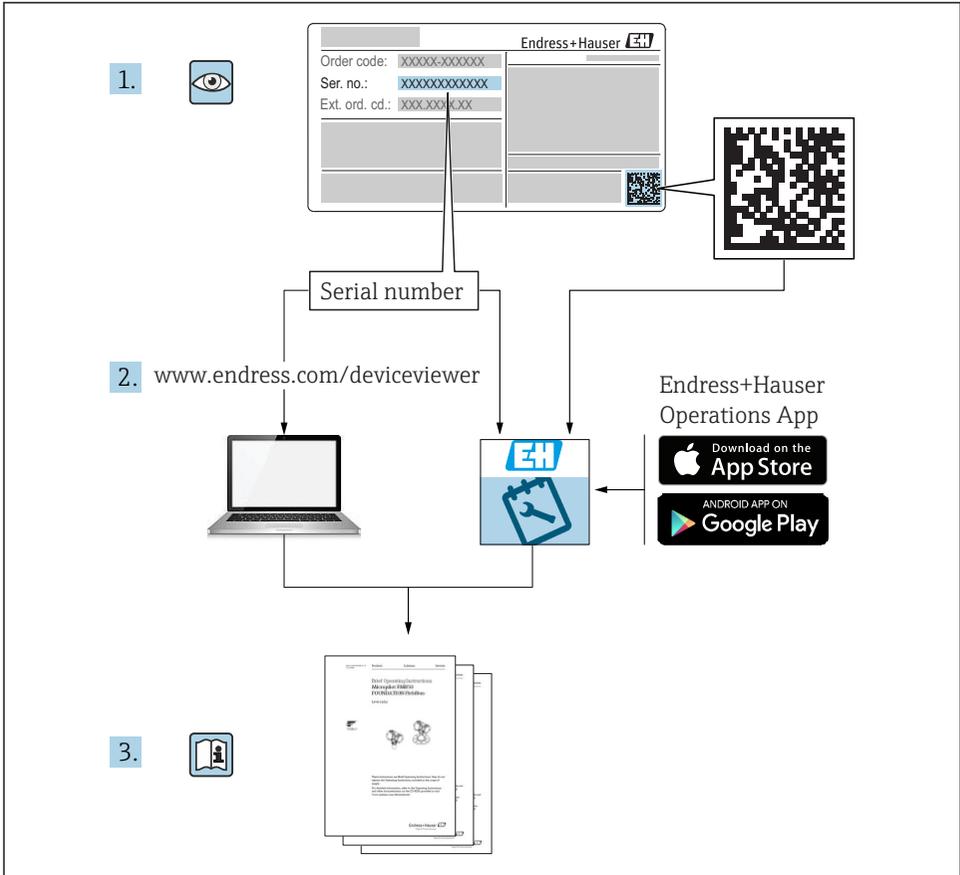


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:

Available for all device versions via:

- Internet: [www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)
- Smart phone/tablet: *Endress+Hauser Operations App*



A0023555

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# 1 Important document information

## 1.1 Symbols

### 1.1.1 Safety symbols

Symbol	Meaning
	<b>DANGER!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	<b>WARNING!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	<b>CAUTION!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	<b>NOTE!</b> This symbol contains information on procedures and other facts which do not result in personal injury.

### 1.1.2 Electrical symbols

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

Symbol	Meaning
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.  The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> <li>▪ Inner ground terminal: Connects the protective earth to the mains supply.</li> <li>▪ Outer ground terminal: Connects the device to the plant grounding system.</li> </ul>

### 1.1.3 Tool symbols

 A0011219	 A0011220	 A0013442	 A0011221	 A0011222
Cross-head screwdriver	Flat blade screwdriver	Torx screwdriver	Allen key	Hexagon wrench

### 1.1.4 Symbols for certain types of information

Symbol	Meaning	Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.		<b>Preferred</b> Procedures, processes or actions that are preferred.
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.		<b>Tip</b> Indicates additional information.
	Reference to documentation.		Reference to page.
	Reference to graphic.	<b>1, 2, 3...</b>	Series of steps.
	Result of a step.		Visual inspection.

### 1.1.5 Symbols in graphics

Symbol	Meaning
<b>1, 2, 3 ...</b>	Item numbers
<b>1, 2, 3...</b>	Series of steps
<b>A, B, C, ...</b>	Views
<b>A-A, B-B, C-C, ...</b>	Sections
	<b>Hazardous area</b> Indicates a hazardous area.
	<b>Safe area (non-hazardous area)</b> Indicates the non-hazardous area.

### 1.1.6 Symbols at the device

Symbol	Meaning
 → 	<b>Safety instructions</b> Observe the safety instructions contained in the associated Operating Instructions.
	<b>Temperature resistance of the connection cables</b> Specifies the minimum value of the temperature resistance of the connection cables.

## 1.2 Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
FieldCare	Scalable software tool for device configuration and integrated plant asset management solutions
DeviceCare	Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices
DTM	Device Type Manager
DD	Device Description for HART communication protocol
$\epsilon_r$ (DC value)	Relative dielectric constant
Operating tool	The term "operating tool" is used in place of the following operating software: <ul style="list-style-type: none"> <li>■ FieldCare / DeviceCare, for operation via HART communication and PC</li> <li>■ SmartBlue (app), for operation using an Android or iOS smartphone or tablet.</li> </ul>
BD	Blocking Distance; no signals are analyzed within the BD.
PLC	Programmable Logic Controller
CDI	Common Data Interface
PFS	Pulse Frequency Status (Switching output)

## 1.3 Registered trademarks

### **HART®**

Registered trademark of the FieldComm Group, Austin, USA

### **Bluetooth®**

The Bluetooth® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

### **Apple®**

Apple, the Apple logo, iPhone, and iPod touch are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

### **Android®**

Android, Google Play and the Google Play logo are trademarks of Google Inc.

### **KALREZ®, VITON®**

Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

### **TEFLON®**

Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

### **TRI CLAMP®**

Registered trademark of Alfa Laval Inc., Kenosha, USA

## 2 Basic 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 measured materials

The measuring device described in these Operating Instructions is intended only for level measurement of liquids. Depending on the version ordered the device can also measure potentially explosive, flammable, poisonous and oxidizing materials.

Observing the limit values specified in the "Technical data" and listed in the Operating Instructions and supplementary documentation, the measuring device may be used for the following measurements only:

- ▶ Measured process variables: level
- ▶ Calculated process variables: Volume or mass in arbitrarily shaped vessels (calculated from the level by the linearization functionality)

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

- ▶ Use the measuring device only for measured materials against which the process-wetted materials are adequately resistant.
- ▶ Observe the limit values in "Technical data".

#### Incorrect use

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

Verification for borderline cases:

- ▶ For special measured materials and cleaning agents, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of wetted materials, but does not accept any warranty or liability.

#### Residual risk

The electronics housing and its built-in components such as display module, main electronics module and I/O electronics module may heat to 80 °C (176 °F) during operation through heat transfer from the process as well as power dissipation within the electronics. During operation the sensor may assume a temperature near the temperature of the measured material.

Danger of burns due to heated surfaces!

- ▶ For high process temperatures: Install protection against contact in order to prevent burns.

## 2.3 Workplace safety

For work on and with the device:

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

With divisible probe rods, medium may penetrate into the joints between the individual parts of the rod. This medium may escape when loosening the joints. In the case of dangerous (e.g. aggressive or toxic) media this may cause injuries.

- ▶ When loosening the joints between the individual parts of the probe rod: Wear appropriate protective equipment according to the medium.

## 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.

### Conversions to the device

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

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

### Repair

To ensure continued operational safety and reliability,

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

### Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):

- ▶ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

## 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.

### NOTICE

#### Loss of degree of protection by opening of the device in humid environments

- ▶ If the device is opened in a humid environment, the degree of protection indicated on the nameplate is no longer valid. This may also impair the safe operation of the device.

### 2.5.1 CE mark

The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

### 2.5.2 EAC conformity

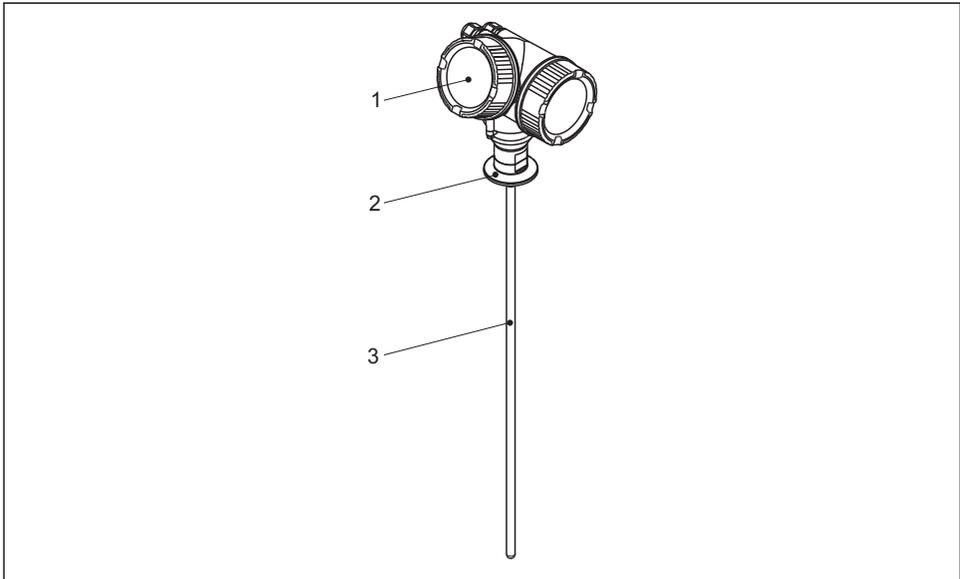
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.

## 3 Product description

### 3.1 Product design

#### 3.1.1 Levelflex FMP53



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#### 1 Design of the Levelflex

- 1 Electronics housing
- 2 Process connection
- 3 Rod probe

## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance

Upon receipt of the goods check the following:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) present?



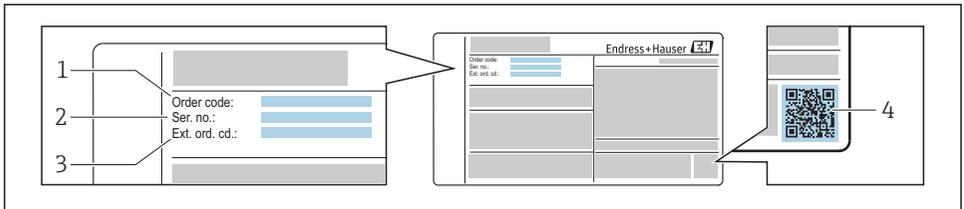
If one of these conditions is not satisfied, contact your Endress+Hauser Sales Center.

### 4.2 Product identification

The following options are available for identification of the measuring device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): All information about the measuring device is displayed.
- Enter the serial number from the nameplates into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information for the measuring device is displayed.

#### 4.2.1 Nameplate



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#### 2 Example of a nameplate

- 1 Order code
- 2 Serial number (Ser. no.)
- 3 Extended order code (Ext. ord. cd.)
- 4 2-D matrix code (QR code)



For detailed information about interpreting the nameplate specifications, refer to the Operating Instructions for the device.



Only 33 digits of the extended order code can be indicated on the nameplate. If the extended order code exceeds 33 digits, the rest will not be shown. However, the complete extended order code can be viewed in the operating menu of the device in the **Extended order code 1 to 3** parameter.

## 5 Storage, Transport

### 5.1 Storage conditions

- Permitted storage temperature:  $-40$  to  $+80$  °C ( $-40$  to  $+176$  °F)
- Use the original packaging.

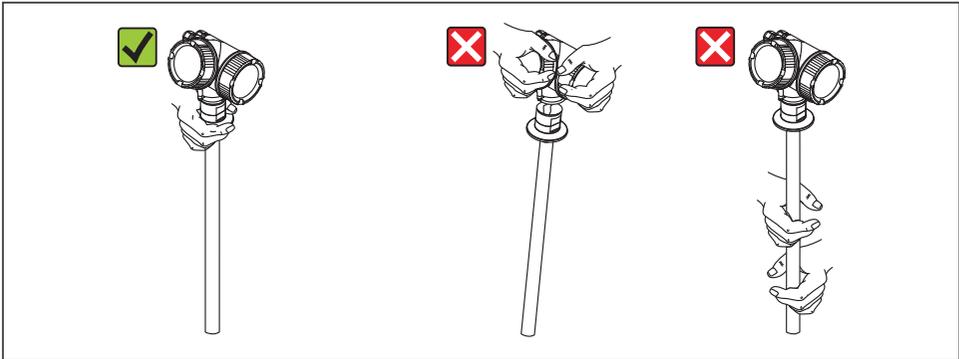
### 5.2 Transport product to the measuring point

#### **⚠ WARNING**

**Housing or probe may be damaged or break away.**

Risk of injury!

- ▶ Transport the measuring device to the measuring point in its original packaging or at the process connection.
- ▶ Do not fasten lifting devices (hoisting slings, lifting eyes etc.) at the housing or the probe but at the process connection. Take into account the mass center of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18kg (39.6lbs) (IEC61010).

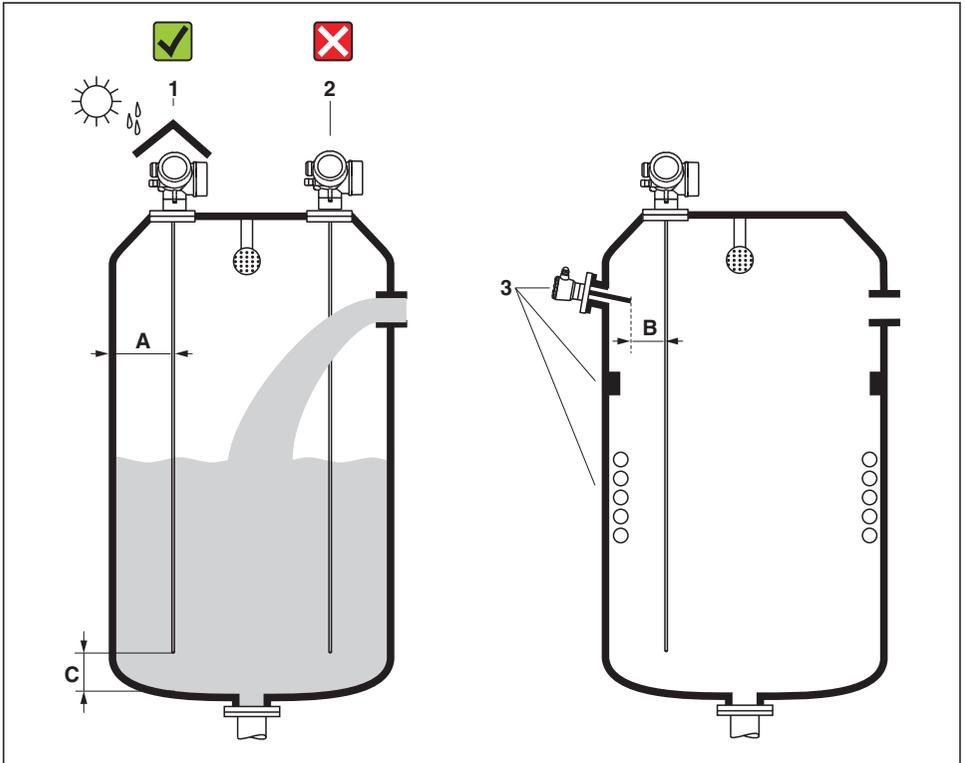


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## 6 Mounting

### 6.1 Mounting requirements

#### 6.1.1 Suitable mounting position



3 Mounting requirements for Levelflex

A0014130

### Mounting distances

- Distance (A) between wall and rod probe:
  - for smooth metallic walls: > 50 mm (2 in)
  - for plastic walls: > 300 mm (12 in) to metallic parts outside the vessel
- Distance (B) between rod probe and internal fittings (3) in the vessel: > 300 mm (12 in)
- When using more than one Levelflex:
  - Minimum distance between the sensor axes: 100 mm (3.94 in)
- Distance (C) from end of probe to bottom of the vessel: > 10 mm (0.4 in).

## 6.2 Mounting the device

### 6.2.1 Required mounting tools

- To shorten rod or coax probes: Saw
- For flanges and other process connections: appropriate mounting tools
- To turn the housing: Hexagonal wrench 8 mm

### 6.2.2 Mounting the "Sensor remote" version

 This section is only valid for devices of the version "Probe Design" = "Sensor remote" (feature 600, option MB or MC).

For the version "Probe design" = "Sensor remote" the following is supplied:

- The probe with the process connection and the connection cable (3m/9ft or 6m/18ft)
- The electronics housing
- The mounting bracket for wall or pipe mounting of the electronics housing

 The connection cable is fixed to the probe on delivery.

 The probe with connection cable and the electronics are adjusted to match each other. They are marked by a common serial number. Only components with the same serial number shall be connected to each other.

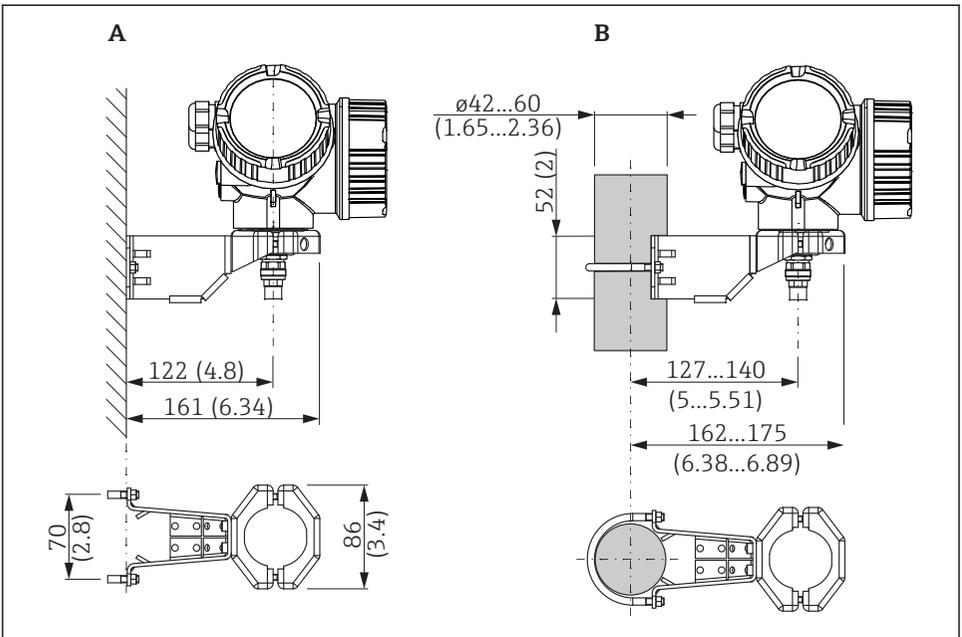
#### CAUTION

**Mechanical stress may damage the plugs of the connection cable or cause accidental loosening of the plugs.**

- ▶ Mount the probe and the electronics housing tightly before connecting the cable.
- ▶ Lay the cable such that it is not exposed to mechanical stress. Minimum bending radius: 50 mm (2").
- ▶ Torque for the coupling nut at the electronics housing: 6 Nm
- ▶ Torque for the coupling nut at the probe: 20 Nm

 If the measuring point is exposed to strong vibrations, an additional locking compound (e.g. Loctite 243) can be applied at the plug connector of the electronics housing.

### Mounting the electronics housing



A0014793

4 *Mounting the electronics housing using the mounting bracket; dimensions: mm (In)*

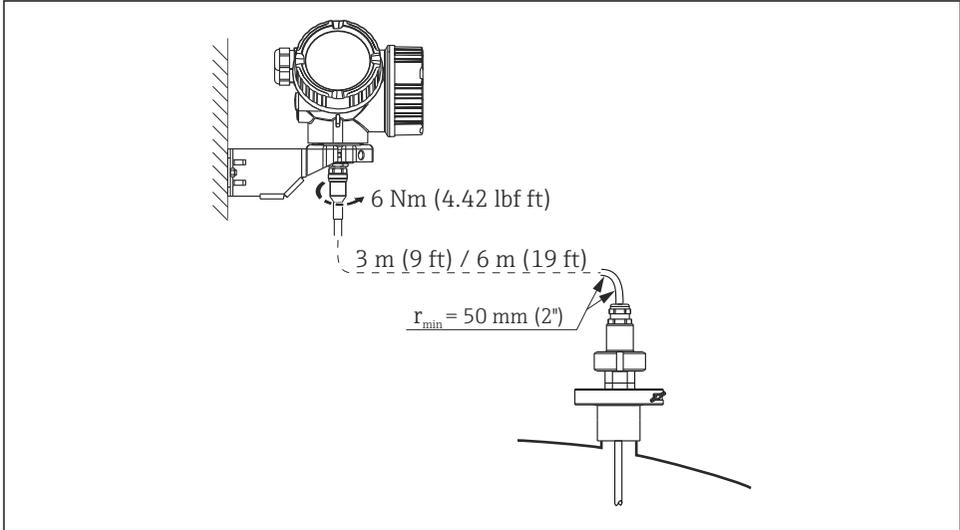
A *Wall mounting*

B *Pipe mounting*

### Connecting the cable

#### Required tools:

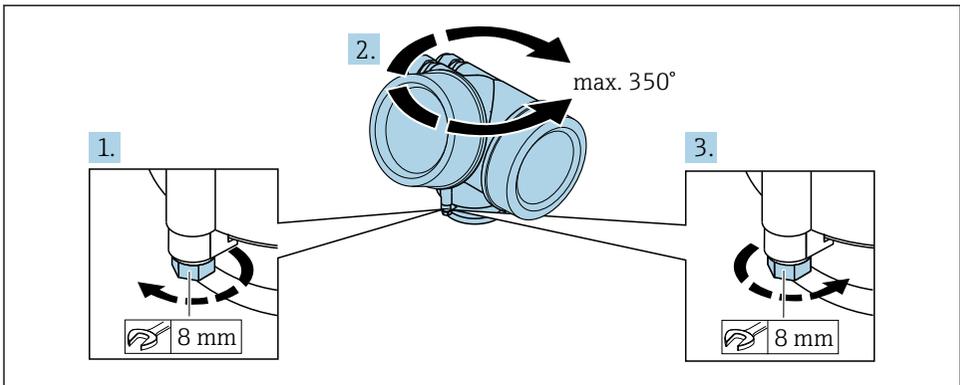
- For the coupling nut at the housing side of the cable: Open-end wrench AF 18mm
- For the coupling nut at the probe side of the cable: 54mm (2.1") hook wrench and 27 mm (1-1/16") open-end wrench



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### 6.2.3 Turning the transmitter housing

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

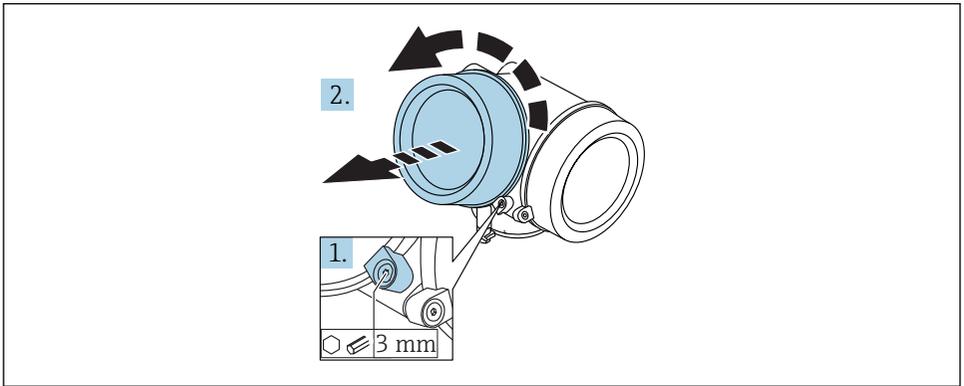


A0032242

1. Unscrew the securing screw using an open-ended wrench.
2. Rotate the housing in the desired direction.
3. Tighten the securing screw (1.5 Nm for plastic housing; 2.5 Nm for aluminum or stainless steel housing).

## 6.2.4 Turning the display

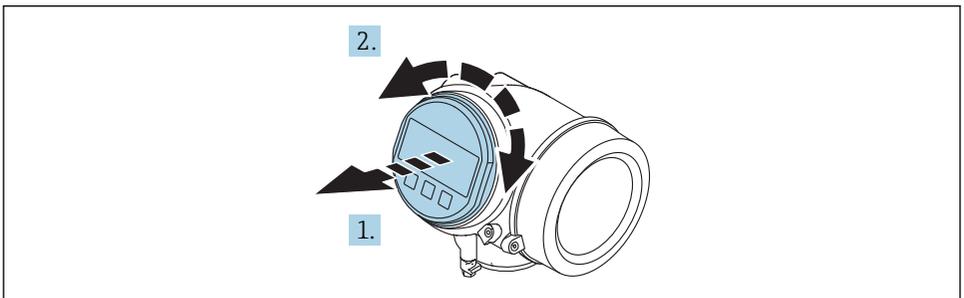
### Opening cover



A0021430

1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
2. Unscrew cover and check lid gasket, replace if necessary.

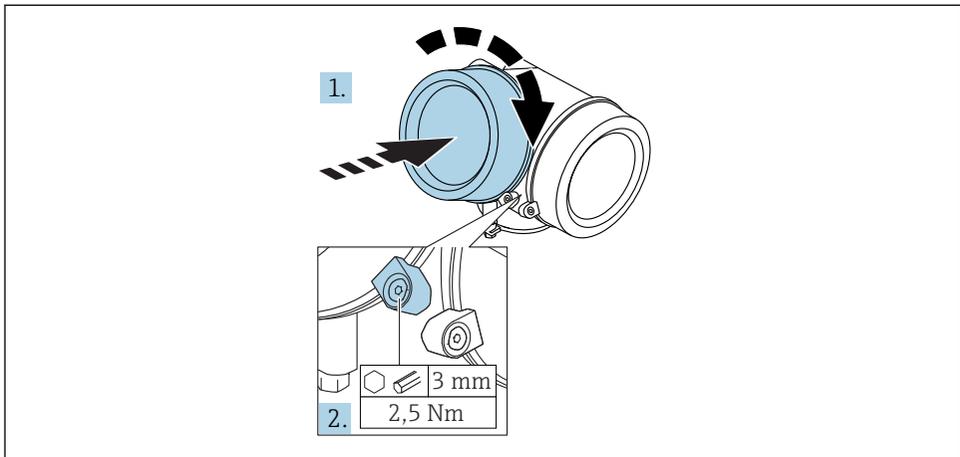
### Turning the display module



A0036401

1. Pull out the display module with a gentle rotational movement.
2. Rotate the display module to the desired position: max.  $8 \times 45^\circ$  in each direction.
3. Feed the coiled cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.

## Closing electronics compartment cover



A0021451

- 1.** Screw back firmly electronics compartment cover.
- 2.** Turning securing clamp 90 ° clockwise and tighten the clamp with 2.5 Nm using the Allen key (3 mm).

## 6.3 Post-installation check

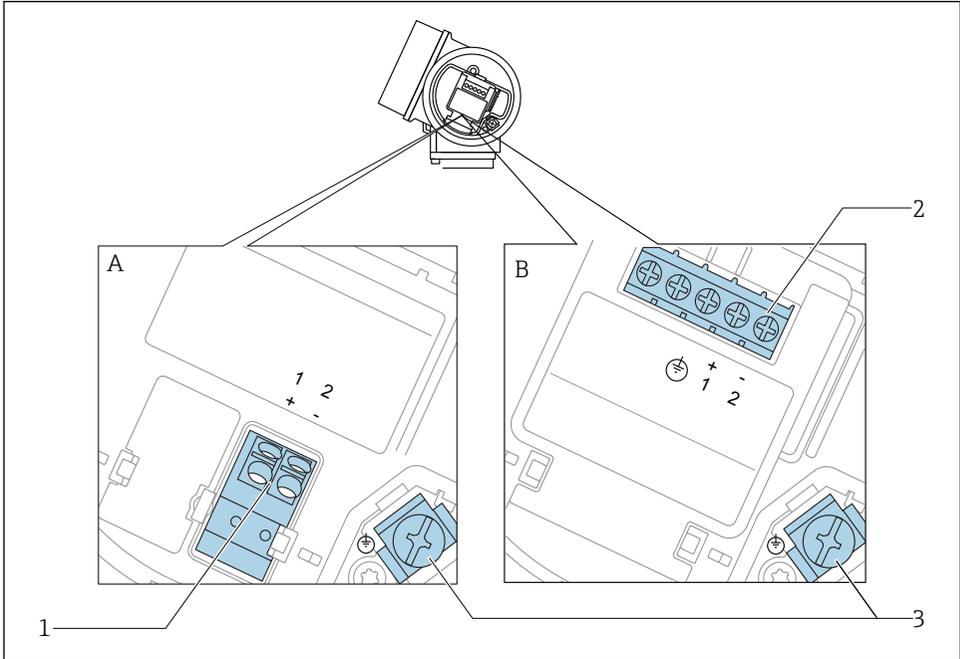
<input type="radio"/>	Is the device undamaged (visual inspection)?
<input type="radio"/>	<p>Does the device conform to the measuring point specifications?</p> <p>For example:</p> <ul style="list-style-type: none"> <li>▪ Process temperature</li> <li>▪ Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document)</li> <li>▪ Ambient temperature range</li> <li>▪ Measuring range</li> </ul>
<input type="radio"/>	Are the measuring point identification and labeling correct (visual inspection)?
<input type="radio"/>	Is the device adequately protected from precipitation and direct sunlight?
<input type="radio"/>	Are the securing screw and securing clamp tightened securely?

## 7 Electrical connection

### 7.1 Connection conditions

#### 7.1.1 Terminal assignment

##### Terminal assignment 2-wire: 4-20 mA HART



A0036498

#### 5 Terminal assignment 2-wire: 4-20 mA HART

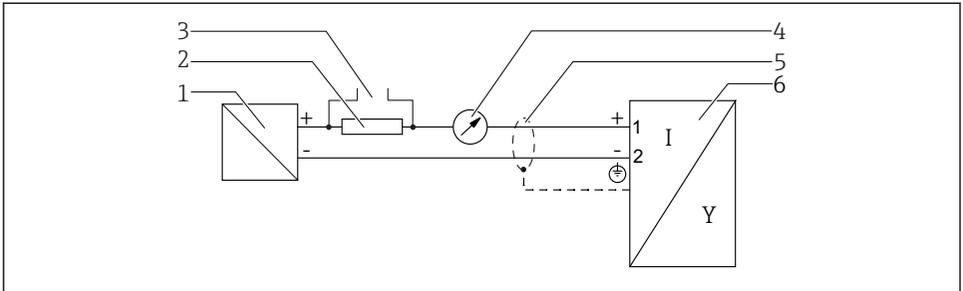
A Without integrated overvoltage protection

B With integrated overvoltage protection

1 Connection 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection

2 Connection 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection

3 Terminal for cable screen

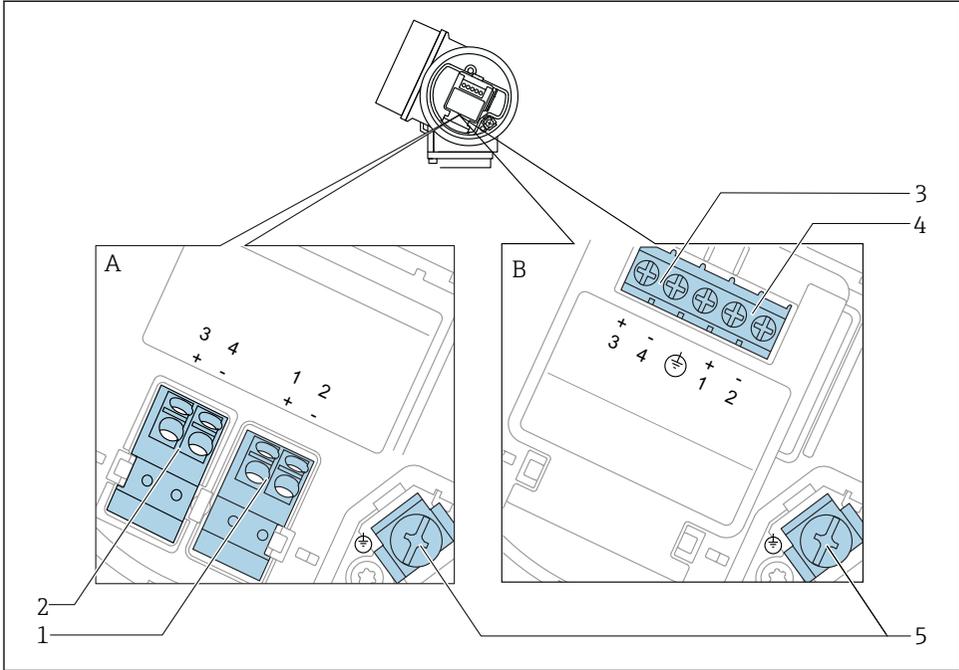
**Block diagram 2-wire: 4-20 mA HART**

A0036499

6 Block diagram 2-wire: 4-20 mA HART

- 1 Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device

## Terminal assignment 2-wire: 4-20 mA HART, switch output



A0036500

### 7 Terminal assignment 2-wire: 4-20 mA HART, switch output

A Without integrated overvoltage protection

B With integrated overvoltage protection

1 Connection 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection

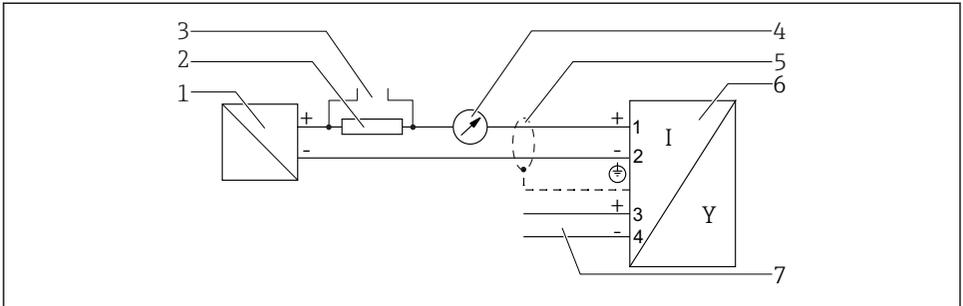
2 Connection switch output (Open Collector): terminals 3 and 4, without integrated overvoltage protection

3 Connection switch output (Open Collector): terminals 3 and 4, with integrated overvoltage protection

4 Connection 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection

5 Terminal for cable screen

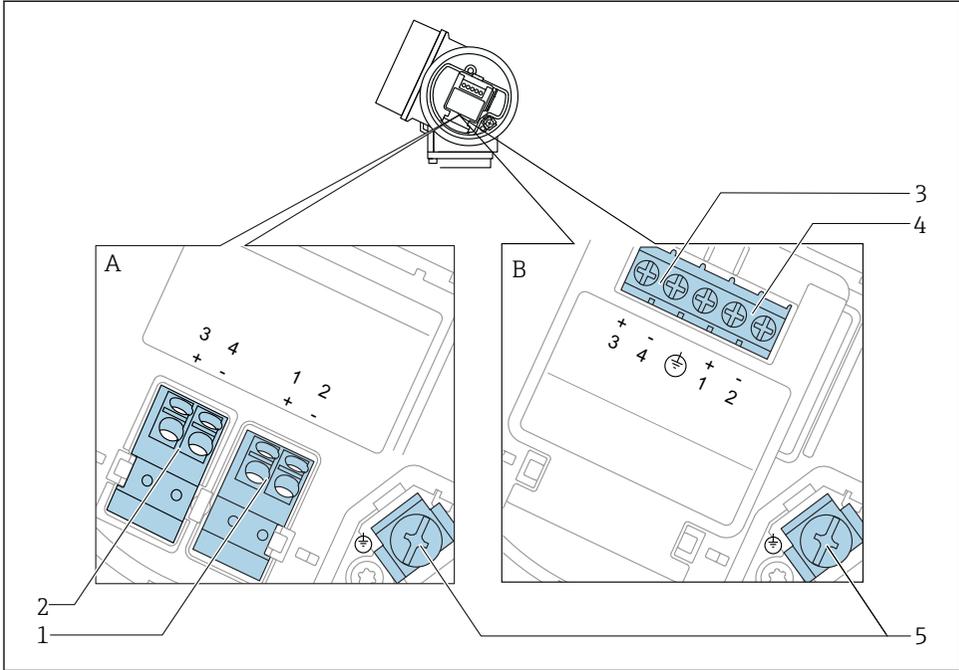
### Block diagram 2-wire: 4-20 mA HART, switch output



A0036501

#### 8 Block diagram 2-wire: 4-20 mA HART, switch output

- 1 Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- 7 Switch output (Open Collector)

**Terminal assignment 2-wire: 4-20 mA HART, 4-20 mA**

A0036500

9 Terminal assignment 2-wire: 4-20 mA HART, 4-20 mA

A Without integrated overvoltage protection

B With integrated overvoltage protection

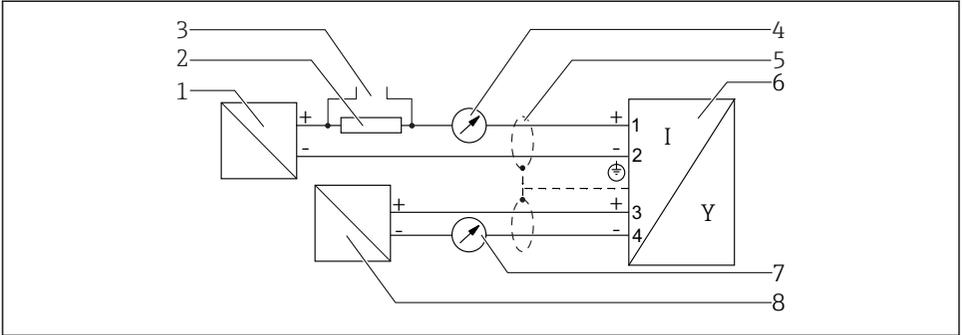
1 Connection current output 1, 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection

2 Connection current output 2, 4-20 mA: terminals 3 and 4, without integrated overvoltage protection

3 Connection current output 2, 4-20 mA: terminals 3 and 4, with integrated overvoltage protection

4 Connection current output 1, 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection

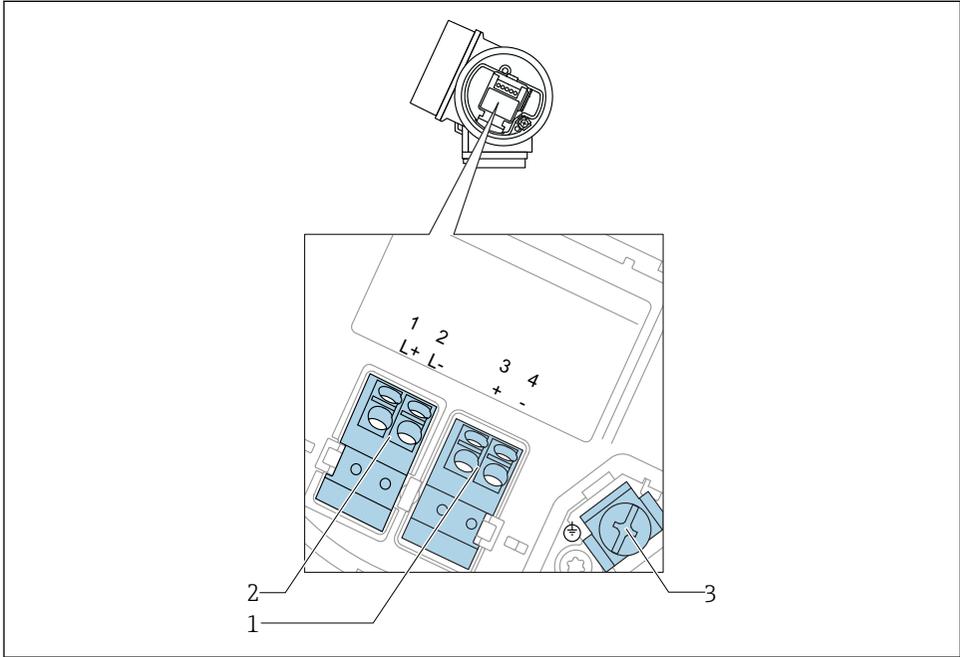
5 Terminal for cable screen

**Block diagram 2-wire: 4-20 mA HART, 4-20 mA**

A0036502

**10 Block diagram 2-wire: 4-20 mA HART, 4-20 mA**

- 1 Active barrier with power supply (e.g. RN221N); observe terminal voltage
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- 7 Analog display device; observe maximum load
- 8 Active barrier with power supply (e.g. RN221N), current output 2; observe terminal voltage

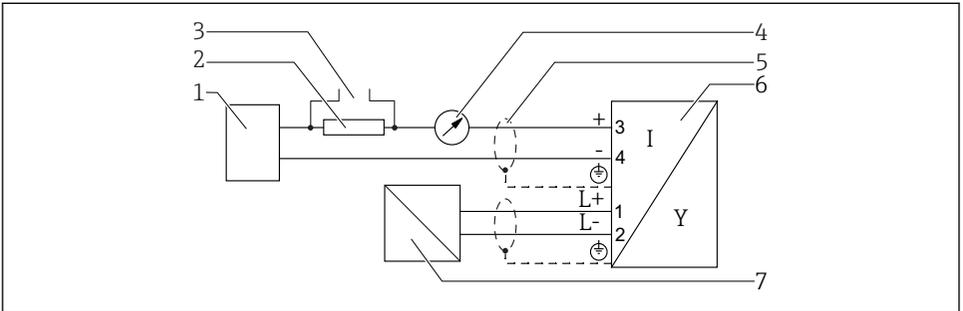
**Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V<sub>DC</sub>)**

A0036516

**11 Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V<sub>DC</sub>)**

- 1 Connection 4-20 mA HART (active): terminals 3 and 4
- 2 Connection supply voltage: terminals 1 and 2
- 3 Terminal for cable screen

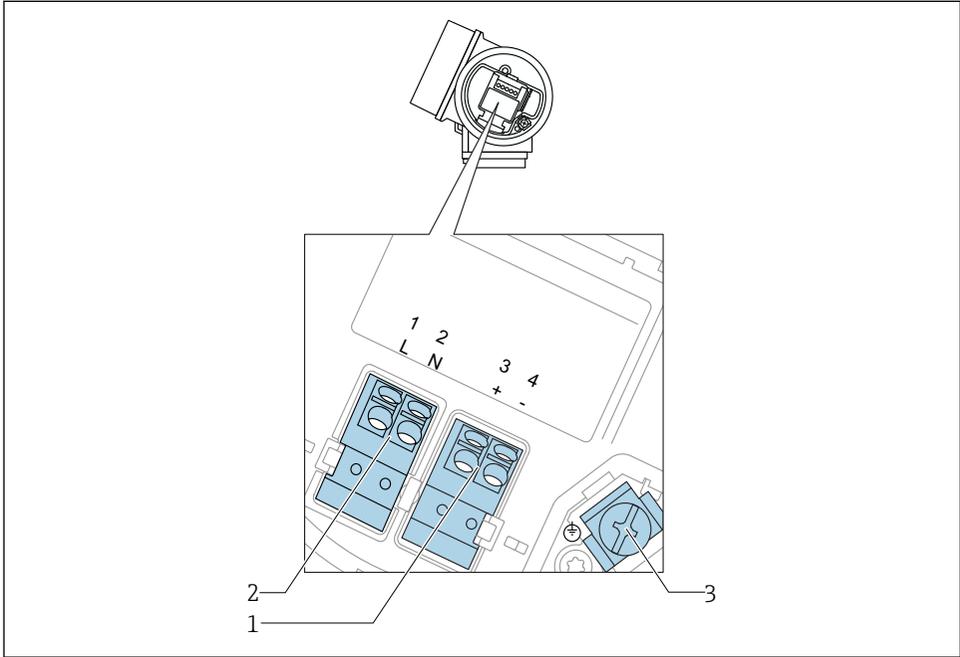
**Block diagram 4-wire: 4-20 mA HART (10.4 to 48 V<sub>DC</sub>)**



A0036526

12 Block diagram 4-wire: 4-20 mA HART (10.4 to 48 V<sub>DC</sub>)

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- 7 Supply voltage; observe terminal voltage, observe cable specification

**Terminal assignment 4-wire: 4-20 mA HART (90 to 253 V<sub>AC</sub>)**

A0036519

**13 Terminal assignment 4-wire: 4-20 mA HART (90 to 253 V<sub>AC</sub>)**

- 1 Connection 4-20 mA HART (active): terminals 3 and 4
- 2 Connection supply voltage: terminals 1 and 2
- 3 Terminal for cable screen

**CAUTION****To ensure electrical safety:**

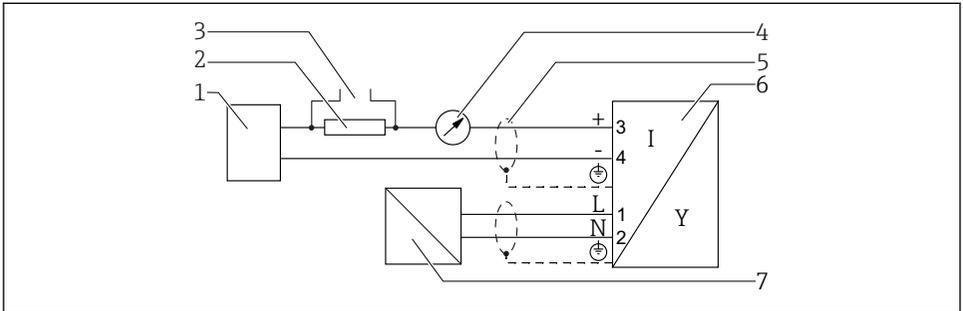
- ▶ Do not disconnect the protective connection.
- ▶ Disconnect the supply voltage before disconnecting the protective earth.

**i** Connect protective earth to the internal ground terminal (3) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal.

**i** In order to ensure electromagnetic compatibility (EMC): Do **not** only ground the device via the protective earth conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.

**i** An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnecter for the device (IEC/EN61010).

### Block diagram 4-wire: 4-20 mA HART (90 to 253 V<sub>AC</sub>)



A0036527

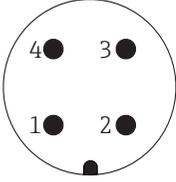
14 Block diagram 4-wire: 4-20 mA HART (90 to 253 V<sub>AC</sub>)

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ( $\geq 250 \Omega$ ); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device; observe maximum load
- 5 Cable scree; observe cable specification
- 6 Measuring device
- 7 Supply voltage; observe terminal voltage, observe cable specification

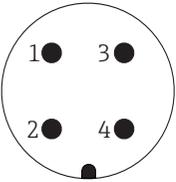
### 7.1.2 Device plug connectors

**i** For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

#### Pin assignment of the M12 plug connector

 <p style="text-align: right; font-size: small;">A0011175</p>	Pin	Meaning
	1	Signal +
	2	not connected
	3	Signal -
	4	Ground

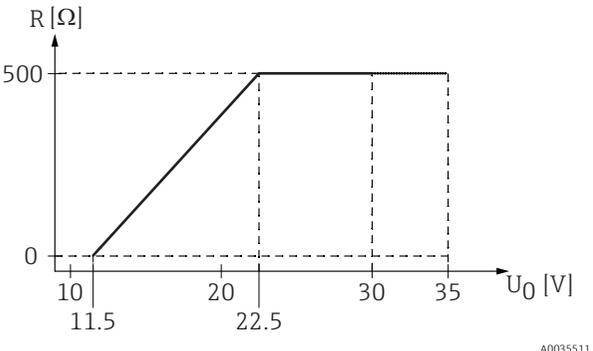
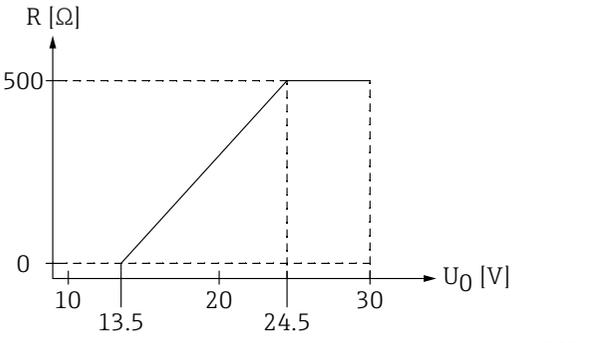
#### Pin assignment of the 7/8" plug connector

 <p style="text-align: right; font-size: small;">A0011176</p>	Pin	Meaning
	1	Signal -
	2	Signal +
	3	Not connected
	4	Screen

### 7.1.3 Power supply

#### 2-wire, 4-20mA HART, passive

2-wire; 4-20mA HART <sup>1)</sup>

"Approval" <sup>2)</sup>	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U <sub>0</sub> at the supply unit
<ul style="list-style-type: none"> <li>▪ Non-Ex</li> <li>▪ Ex nA</li> <li>▪ Ex ic</li> <li>▪ CSA GP</li> </ul>	11.5 to 35 V <sup>3) 4)</sup>	 <p style="text-align: right; font-size: small;">A0035511</p>
Ex ia / IS	11.5 to 30 V <sup>4)</sup>	
<ul style="list-style-type: none"> <li>▪ Ex d / XP</li> <li>▪ Ex ic[ia]</li> <li>▪ Ex tD / DIP</li> </ul>	13.5 to 30 V <sup>4) 5)</sup>	 <p style="text-align: right; font-size: small;">A0034969</p>

- 1) Feature 020 of the product structure: option A
- 2) Feature 010 of the product structure
- 3) For ambient temperatures  $T_a \leq -30\text{ °C}$  ( $-22\text{ °F}$ ) a minimum voltage of 14 V is required for the start-up of the device at the minimum error current (3,6 mA). For ambient temperatures  $T_a \geq 60\text{ °C}$  ( $140\text{ °F}$ ) a minimum voltage of 12V is required for the start-up of the device at the minimum error current (3,6 mA). The startup current can be parametrized. If the device is operated with a fixed current  $I \geq 4,5\text{ mA}$  (HART multidrop mode), a voltage of  $U \geq 11,5\text{ V}$  is sufficient throughout the entire range of ambient temperatures.
- 4) If the Bluetooth modem is used, the minimum supply voltage increases by 2 V.
- 5) For ambient temperatures  $T_a \leq -20\text{ °C}$  ( $-4\text{ °F}$ ) a minimum voltage of 16 V is required for the start-up of the device at the minimum error current (3.6 mA).

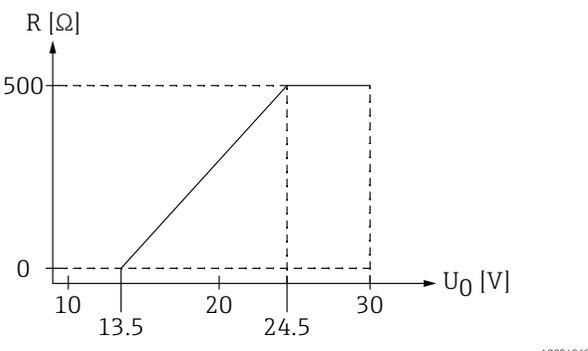
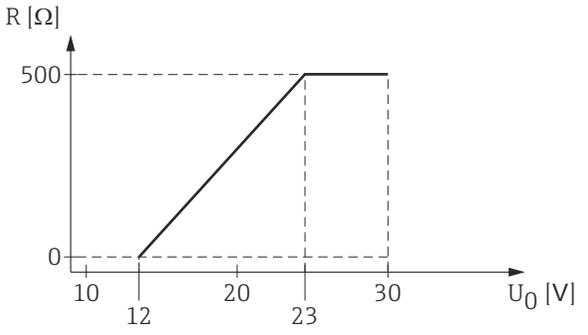
2-wire; 4-20 mA HART, switch output <sup>1)</sup>

"Approval" <sup>2)</sup>	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U <sub>0</sub> at the supply unit
<ul style="list-style-type: none"> <li>▪ Non-Ex</li> <li>▪ Ex nA</li> <li>▪ Ex nA ia </li> <li>▪ Ex ic</li> <li>▪ Ex ic ia </li> <li>▪ Ex d ia  / XP</li> <li>▪ Ex ta / DIP</li> <li>▪ CSA GP</li> </ul>	13.5 to 35 V <sup>3) 4)</sup>	
<ul style="list-style-type: none"> <li>▪ Ex ia / IS</li> <li>▪ Ex ia + Ex d ia  / IS + XP</li> </ul>	13.5 to 30 V <sup>3) 4)</sup>	

A0034971

- 1) Feature 020 of the product structure: option B
- 2) Feature 010 of the product structure
- 3) For ambient temperatures  $T_a \leq -30^\circ\text{C}$  ( $-22^\circ\text{F}$ ) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).
- 4) If the Bluetooth modem is used, the minimum supply voltage increases by 2 V.

2-wire; 4-20mA HART, 4-20mA <sup>1)</sup>

"Approval" <sup>2)</sup>	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U <sub>0</sub> at the supply unit
any	<b>Channel 1:</b> 13.5 to 30 V <sup>3) 4) 5)</sup>	 <p style="text-align: right; font-size: small;">A0034969</p>
	<b>Channel 2:</b> 12 to 30 V	 <p style="text-align: right; font-size: small;">A0022583</p>

- 1) Feature 020 of the product structure: option C
- 2) Feature 010 of the product structure
- 3) For ambient temperatures  $T_a \leq -30\text{ °C}$  ( $-22\text{ °F}$ ) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).
- 4) For ambient temperatures  $T_a \leq -40\text{ °C}$  ( $-40\text{ °F}$ ), the maximum terminal voltage must be restricted to  $U \leq 28\text{ V}$ .
- 5) If the Bluetooth modem is used, the minimum supply voltage increases by 2 V.

<b>Polarity reversal protection</b>	Yes
<b>Admissible residual ripple at f = 0 to 100 Hz</b>	$U_{SS} < 1\text{ V}$
<b>Admissible residual ripple at f = 100 to 10000 Hz</b>	$U_{SS} < 10\text{ mV}$

## 4-wire, 4-20mA HART, active

"Power supply; Output" <sup>1)</sup>	Terminal voltage	Maximum load $R_{max}$
K: 4-wire 90-253VAC; 4-20mA HART	90 to 253 V <sub>AC</sub> (50 to 60 Hz), overvoltage category II	500 Ω
L: 4-wire 10,4-48VDC; 4-20mA HART	10.4 to 48 V <sub>DC</sub>	

1) Feature 020 of the product structure

### 7.1.4 Overvoltage protection

If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse 8/20 μs), an overvoltage protection module has to be installed.

#### Integrated overvoltage protection module

An integrated overvoltage protection module is available for 2-wire HART as well as PROFIBUS PA and FOUNDATION Fieldbus devices.

Product structure: Feature 610 "Accessory mounted", option NA "Overvoltage protection".

Technical data	
Resistance per channel	$2 \times 0,5 \Omega \text{ max.}$
Threshold DC voltage	400 to 700 V
Threshold impulse voltage	< 800 V
Capacitance at 1 MHz	< 1.5 pF
Nominal arrest impulse voltage (8/20 μs)	10 kA

#### External overvoltage protection module

HAW562 or HAW569 from Endress+Hauser are suited as external overvoltage protection.



For detailed information please refer to the following documents:

- HAW562: TI01012K
- HAW569: TI01013K

## 7.2 Connecting the measuring device

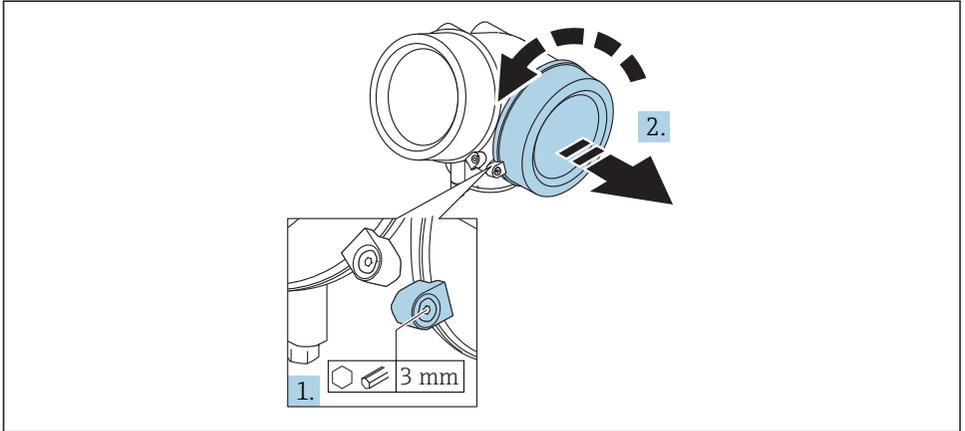
### **⚠ WARNING**

#### Risk of explosion!

- ▶ Observe applicable national standards.
- ▶ Comply with the specifications in the Safety Instructions (XA).
- ▶ Use specified cable glands only.
- ▶ Check to ensure that the power supply matches the information on the nameplate.
- ▶ Switch off the power supply before connecting the device.
- ▶ Connect the potential matching line to the outer ground terminal before applying the power supply.

**Required tools/accessories:**

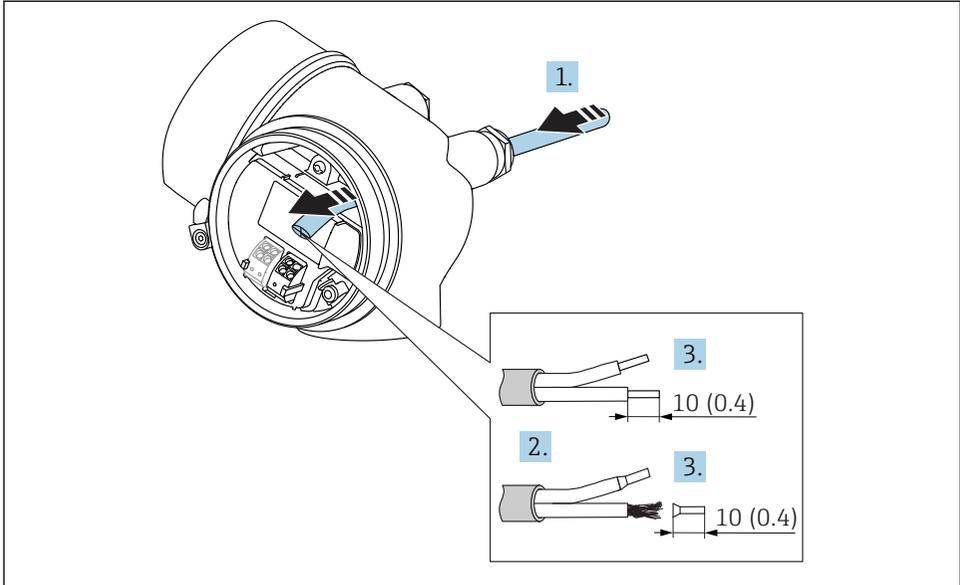
- For devices with a cover lock: Allen key AF3
- Wire stripper
- When using stranded cables: One ferrule for every wire to be connected.

**7.2.1 Opening connection compartment cover**

A0021490

1. Loosen the screw of the securing clamp of the connection compartment cover using an Allen key (3 mm) and turn the clamp 90° clockwise.
2. Afterwards unscrew connection compartment cover and check lid gasket, replace if necessary.

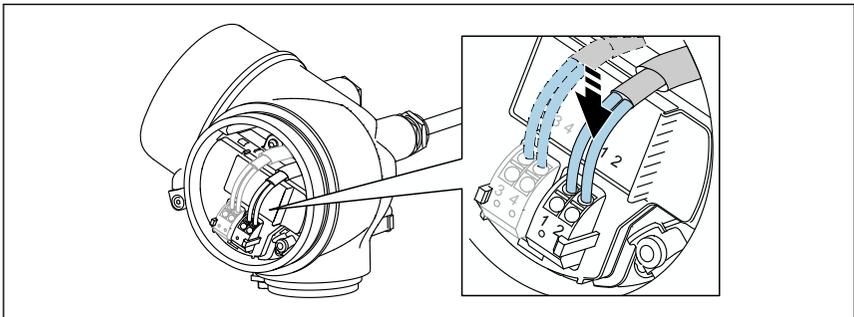
## 7.2.2 Connecting



A0036418

15 Dimensions: mm (in)

1. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
2. Remove the cable sheath.
3. Strip the cable ends over a length of 10 mm (0.4 in). In the case of stranded cables, also fit ferrules.
4. Firmly tighten the cable glands.
5. Connect the cable in accordance with the terminal assignment.

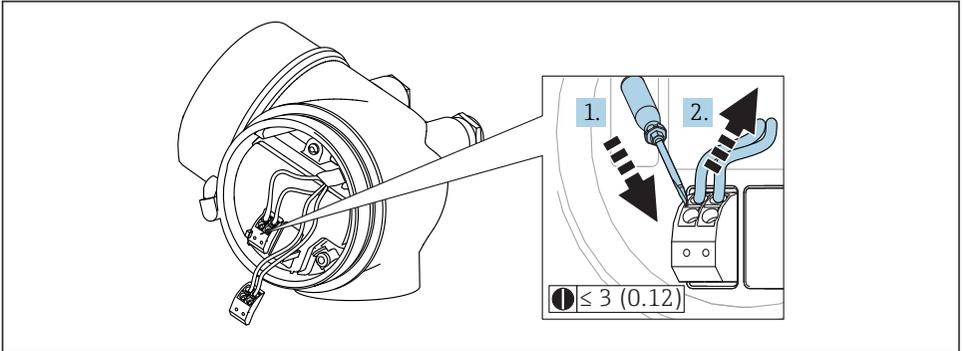


A0036482

6. If using shielded cables: Connect the cable shield to the ground terminal.

### 7.2.3 Plug-in spring-force terminals

In the case of devices without integrated overvoltage protection, electrical connection is via plug-in spring-force terminals. Rigid conductors or flexible conductors with ferrules can be inserted directly into the terminal without using the lever, and create a contact automatically.



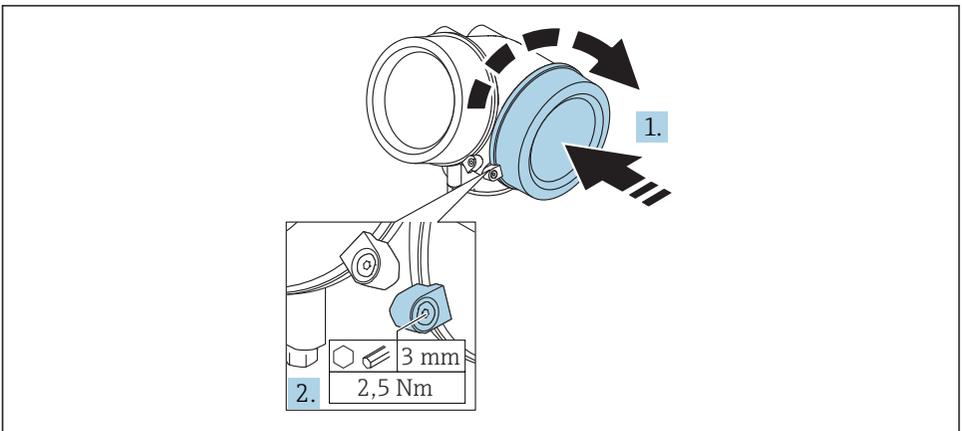
A0013661

16 Dimensions: mm (in)

To remove cables from the terminal:

1. Using a flat-blade screwdriver  $\leq 3$  mm, press down on the slot between the two terminal holes
2. while simultaneously pulling the cable end out of the terminal.

### 7.2.4 Closing connection compartment cover



A0021491

1. Screw back firmly connection compartment cover.

2. Turning securing clamp 90 ° counterclockwise and tighten the clamp with 2.5 Nm (1.84 lbf ft) again using the Allen key (3 mm).

### 7.3 Post-connection check

<input type="checkbox"/>	Is the device or cable undamaged (visual check)?
<input type="checkbox"/>	Do the cables comply with the requirements ?
<input type="checkbox"/>	Do the cables have adequate strain relief?
<input type="checkbox"/>	Are all cable glands installed, securely tightened and leak-tight?
<input type="checkbox"/>	Does the supply voltage match the specifications on the nameplate?
<input type="checkbox"/>	Is the terminal assignment correct?
<input type="checkbox"/>	If required: Has protective ground connection been established ?
<input type="checkbox"/>	If supply voltage is present, is the device ready for operation and do values appear on the display module?
<input type="checkbox"/>	Are all housing covers installed and securely tightened?
<input type="checkbox"/>	Is the securing clamp tightened correctly?

## 8 Commissioning via SmartBlue (app)

### 8.1 Requirements

#### Device requirements

Commissioning via SmartBlue is only possible if the device has a Bluetooth module.

#### System requirements SmartBlue

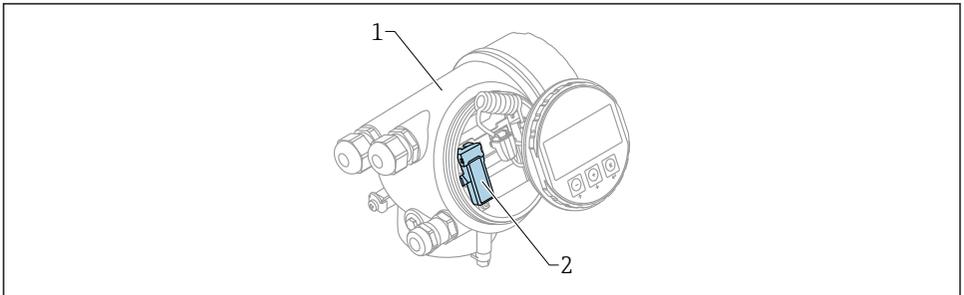
SmartBlue is available as download for Android devices from the Google Play Store and for iOS devices from the iTunes Store.

- iOS devices:
  - iPhone 4S or higher from iOS9.0; iPad2 or higher from iOS9.0; iPod Touch 5th generation or higher from iOS9.0
- Devices with Android:
  - from Android 4.4 KitKat and *Bluetooth*® 4.0

#### Initial password

The ID of the Bluetooth module serves as the initial password used to establish the first connection to the device. It can be found:

- on the information sheet which is supplied with the device. This serial number specific sheet is also stored in W@M.
- on the nameplate of the Bluetooth module.



A0036790

#### 17 Device with Bluetooth module

- 1 Electronics housing of the device
- 2 Nameplate of the Bluetooth module; the ID on this nameplate serves as initial password.



All login data (including the password changed by the user) are not stored in the device but in the Bluetooth module. This must be taken into account when the module is removed from one device and inserted into a different device.

## 8.2 Commissioning

Download and install SmartBlue

1. To download the app, scan the QR code or enter "SmartBlue" in the search field



A0033202

 18 Download link

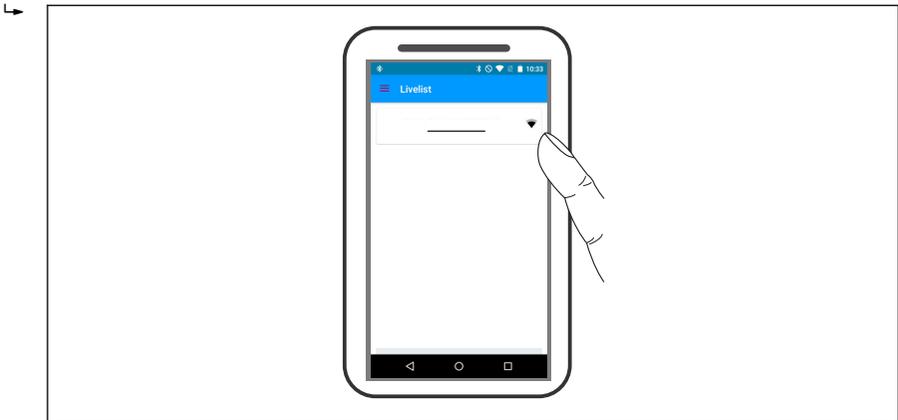
2. Start SmartBlue



A0029747

 19 SmartBlue pictogram

3. Select device from displayed livelist (available devices only)

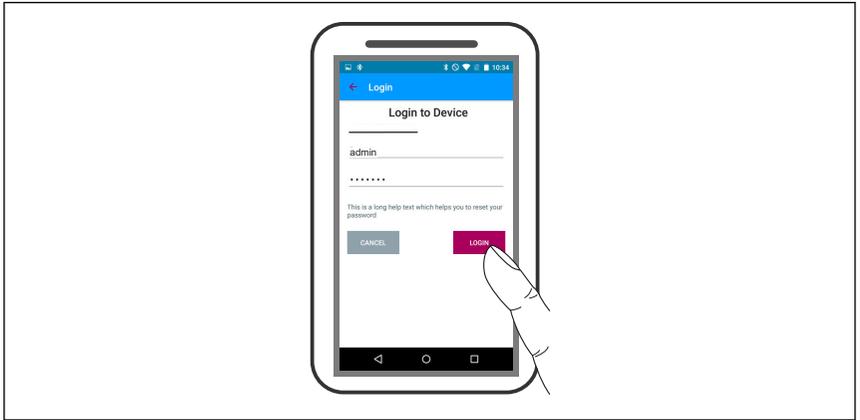


A0029502

 20 Livelist

 Only one point-to-point connection can be established between **one** sensor and **one** smartphone or tablet.

#### 4. Perform login

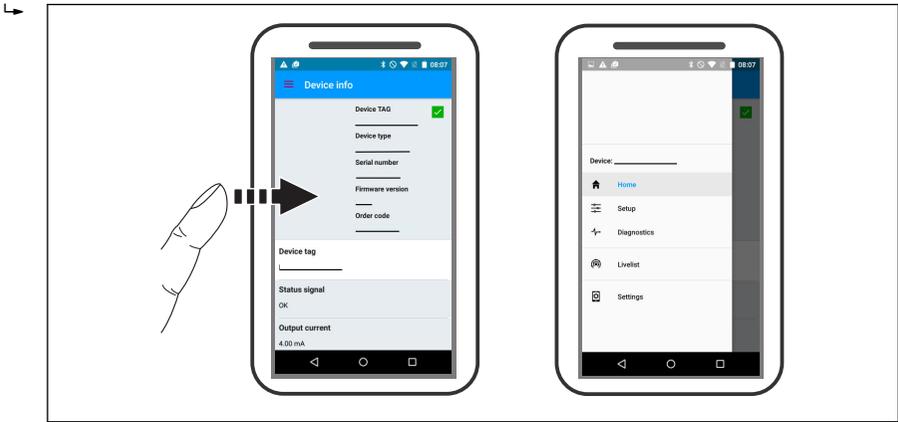


A0029503

#### 21 Login

5. Enter user name -> admin
6. Enter initial password -> ID of the Bluetooth module
7. Change the password after logging in for the first time

8. By wiping from the side, additional information (e.g. main menu) can be dragged into the image



A0029504

22 Main menu

**i** Envelope curves can be displayed and recorded

**Additionally to the envelope curve, the following values are displayed:**

- D = Distance
- L = Level
- A = Absolute amplitude
- In the case of screenshots, the displayed section (zoom function) is saved
- In video sequences, always the whole area without zoom function is saved

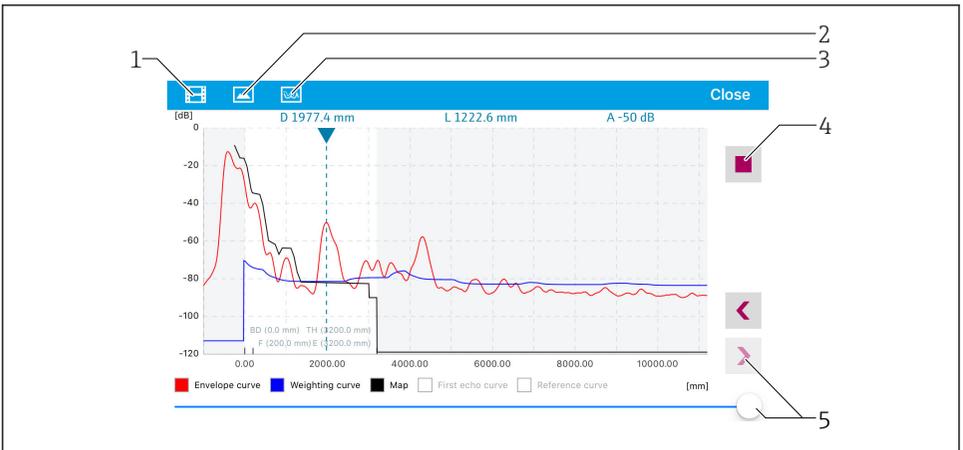
It is also possible to send envelope curves (video sequences) using the relevant smartphone or tablet functions.



A0029486

23 Envelope curve display (example) in SmartBlue; Android view

- 1 Record video
- 2 Create screenshot
- 3 Navigation to mapping menu
- 4 Start / stop video recording
- 5 Move time on time axis



A0029487

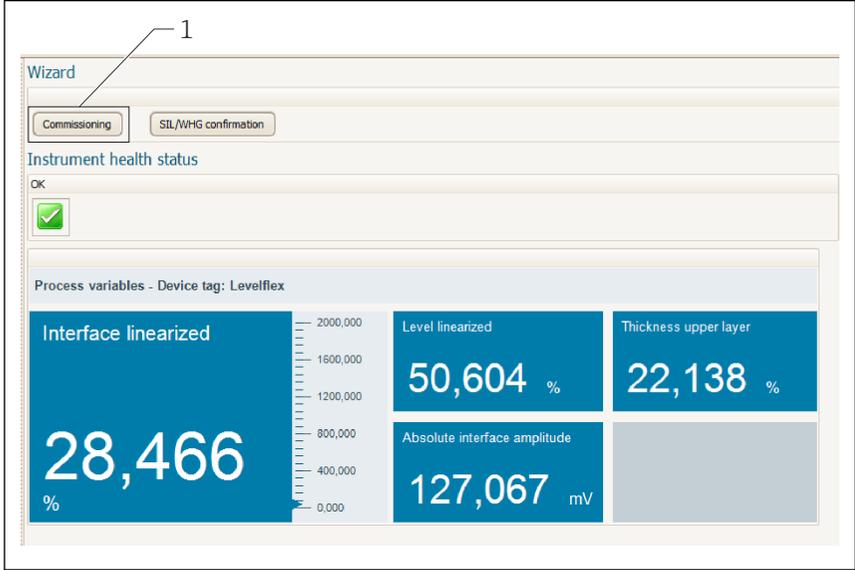
24 Envelope curve display (example) in SmartBlue; iOS view

- 1 Record video
- 2 Create screenshot
- 3 Navigation to mapping menu
- 4 Start / stop video recording
- 5 Move time on time axis

## 9 Commissioning via wizard

A wizard guiding the user through the initial setup is available in FieldCare and DeviceCare <sup>1)</sup>.

1. Connect the device to FieldCare or DeviceCare (for details refer to the "Operating options" chapter of the Operating Instructions).
2. Open the device in FieldCare or DeviceCare.
  - ↳ The dashboard (home page) of the device appears:



A0025866

1 *"Commissioning" button calls up the wizard.*

3. Click on "Commissioning" to call up the wizard.
4. Enter or select the appropriate value for each parameter. These values are immediately written to the device.
5. Click "Next" to switch to the next page.
6. After finishing the last page, click "End of sequence" to close the wizard.

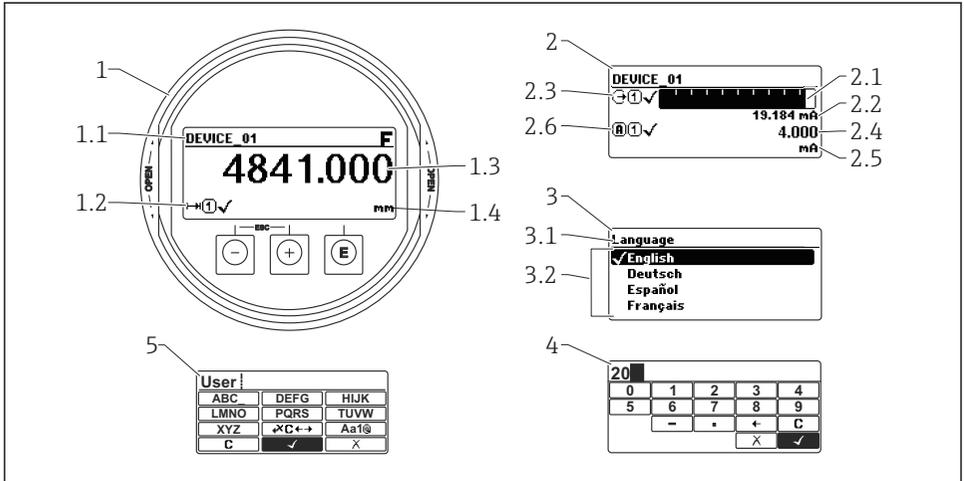
 If the wizard is cancelled before all necessary parameters have been set, the device may be in an undefined state. A reset to the default settings is recommended in this case.

1) DeviceCare is available for download at [www.software-products.endress.com](http://www.software-products.endress.com). The download requires a registration in the Endress+Hauser software portal.

# 10 Commissioning (via operating menu)

## 10.1 Display and operating module

### 10.1.1 Display appearance

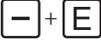


A0012635

25 Appearance of the display and operation module for on-site operation

- 1 Measured value display (1 value max. size)
- 1.1 Header containing tag and error symbol (if an error is active)
- 1.2 Measured value symbols
- 1.3 Measured value
- 1.4 Unit
- 2 Measured value display (1 bargraph + 1 value)
- 2.1 Bargraph for measured value 1
- 2.2 Measured value 1 (including unit)
- 2.3 Measured value symbols for measured value 1
- 2.4 Measured value 2
- 2.5 Unit for measured value 2
- 2.6 Measured value symbols for measured value 2
- 3 Representation of a parameter (here: a parameter with selection list)
- 3.1 Header containing parameter name and error symbol (if an error is active)
- 3.2 Selection list;  marks the current parameter value.
- 4 Input matrix for numbers
- 5 Input matrix for alphanumeric and special characters

## 10.1.2 Operating elements

Key	Meaning
 A0018330	<p><b>Minus key</b></p> <p><i>For menu, submenu</i>            Moves the selection bar upwards in a picklist.</p> <p><i>For text and numeric editor</i>            In the input mask, moves the selection bar to the left (backwards).</p>
 A0018329	<p><b>Plus key</b></p> <p><i>For menu, submenu</i>            Moves the selection bar downwards in a picklist.</p> <p><i>For text and numeric editor</i>            In the input mask, moves the selection bar to the right (forwards).</p>
 A0018328	<p><b>Enter key</b></p> <p><i>For measured value display</i></p> <ul style="list-style-type: none"> <li>■ Pressing the key briefly opens the operating menu.</li> <li>■ Pressing the key for 2 s opens the context menu.</li> </ul> <p><i>For menu, submenu</i></p> <ul style="list-style-type: none"> <li>■ Pressing the key briefly              Opens the selected menu, submenu or parameter.</li> <li>■ Pressing the key for 2 s for parameter:              If present, opens the help text for the function of the parameter.</li> </ul> <p><i>For text and numeric editor</i></p> <ul style="list-style-type: none"> <li>■ Pressing the key briefly             <ul style="list-style-type: none"> <li>- Opens the selected group.</li> <li>- Carries out the selected action.</li> </ul> </li> <li>■ Pressing the key for 2 s confirms the edited parameter value.</li> </ul>
 A0032909	<p><b>Escape key combination (press keys simultaneously)</b></p> <p><i>For menu, submenu</i></p> <ul style="list-style-type: none"> <li>■ Pressing the key briefly             <ul style="list-style-type: none"> <li>- Exits the current menu level and takes you to the next higher level.</li> <li>- If help text is open, closes the help text of the parameter.</li> </ul> </li> <li>■ Pressing the key for 2 s returns you to the measured value display ("home position").</li> </ul> <p><i>For text and numeric editor</i>            Closes the text or numeric editor without applying changes.</p>
 A0032910	<p><b>Minus/Enter key combination (press and hold down the keys simultaneously)</b></p> <p>Reduces the contrast (brighter setting).</p>
 A0032911	<p><b>Plus/Enter key combination (press and hold down the keys simultaneously)</b></p> <p>Increases the contrast (darker setting).</p>

### 10.1.3 Opening the context menu

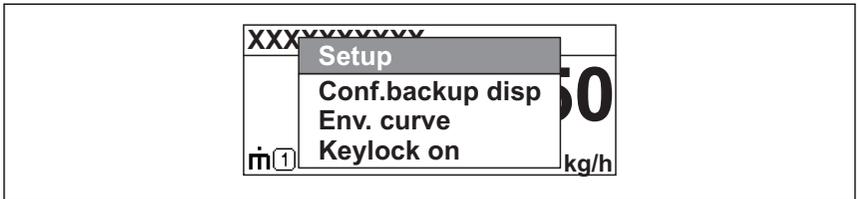
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Conf. backup disp.
- Env. curve
- Keylock on

#### Opening and closing the context menu

The user is in the operational display.

1. Press  $\square$  for 2 s.
  - ↳ The context menu opens.



A0033110-EN

2. Press  $\square$  +  $\oplus$  simultaneously.
  - ↳ The context menu is closed and the operational display appears.

#### Calling up the menu via the context menu

1. Open the context menu.
2. Press  $\oplus$  to navigate to the desired menu.
3. Press  $\square$  to confirm the selection.
  - ↳ The selected menu opens.

## 10.2 Operating menu

Parameter/Submenu	Meaning	Description
<b>Language</b> <sup>1)</sup>	Defines the operating language of the on-site display.	BA01002F (Operating Instructions FMP53, HART)
<b>Setup</b>	When appropriate values have been assigned to all setup parameters, the measured should be completely configured in a standard application.	
<b>Setup→Mapping</b>	Interference echo suppression	
<b>Setup→Advanced setup</b>	Contains further submenus and parameters: <ul style="list-style-type: none"> <li>▪ to adapt the device to special measuring conditions.</li> <li>▪ to process the measured value (scaling, linearization).</li> <li>▪ to configure the signal output.</li> </ul>	
<b>Diagnostics</b>	Contains the most important parameters needed to detect and analyze operational errors.	GP01000F (Description of Device Parameters FMP5x, HART)
<b>Expert</b> <sup>2)</sup>	Contains all parameters of the device (including those which are already contained in one of the above submenus). This menu is organized according to the function blocks of the device.	

- 1) In case of operation via operating tools (e.g. FieldCare), the "Language" parameter is located at "Setup→Advanced setup→Display"
- 2) On entering the "Expert" menu, an access code is always requested. If a customer specific access code has not been defined, "0000" has to be entered.

### 10.3 Unlock the device

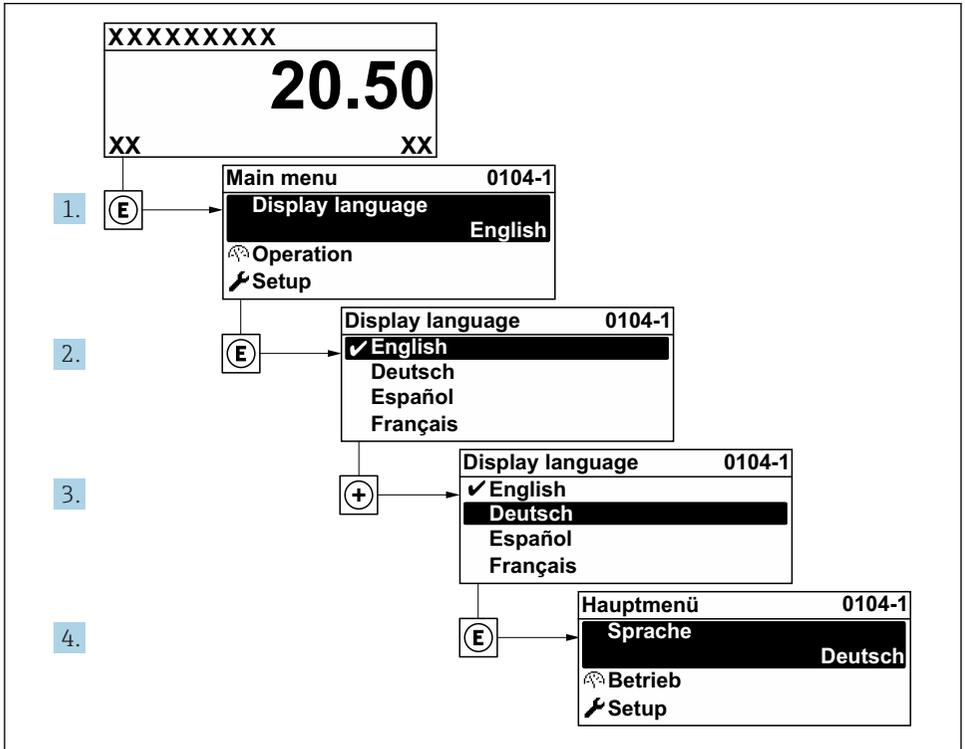
If the device has been locked, it must be be unlocked before the measurement can be configured.



For details refer to the Operating Instructions of the device:  
BA01002F (FMP53, HART)

### 10.4 Setting the operating language

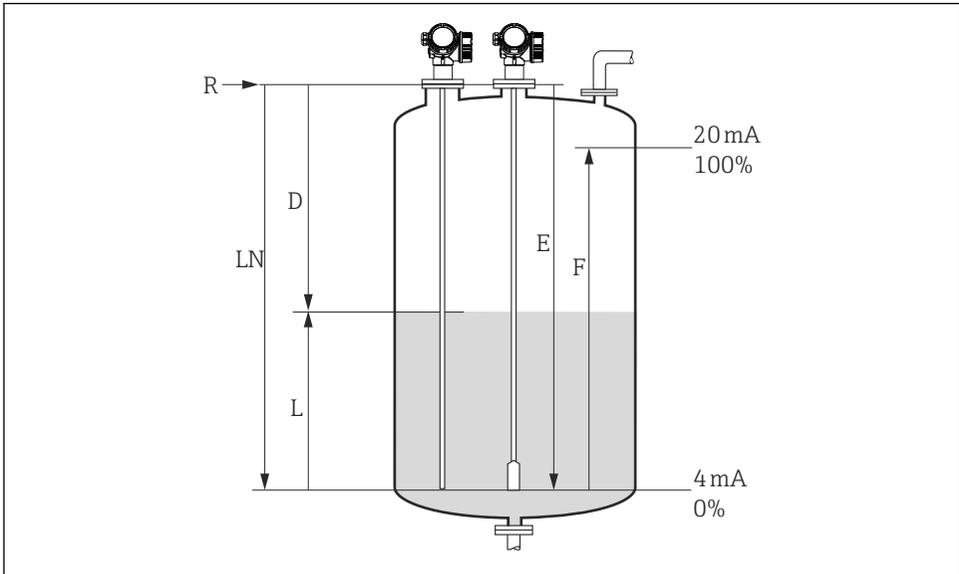
Factory setting: English or ordered local language



A0029420

26 Using the example of the local display

## 10.5 Configuration of a level measurement



A0011360

27 Configuration parameters for level measurements in liquids

*LN* = Length of probe

*D* = Distance

*L* = Level

*R* = Reference point of the measurement

*E* = Empty calibration (= Zero point)

*F* = Full calibration (= span)

### 1. Setup → Device tag

↳ Enter tag for measuring point.

### 2. Setup → Distance unit

↳ Select distance unit.

### 3. Setup → Tank type

↳ Select tank type.

### 4. Setup → Tube diameter (only if "Tank type" = "Bypass / pipe")

↳ Enter the diameter of the bypass or stilling well.

### 5. Setup → Medium group

↳ Select medium group (**Others** or **Water based (DC >= 4)**)

### 6. Setup → Empty calibration

↳ Enter the distance *E* between the reference point *R* and the minimum level (0%).

### 7. Setup → Full calibration

↳ Enter distance *F* between the minimum (0%) and maximum (100%) level.

**8. Setup → Level**

- ↳ Displays the measured level L.

**9. Setup → Distance**

- ↳ Displays the distance D between the reference point R and the level L.

**10. Setup → Signal quality**

- ↳ Displays the signal quality of the level echo.

**11. Setup → Mapping → Confirm distance**

- ↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve.

## 10.6 User-specific applications



For details of setting the parameters of user-specific applications, see separate documentation:

BA01002F (Operating Instructions FMP53, HART)



For the **Expert** submenu refer to:

GP01000F (Description of Device Parameters FMP5x, HART)



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