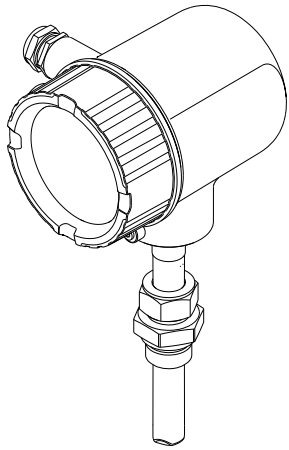
KA01155D/06/EN/01.13
71237441

Brief Operating Instructions
Proline t-mass T 150

Thermal mass flowmeter



These Instructions are Brief Operating Instructions; they do not replace the Operating Instructions included in the scope of supply.

For detailed information, refer to the Operating Instructions and other documentation on the CD-ROM provided or visit "www.endress.com/deviceviewer".

Endress+Hauser
People for Process Automation

Table of contents

1 Document information

1.1 Symbols used

1.1.1 Safety symbols

Symbol	Meaning
 A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.1.2 Electrical symbols

Symbol	Meaning
 A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.1.3 Tool symbols

Symbol	Meaning
 A0011220	Flat blade screwdriver
 A0011221	Allen key
 A0011222	Open-ended wrench

1.1.4 Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.
1., 2., 3. ...	**Series of steps**
✔	**Result of a sequence of actions**

1.1.5 Symbols in graphics

Symbol	Meaning
1, 2, 3,...	Item numbers
1., 2., 3. ...	Series of steps

Symbol	Meaning
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
 A0013441	Flow direction
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

2.2 Designated use

Application and media
The measuring device described in these Operating Instructions is intended only for flow measurement of liquids.

Measuring devices for use in hazardous areas, in hygienic applications or in applications 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:
- 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 against which the process-wetted materials are adequately resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the device documentation provided (on the CD-ROM) is absolutely essential.

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

⚠ WARNING

Risk of injury if the process connection and sensor gland are opened under pressure.
- ▶ The process connection and the sensor gland should only be opened in an unpressurized state.

NOTICE

Penetration of dust and moisture when the transmitter housing is opened.
- ▶ Only open the transmitter housing briefly, ensuring that no dust or moisture enters the housing.

NOTICE

Danger of breakage of the sensor due to corrosive or abrasive fluids!
- ▶ 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.

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
The external surface temperature of the housing can increase by max. 15 K due to the power consumption of the electronic components. Hot process fluids passing through the measuring device will further increase the surface temperature of the housing. The surface of the sensor, in particular, can reach temperatures which are close to the fluid temperature.

Possible burn hazard due to fluid temperatures!
- ▶ For elevated fluid temperature, ensure protection against contact 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.

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

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 EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.6 IT security

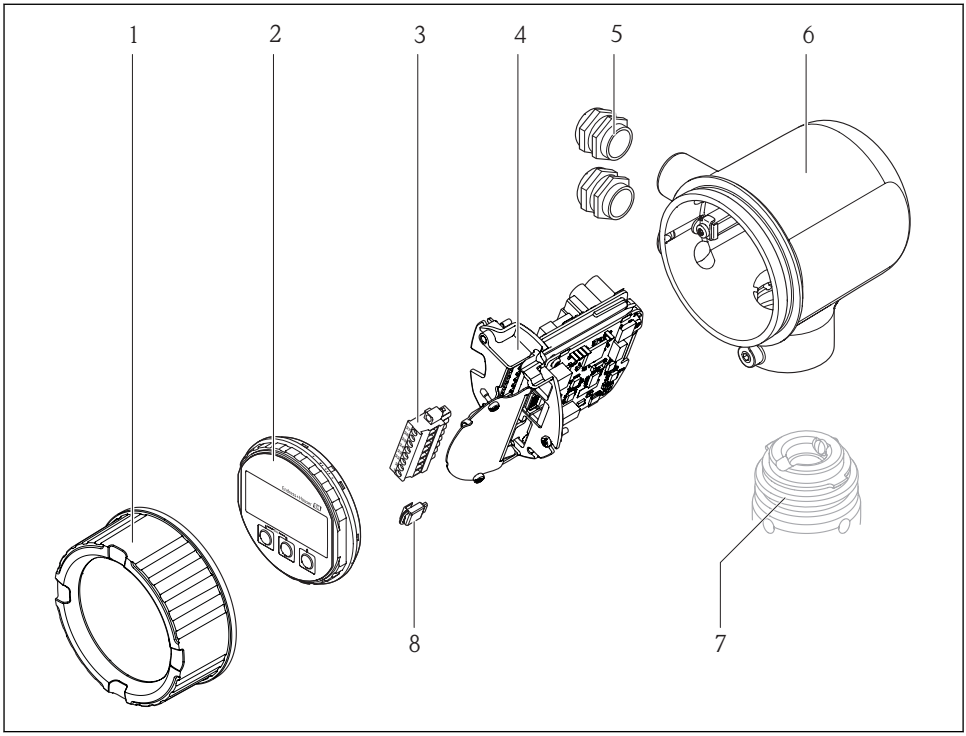
We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Endress+Hauser can be contacted to provide support in performing this task.

3 Product description

3.1 Product design



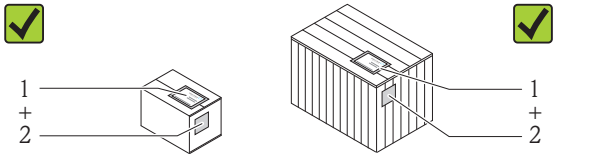
A0017196

1 *Electronics compartment cover*
2 *Display module*
3 *Terminal block*
4 *Electronics module*
5 *Cable gland*
6 *Transmitter housing*
7 *Sensor*
8 *S-DAT*

4 Incoming acceptance and product identification

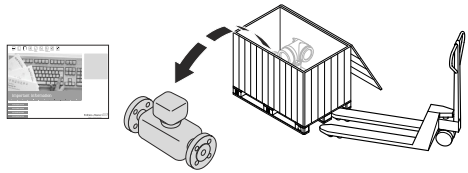
4.1 Incoming acceptance


A0015502



A0013843

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

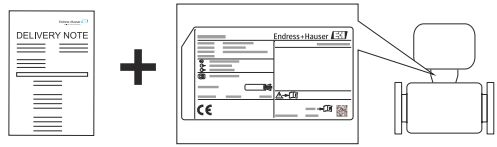

A0013695


A0015502


A0013698

Are the goods undamaged?


A0015502



A0013699

Do the nameplate data match the ordering information on the delivery note?


A0015502

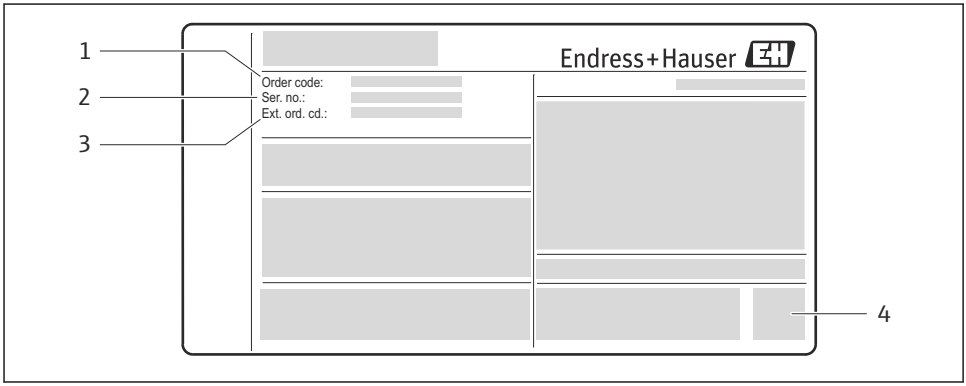

A0013697

Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! In such cases, the technical documentation is available via the Internet or via the *Endress +Hauser Operations App*, see the "Device documentation" section (→ 10).

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): 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.



1 *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 on the breakdown of the specifications on the nameplate, see the Operating Instructions for the device (→ 10).

4.2.1 Device documentation

All devices are supplied with Brief Operating Instructions. These Brief Operating Instructions 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:
- On the CD-ROM supplied (is not included in the delivery for all device versions).
- Available for all device versions via:
  - Internet: www.endress.com/deviceviewer
  - Smart phone/tablet: *Endress+Hauser Operations App*

The information required to retrieve the documentation can be found on the nameplate of the device (→ 1, 10).

Technical documentation can also be downloaded from the Download Area of the Endress+Hauser web site: www.endress.com→ Download. However this technical documentation applies to a particular instrument family and is not assigned to a specific device.

W@M Device Viewer

1. Launch the W@M Device Viewer: www.endress.com/deviceviewer
2. Enter the serial number (Ser. no.) of the device: see nameplate (→ 1, 10).
   ↳ All the associated documentation is displayed.

Endress+Hauser Operations App

The *Endress+Hauser Operations App* is available both for android smart phones (Google Play store) and for iPhones and iPads (App Store).

Via the serial number:

1. Launch the *Endress+Hauser Operations App*.
2. Enter the serial number (Ser. no.) of the device: see nameplate (→ 1, 10).
   ↳ All the associated documentation is displayed.

Via the 2-D matrix code (QR code):

1. Launch the *Endress+Hauser Operations App*.
2. Scan the 2-D matrix code (QR code) on the nameplate (→ 1, 10).
   ↳ All the associated documentation is displayed.

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:
- Store in original packaging.
- Do not remove the protection cap mounted on the transducer.
- Protect from direct sunlight.
- Select a storage location where moisture cannot collect in the measuring device.
- Storage temperature: –40 to +60 °C (–40 to +140 °F)
- Store in a dry and dust-free place.
- Do not store outdoors.

5.2 Transporting the product

Observe the following notes during transport:
- Transport the measuring device to the measuring point in the original packaging.
- Do not remove the protection cap mounted on the transducer. It prevents mechanical damage and contamination in the measuring tube.

5.3 Packaging disposal

For detailed information about disposing of the packaging materials, refer to the Operating Instructions for the device on the CD-ROM provided

6 Installation

6.1 Installation conditions

For mechanical reasons and to protect the pipe, support is recommended for heavy sensors (e.g. with a hot-tap retractable assembly).

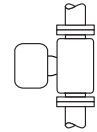
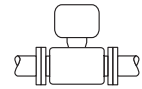
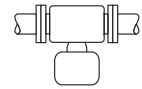
6.1.1 Mounting position

Orientation

The direction of the arrow on the sensor body helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

For detailed information on aligning with the flow direction: (→ 19)

Installation is generally not recommended in the event of high vibrations or unstable internal fittings.

	Orientation	Recommendation
Vertical orientation	 A0017337	✔ 1)
Horizontal orientation, transmitter head up	 A0015589	✔✔
Horizontal orientation, transmitter head down	 A0015590	✔✔

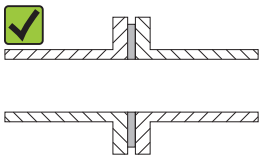
1) Partially filled pipe detection is not possible in this orientation.

For detailed information about partially filled pipe detection, refer to the Operating Instructions for the device on the CD-ROM provided

Pipes

The measuring device must be professionally installed, and the following points must be observed:

Further information → ISO standard 14511



A0005103

Correctly aligned flanges and seals

Insertion depth

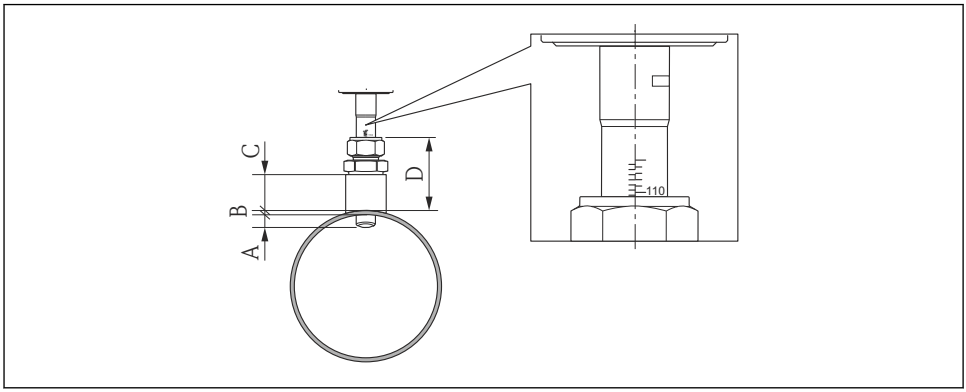
Standard version

Order code for *"Insertion Length"*, option L5 *"110mm 4"* and L6 *"330mm 13"*

NOTICE

Metal clamping ferrules undergo plastic deformation during the initial installation.
As a result the insertion depth is fixed after initial installation and the clamping ferrules can no longer be replaced.
- ▶ Pay attention to information on preconditions and on determining the insertion depth.
- ▶ Check the insertion depth closely before tightening the clamping ferrules.

Preconditions



A0022049

A Fixed insertion depth 8 mm (0.31 in) ±2 mm (0.08 in)
B Pipe wall thickness
C Mounting boss height
D Socket height (incl. coupling)

1. Determine pipe wall thickness (B).
2. Measure socket height (D).

↳ **NOTE!** Mounting for the first time: Tighten thread adapter nut of the coupling hand tight.

3. Observe the maximum socket height D.
   ↳ **NOTE!** The pipe wall thickness (B) and socket height (D) may not exceed the permitted height.

   B + D may not be greater than 102 mm (4.02 in).

4. If a mounting boss is used, pay attention to mounting boss height C.
   ↳ **NOTE!** The pipe wall thickness (B) and mounting boss height (C) may not exceed the permitted height.

   B + C may not be greater than 53 mm (2.09 in).

Determining the insertion depth before mounting for the first time

► For all nominal diameters: 8 + B + D -1

Controlling the insertion depth after mounting

► For all nominal diameters: 8 + B + D

Hygienic version

Order code for *"Insertion Length"*, option LH *"Hygienic version"*

Factory length

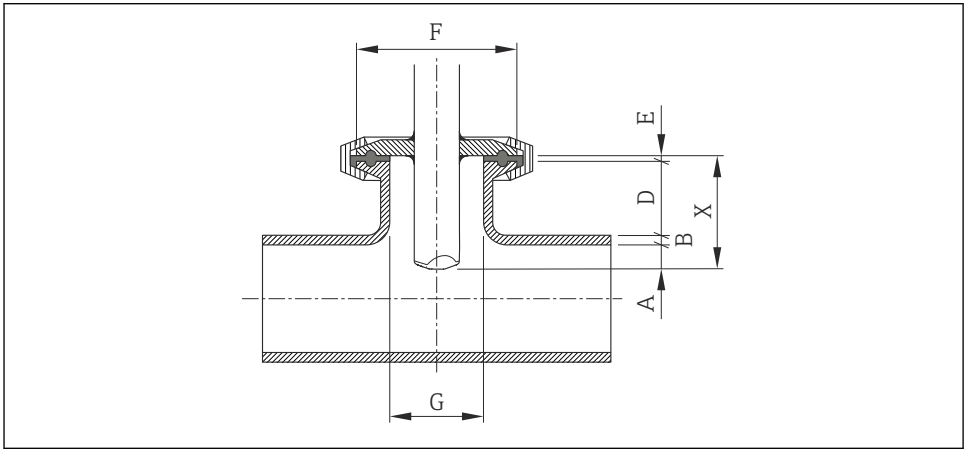
Order code for *"Insertion Tube Material; Sensor"*, option BB *"Stainless steel, factory length, 0.8µm, mechanically polished"* and option BC *"Stainless steel, factory length, 0.4µm, mechanically polished"*

NOTICE

Certain dimensions are required to comply with the factory length.

► Pay attention to information in the dimension drawings.

Preconditions



A0022058

A *Fixed insertion depth 8 mm (0.31 in) ±2 mm (0.08 in)*
B *Pipe wall thickness*
D *Socket height*
E *Seal thickness*
X *Length*
G *Socket internal diameter*

1. Determine pipe wall thickness (B).
2. If a Tri-Clamp process connection is used, determine seal thickness (E).
   ↳ **NOTE!** The socket internal diameter (G) may not be smaller than 25 mm (0.98 in).
3. If a conical coupling process connection with a self-centering sealing ring is used, determine seal thickness (E).
4. If an aseptic liner or a conical coupling process connection is used, set the seal thickness (E) to equal zero and do not take it into consideration.

Determining the socket height (D)

► For all nominal diameters: 32 - B - E

NOTICE

For optimum cleaning it is recommended to:
► Have a large socket internal diameter (G).
► Keep the socket height (D) small.

Customized length

Order code for *"Material of insertion pipe; sensor"*, option CB *"..... mm customized length, 0.8µm, mechanically polished"* and option CC *"..... mm customized length, 0.4µm, mechanically polished"*

Order code for *"Material of insertion pipe; sensor"*, option CD *"..... inch customized length, 0.8µm, mechanically polished"* and option CE *"..... inch customized length, 0.4µm, mechanically polished"*

NOTICE

When ordering the customized length, it is necessary to declare the sensor length with the following decimal accuracies:

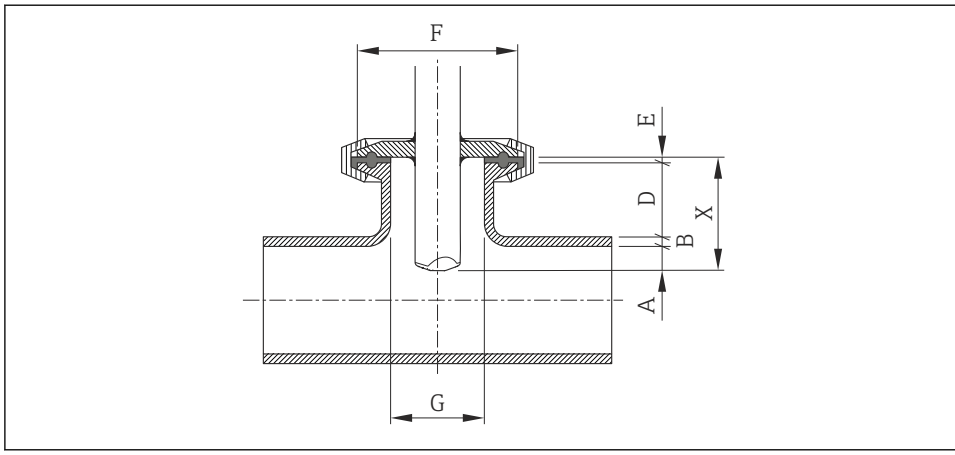
- **SI units (mm):** With a minimum of 1 decimal place. Example: 43.3 mm
- **US units (in):** With a minimum of 2 decimal places. Example: 17.05 in
- When ordering, a maximum of 3 decimal places can be declared.

NOTICE

Certain dimensions are required for determining the customized length.

- Pay attention to information in the dimension drawings.

Preconditions



A0022058

A Fixed insertion depth 8 mm (0.31 in) ±2 mm (0.08 in)
B Pipe wall thickness
D Socket height
E Seal thickness
X Length
G Socket internal diameter

1. Determine pipe wall thickness (B).
2. Measure socket height (D).
3. Observe the maximum socket height D.
   ↳ **NOTE!** The pipe wall thickness (B) and socket height (D) may not exceed the permitted height.

   B + D may not be greater than 77 mm (3.03 in).

4. If a Tri-Clamp process connection is used, determine seal thickness (E).
   ↳ **NOTICE!** The pipe wall thickness (B), socket height (D) and sealing thickness (E) may not exceed the permitted height.

   B + D + E may not be greater than 77 mm (3.03 in).
5. If a conical coupling process connection with a self-centering sealing ring is used, determine seal thickness (E).
   ↳ **NOTE!** The pipe wall thickness (B), socket height (D) and sealing thickness (E) may not exceed the permitted height.

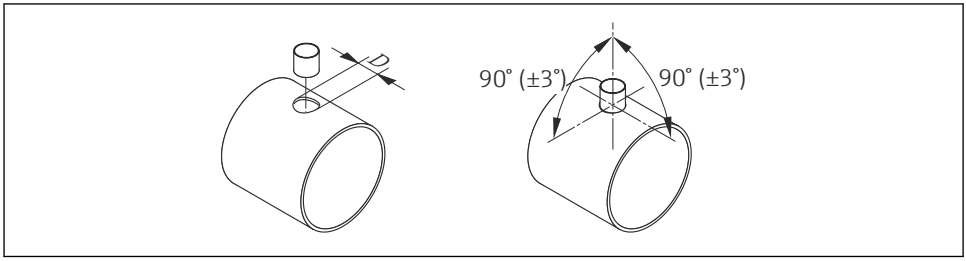
   B + D + E may not be greater than 77 mm (3.03 in).
6. If an aseptic liner or a conical coupling process connection is used, set the seal thickness (E) to equal zero and do not take it into consideration.
   ↳ **NOTE!** The pipe wall thickness (B) and socket height (D) may not exceed the permitted height.

   B + D may not be greater than 77 mm (3.03 in).

Determining the customized length

▶ For all nominal diameters: 8 + B + D + E

Installation conditions for nipples



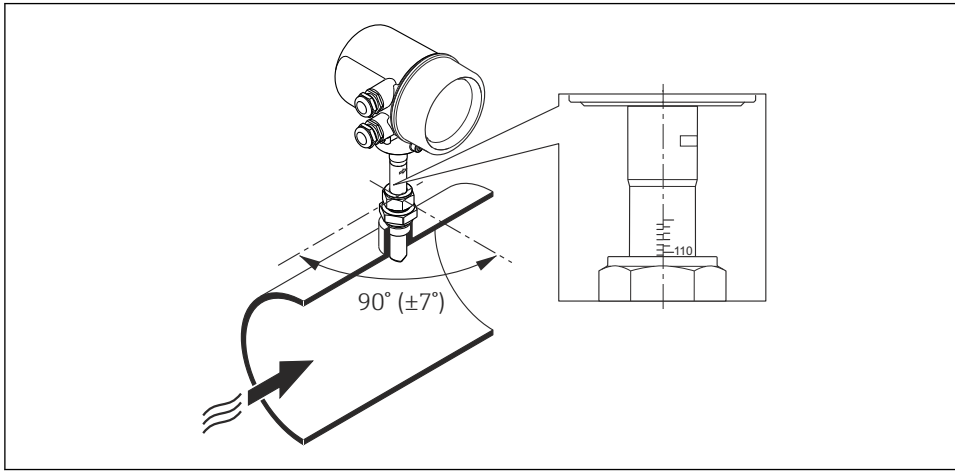
2 Installation conditions for mounting bosses and threadolets

D = 20.0 mm ± 0.5 mm (0.79 in ± 0.02 in)

▶ In the case of weld-in couplings with PEEK clamping ferrules, remove the clamping ferrules before you commence welding to avoid heat damage from the welding process.

Alignment with flow direction

Insertion version

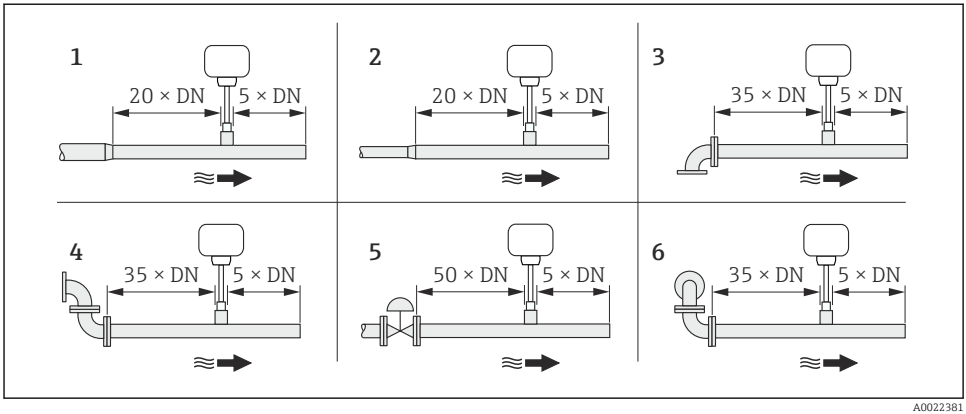


A0022051

1. Check and ensure that the sensor on the pipe is aligned at a 90° angle to the direction of flow (as shown in the graphic).
2. Rotate the sensor so that the arrow marking on the sensor body corresponds to the direction of flow.
3. Align the scale to the pipe axis.

Inlet and outlet runs

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



1 *reduction*
2 *expansion*
3 *90 ° elbow or T-section*
4 *2 × 90° elbow*
5 *Control valve*
6 *2 × 90 ° elbow 3-dimensional*

6.1.2 Requirements from environment and process

Ambient temperature range

Measuring device	−40 to +60 °C (−40 to +140 °F)
Local display	−20 to +60 °C (−4 to +140 °F), the readability of the display may be impaired at temperatures outside the temperature range.

► If operating outdoors:
Avoid direct sunlight, particularly in warm climatic regions.

System pressure

NOTICE

Depending on version:
Observe information on nameplate.
► Max. 40 bar g (580 psi g)

⚠ WARNING

If the coupling is opened incorrectly under full process pressure, the sensor will shoot out. Therefore it must be ensured that the sensor does not accelerate to a dangerous exit velocity.
► Use a safety chain for pressures > 4.5 bar (65.27 psi) in combination with PEEK clamping ferrules .

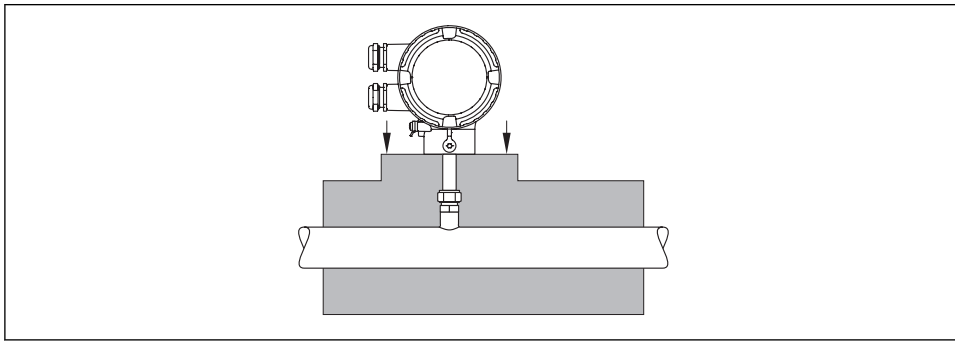
⚠ WARNING

The sensor is exposed to high temperatures.
Risk of burns from hot surfaces or leaking medium!
- ▶ Before commencing work: allow the system and measuring device to cool to a safe temperature.

Thermal insulation

The maximum possible thickness of the thermal insulation layer is:
Order code for "Insertion Length", option L5 "110mm 4": 100 mm (3.94 in)

The following is recommended for thicker insulation layers:
Order code for "Insertion Length", option L6 "330mm 13": 320 mm (12.6 in)



A0015763

6.2 Mounting the measuring device

6.2.1 Required tools

For transmitter

For turning the transmitter housing (in increments of 90°): Allen screw 4 mm (0.15 in)

For sensor

6.2.2 Preparing the measuring device

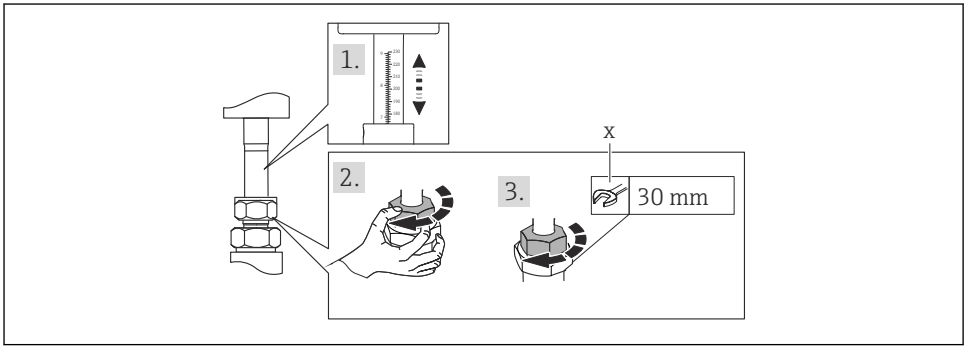
1. Remove all remaining transport packaging.
2. Remove stick-on label on the electronics compartment cover.

6.2.3 Mounting the measuring device

⚠ WARNING

Danger due to improper process sealing!

- ▶ Ensure that the gaskets are clean and undamaged.
- ▶ Ensure that the correct sealing material has been used (e.g. Teflon tape for NPT ¾").
- ▶ Install the gaskets correctly.

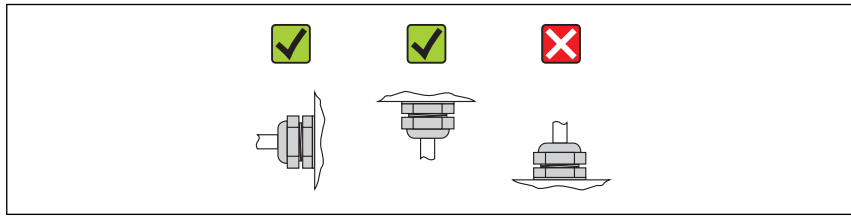


3 Engineering unit mm (in)

x number of turns to tighten

1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium. Ensure the insertion depth (→ 14)and alignment (→ 19) are correct.
2. Tighten thread adapter nut hand tight.
3. **Depending on the process connection:**
   Tighten thread adapter nut with x turns:
   ↳ For PEEK clamping ferrules continue with Step 4.
   For metallic clamping ferrules continue with Step 5.
   For hygienic process connections continue with Step 6.
4. **For PEEK clamping ferrules:**
   Mounting for the first time: tighten thread adapter nut with 1¼ turns (→ 22).
   Repeat mounting: tighten thread adapter nut with 1 turn (→ 22).
   ↳ **NOTE!** If strong vibrations can be expected, tighten the thread adapter nut with 1½ turns (→ 22) when mounting for the first time.
5. **For metallic clamping ferrules:**
   Mounting for the first time: tighten thread adapter nut with 1¼ turns (→ 22).
   Repeat mounting: tighten thread adapter nut with ¼ turn (→ 22).
6. **For hygienic process connections:**
   Make sure the connection is aligned correctly and tighten the union nut or clamp for Tri-Clamp (not included in the delivery).

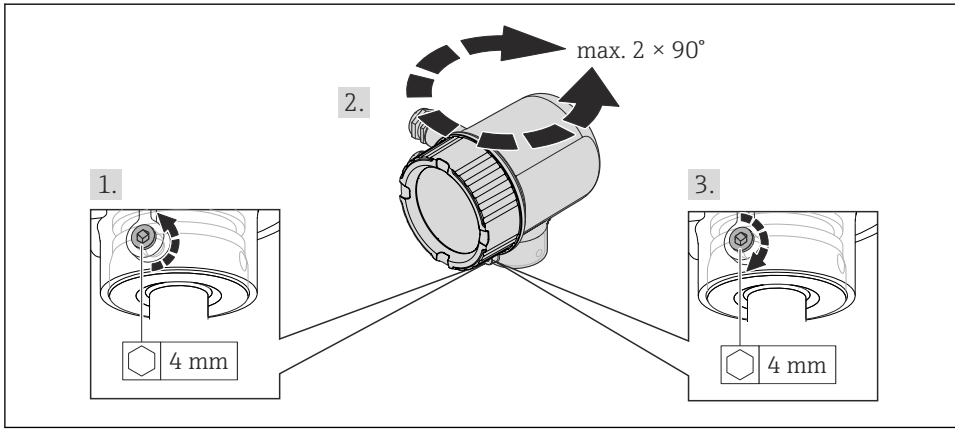
7. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.



A0013964

6.2.4 Turning the transmitter housing

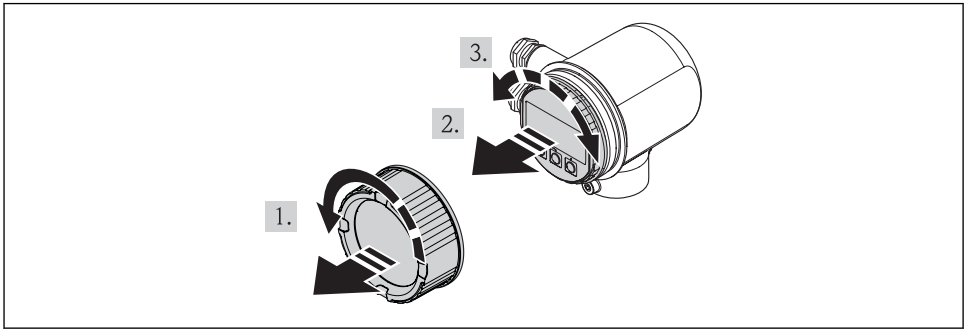
To provide easier access to the connection compartment or display module, the transmitter housing can be turned clockwise or counterclockwise to 4 indexed positions by a maximum of 2× 90°:



A0017227

4 *Engineering unit mm (in)*

6.2.5 Turning the display module



A0017228

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document on the CD-ROM provided) ▪ Ambient temperature (→ 🖹 20) ▪ Measuring range	❑
Has the correct orientation for the sensor been selected (→ 🖹 13)? ▪ According to sensor type ▪ According to medium properties ▪ According to medium temperature ▪ According to process pressure	❑
Does the arrow on the sensor match the direction of flow of the medium through the piping (→ 🖹 13)?	❑
Have sufficient inlet and outlet runs been provided upstream and downstream of the measuring point?	❑
Correctly aligned in the direction of flow?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Is the device protected against overheating?	❑
Is the device protected against excessive vibrations?	❑
Check liquid properties (e.g. purity, cleanness).	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑

7 Electrical connection

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use corresponding tools
- Wire stripper
- When using stranded cables: Crimping tool for ferrule
- Flat blade screwdriver≤3 mm (0.12 in)

7.1.2 Requirements for connecting cable

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

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

- −40 °C (−40 °F) to ≥ +80 °C (+176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output

For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output, status input

Standard installation cable is sufficient.

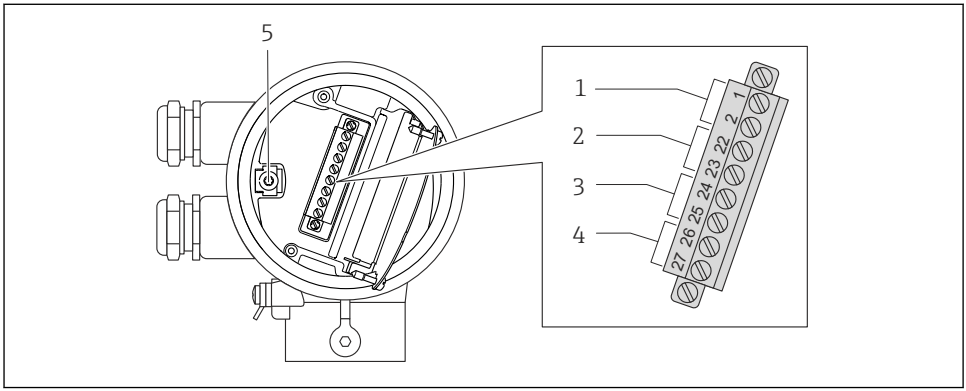
Cable diameter

- Included cable glands: M20 × 1.5 with cable ⌀6 to 12 mm (0.24 to 0.47 in)
- Wire cross-sections 0.5 to 1.5 mm^2 (21 to 16 AWG)

7.1.3 Terminal assignment

Transmitter

Connection version 4-20 mA HART, pulse/frequency/switch output, status input



A0017178

1 Supply voltage
2 Status input
3 Signal transmission: pulse/frequency/switch output
4 Signal transmission: 4-20 mA HART
5 Ground terminal for cable shield

Supply voltage

Order code for "Power supply"	Terminal numbers	
	1 (L+) [1]	2 (L-) [1]
Option **D**	DC 18 to 30 V	

1) Securely tighten the screws of the terminal. Recommended torque: 0.5 Nm.

Signal transmission

Order code for "Output, input"	Terminal numbers					
	Output 1		Output 2		Input	
	26 (+) [1]	27 (-) [1]	24 (+) [1]	25 (-) [1]	22 (+) [1]	23 (-) [1]
Option **A**	4-20 mA HART (active)		-		-	
Option **B**	4-20 mA HART (active)		Pulse/frequency/switch output (passive)		-	

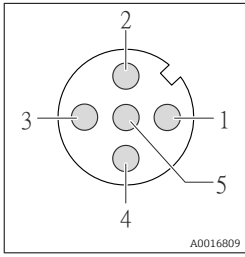
Order code for "Output, input"	Terminal numbers					
	Output 1		Output 2		Input	
	26 (+) [1]	27 (-) [1]	24 (+) [1]	25 (-) [1]	22 (+) [1]	23 (-) [1]
Option **K**	-		Pulse/frequency/switch output (passive)		-	
Option **Q**	4-20 mA HART (active)		Pulse/frequency/switch output (passive)		Status input	

1) Securely tighten the screws of the terminal. Recommended torque: 0.5 Nm.

7.1.4 Pin assignment of the connector

Supply voltage

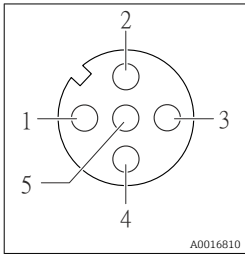
Supply voltage for all communication types (on the device side)



Pin	Assignment		Coding	Plug/socket
1	L+	DC24 V	A	Plug
2	+	Status input		
3	-	Status input		
4	L-	DC24 V		
5		Grounding/shielding		

4-20 mA HART with pulse/frequency/switch output

4-20 mA HART with pulse/frequency/switch output (on the device side)



Pin	Assignment		Coding	Plug/socket
1	+	4-20 mA HART (active)	A	Socket
2	-	4-20 mA HART (active)		
3	+	Pulse/frequency/switch output (passive)		
4	-	Pulse/frequency/switch output (passive)		
5		Grounding/shielding		

7.1.5 Requirements for the supply unit

Supply voltage

DC 24 V (18 to 30 V)

The power supply circuit must comply with SELV/PELV requirements.

Load

0 to 750 Ω, depending on the external supply voltage of the power supply unit

7.1.6 Preparing the measuring device

1. Remove dummy plug if present.
2. **NOTICE!** Insufficient sealing of the housing. Operational reliability of the measuring device could be defeated. Use suitable cable glands corresponding to the degree of protection.
   If measuring device is delivered without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If measuring device is delivered with cable glands:
   Observe cable specification .

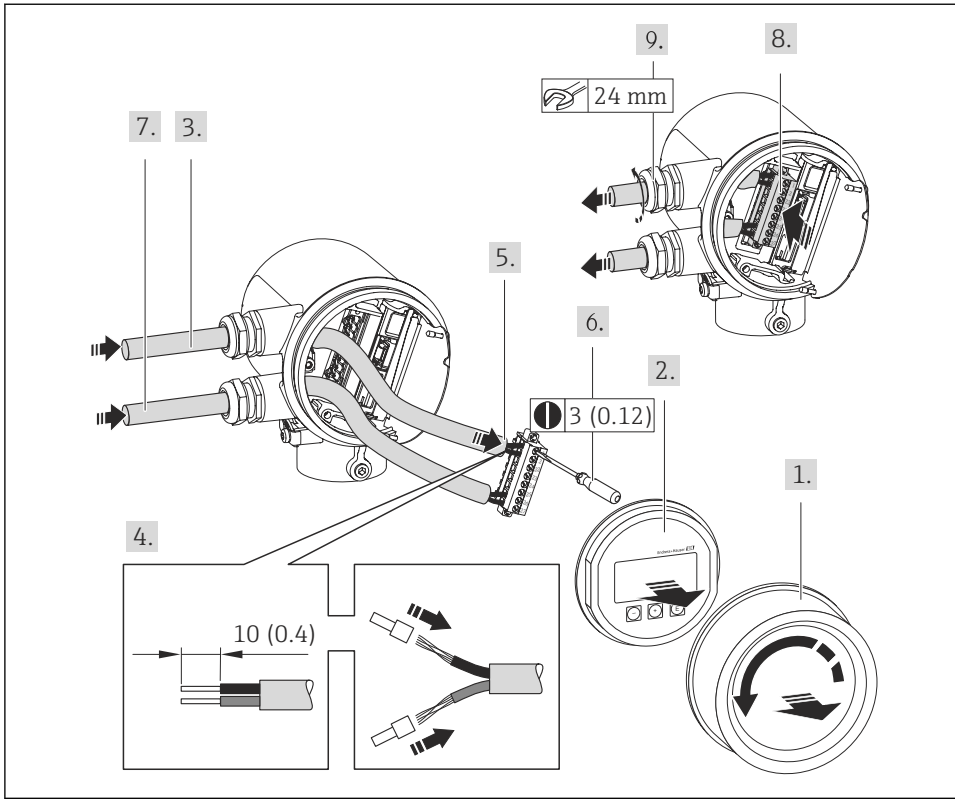
7.2 Connecting the measuring device

NOTICE

Limitation of electrical safety due to incorrect connection!

- ▶ SELV/PELV-compliant 24 V DC (18 to 30 V) power supply.
- ▶ 4 to 20 mAHART active
- ▶ Maximum output values: DC 24V, 22 mA, load0 to 750 Ω

7.2.1 Connecting the cables



5 *Engineering unit mm (in)*

▶ **NOTICE!** Housing degree of protection voided due to insufficient sealing of the housing. Screw in the thread without using any lubricant. The threads on the cover are coated with a dry lubricant.
Reverse the removal procedure to reassemble the transmitter.

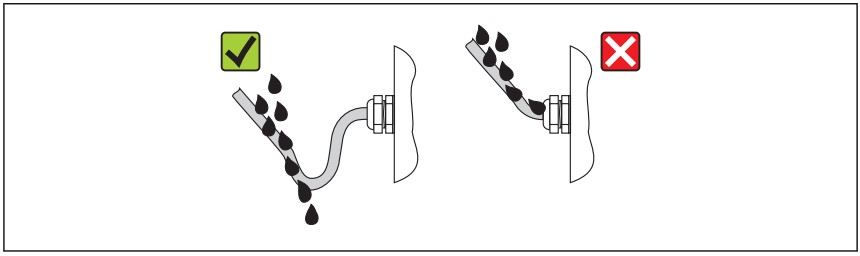
For HART communication: When connecting the cable shielding to the ground terminal, observe the grounding concept of the facility.

7.3 Ensuring the degree of protection

The measuring device fulfills all the requirements for the IP66 and IP67 (Type 4X enclosure) degree of protection.

To guarantee IP 66 and IP 67 degree of protection (Type 4X enclosure), carry out the following steps after the electrical connection:

1. Check whether the housing seals of the connection and electronics compartment are clean and inserted 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").



A0013960

5. Insert dummy plugs into unused cable entries.

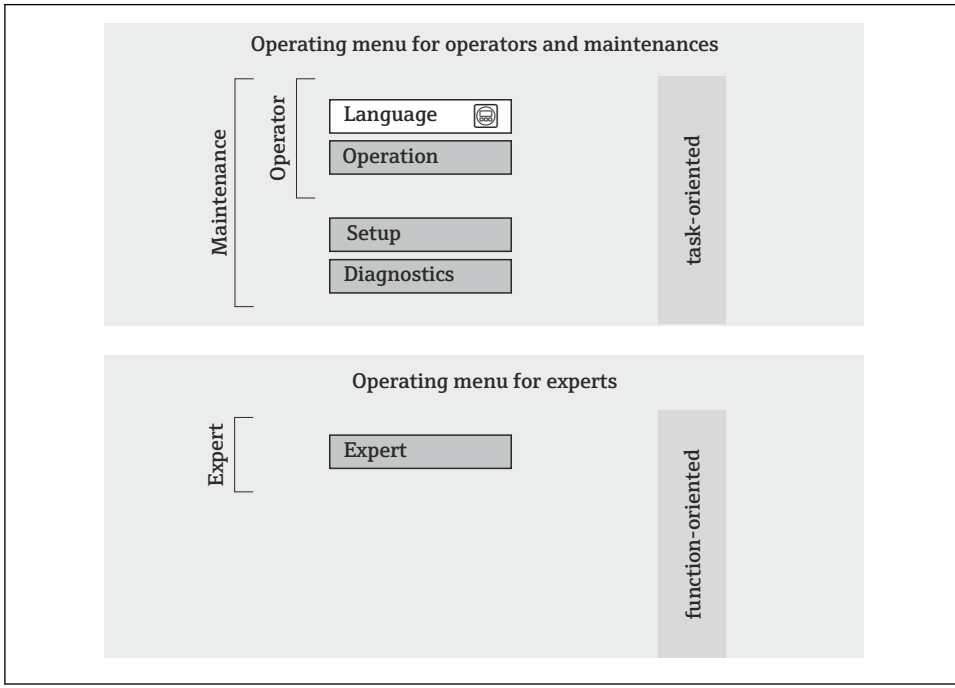
7.4 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Are the power supply and signal cables correctly connected?	❑
Does the supply voltage correspond to the specifications in the connection diagram?	❑
Do the cables comply with the requirements ?	❑
Do the cables have adequate strain relief? Are they routed securely?	❑
Is the cable type route completely isolated? Without loops and cross-overs?	❑
Are all the screw terminals firmly tightened?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap"? (→ 🖹 25)	❑
Does the supply voltage match the specifications on the transmitter nameplate ?	❑
Is the terminal assignment correct ?	❑
If supply voltage is present, is the device ready for operation and do values appear on the display module?	❑
Are all housing covers installed and firmly tightened?	❑

8 Operation options

8.1 Structure and function of the operating menu

8.1.1 Structure of the operating menu



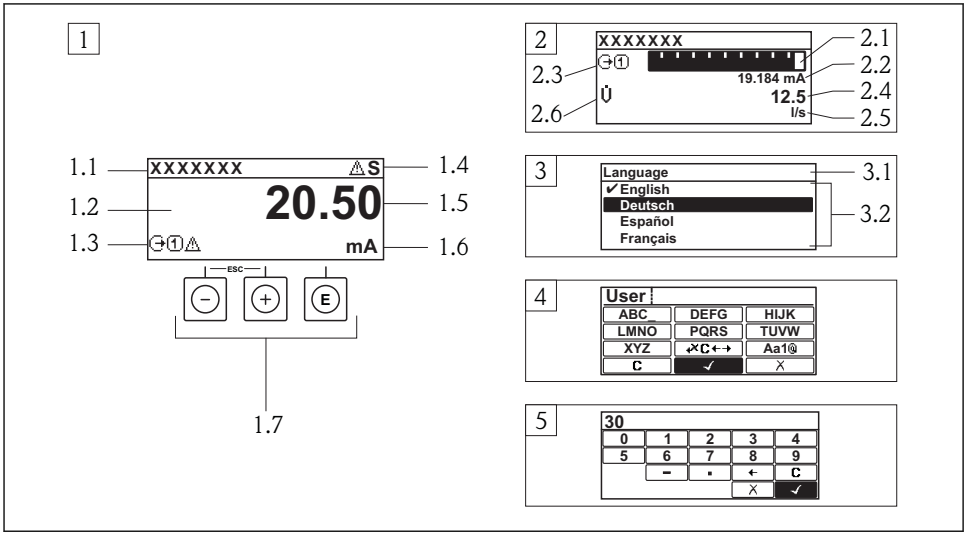
6 Schematic structure of the operating menu

8.1.2 Operating philosophy

The individual parts of the operating menu are assigned to certain user roles. Each user role corresponds to typical tasks within the device lifecycle.

For detailed information about the operating philosophy of the instrument, refer to the Operating Instructions for the device on the CD-ROM provided

8.2 Access to the operating menu via the local display



A0014013

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

8.2.1 Operational display

Status area

Status signals			
F A0013956	C A0013959	S A0013958	M A0013957
Failure	Function check	Out of specification	Maintenance required
Diagnostic behavior		**Locking**	**Communication**
A0013961	A0013962	A0013963	A0013965
Alarm	Warning	Device locked	Remote operation enabled

Display area

Measured variables

Symbol	Meaning
A0013711	Volume flow
A0013710	Mass flow
A0013947	Temperature
A0013943	Totalizer
A0013945	Current output
A0017270	Status input
Symbols for measurement channel numbers	
1 ... 4 A0016325	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type.	
Symbols for diagnostic behavior	
The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable. For more information about the symbols, refer to the "Status area" section	

8.2.2 Navigation view

Status area

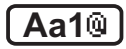
The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code for the parameter you are navigating to (e.g. 0022-1)
  - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard
  If a diagnostic event is present, the diagnostic behavior and status signal

Display area

Icons for menus			
 A0013973	 A0013974	 A0013975	 A0013966
Display/operat.	Setup	Diagnostics	Expert
Icons for submenus, wizards, parameters			**Lock symbols**
 A0013967	 A0013968	 A0013972	 A0013963
Submenu	Wizard	Parameters within a wizard	Parameter locked

8.2.3 Editing view

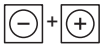
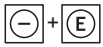
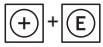
Input mask

Operating symbols in the numeric editor		
 A0013985	 A0016621	 A0013986
Confirms selection.	Moves the input position one position to the left.	Exits the input without applying the changes.
 A0016619	 A0016620	 A0014040
Inserts decimal separator at the input position.	Inserts minus sign at the input position.	Clears all entered characters.
Operating symbols in the text editor		
 A0013985	 A0013987	 A0013986
Confirms selection.	Switches to the selection of the correction tools.	Exits the input without applying the changes.
 A0014040	 A0013981	
Clears all entered characters.	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters	

Correction symbols under			
 A0013989	 A0013990	 A0013991	 A0013988
Clears all entered characters.	Moves the input position one position to the left.	Moves the input position one position to the right.	Deletes one character immediately to the left of the input position.

8.2.4 Operating elements

Key	Meaning
 A0013969	**Minus key** *In a menu, submenu* Moves the selection bar upwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the previous parameter. *With a text and numeric editor* In the input mask, moves the selection bar to the left (backwards).
 A0013970	**Plus key** *In a menu, submenu* Moves the selection bar downwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the next parameter. *With a text and numeric editor* Moves the selection bar to the right (forwards) in an input screen.
 A0013952	**Enter key** *For operational display* ▪ Pressing the key briefly opens the operating menu. ▪ Pressing the key for 2 s opens the context menu. *In a menu, submenu* ▪ Pressing the key briefly: – Opens the selected menu, submenu or parameter. – Starts the wizard. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. *With a Wizard* Opens the editing view of the parameter. *With a text and numeric editor* ▪ Pressing the key briefly: – Opens the selected group. – Carries out the selected action. ▪ Pressing the key for 2 s confirms the edited parameter value.

Key	Meaning
 A0013971	**Escape key combination (press keys simultaneously)** *In a menu, submenu* ▪ Pressing the key briefly: – Exits the current menu level and takes you to the next higher level. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s returns you to the operational display ("home position"). *With a Wizard* Exits the wizard and takes you to the next higher level. *With a text and numeric editor* Closes the text or numeric editor without applying changes.
 A0013953	**Minus/Enter key combination (press the keys simultaneously)** Reduces the contrast (brighter setting).
 A0013954	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
 A0013955	**Minus/Plus/Enter key combination (press the keys simultaneously)** *For operational display* Enables or disables the keypad lock.

8.2.5 Calling up help text

Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Calling up and closing the help text

The user is in the navigation view and the selection bar is on a parameter.

1. Press E for 2 s.
   ↳ The help text for the selected parameter opens.
2. Press − + + simultaneously.
   ↳ The help text is closed.

8.2.6 User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access .

Access authorization to parameters

User role	Read access		Write access	
	Without access code (from the factory)	With access code	Without access code (from the factory)	With access code
Operator	✔	✔	✔	-- [1]
Maintenance	✔	✔	✔	✔

1) Despite the defined access code, certain parameters can always be modified and thus are excepted from the write protection, as they do not affect the measurement. Refer to the "Write protection via access code" section

For detailed information about parameters which can always be modified, refer to the Operating Instructions for the device on the CD-ROM provided

If an incorrect access code is entered, the user obtains the access rights of the "Operator" role.

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

8.2.7 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using the local display .

The locking of the write access via local operation can be disabled by entering the customer-defined access code via the respective access option.

1. After you press E, the input prompt for the access code appears.
2. Enter the access code.
   ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.2.8 Enabling and disabling the keypad lock

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

Local operation with mechanical push buttons (display module SD02)

Display module SD02: order characteristic *"Display; Operation"*, option **C**

The keypad lock is switched on and off in the same way:

Switching on the keypad lock

▶ The device is in the measured value display.
Press the ⊟ + ⊞ + Ⓔ keys simultaneously.
↳ The message **Keylock on** appears on the display: The keypad lock is switched on.

Switching off the keypad lock

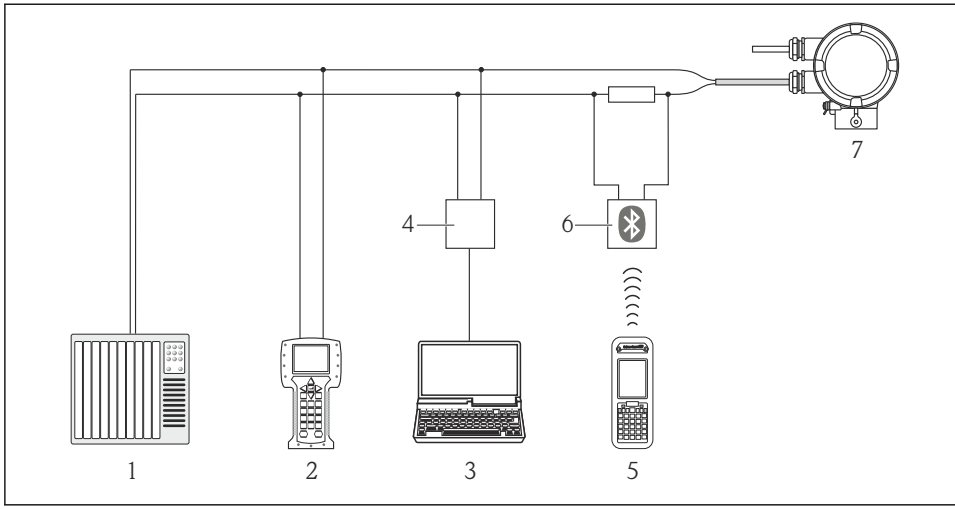
▶ The keypad lock is switched on.
Press the ⊟ + ⊞ + Ⓔ keys simultaneously.
↳ The message **Keylock off** appears on the display: The keypad lock is switched off.

8.3 Access to the operating menu via the operating tool

For detailed information about access to the operating menu via operating tool, refer to the Operating Instructions for the device on the CD-ROM provided

8.3.1 Via HART protocol

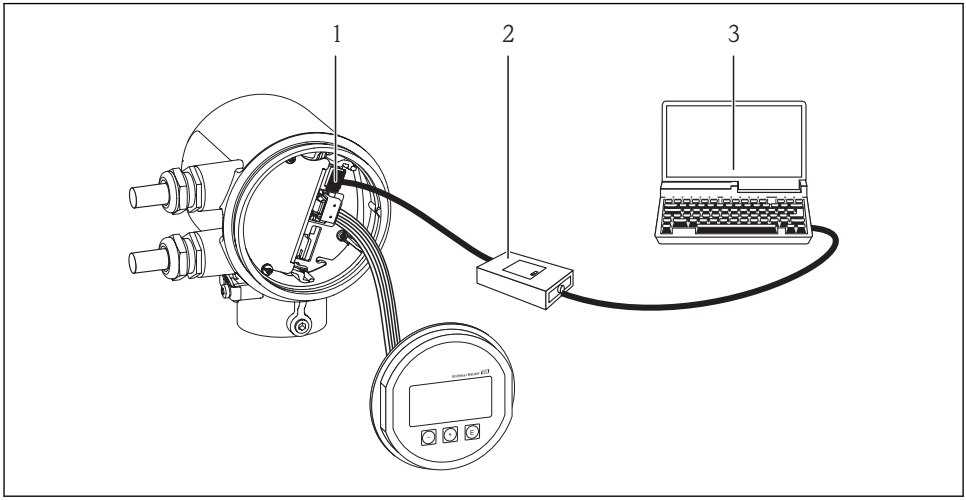
This communication interface is present in the following device version:
- Order code for "Output", option **A**: 4-20 mA HART
- Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
- Order code for "Output", option **Q**: 4-20 mA HART, pulse/frequency/switch output, status input



7 Options for remote operation via HART protocol

1 Control system (e.g. PLC)
2 Field Communicator 475
3 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
4 Commubox FXA195 (USB)
5 Field Xpert SFX350 or SFX370
6 VIATOR Bluetooth modem with connecting cable
7 Transmitter

8.3.2 Via service interface (CDI)



A0017253

1 Service interface (CDI) of the measuring device
2 Commubox FXA291
3 Computer with "FieldCare" operating tool with COM DTM "CDI Communication FXA291"

9 System integration

For system integration, see the Operating Instructions for the device (→ 10).

10 Commissioning

10.1 Function check

Before commissioning the device, make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist (→ 24)
- "Post-connection check" checklist

10.2 Switching on the measuring device

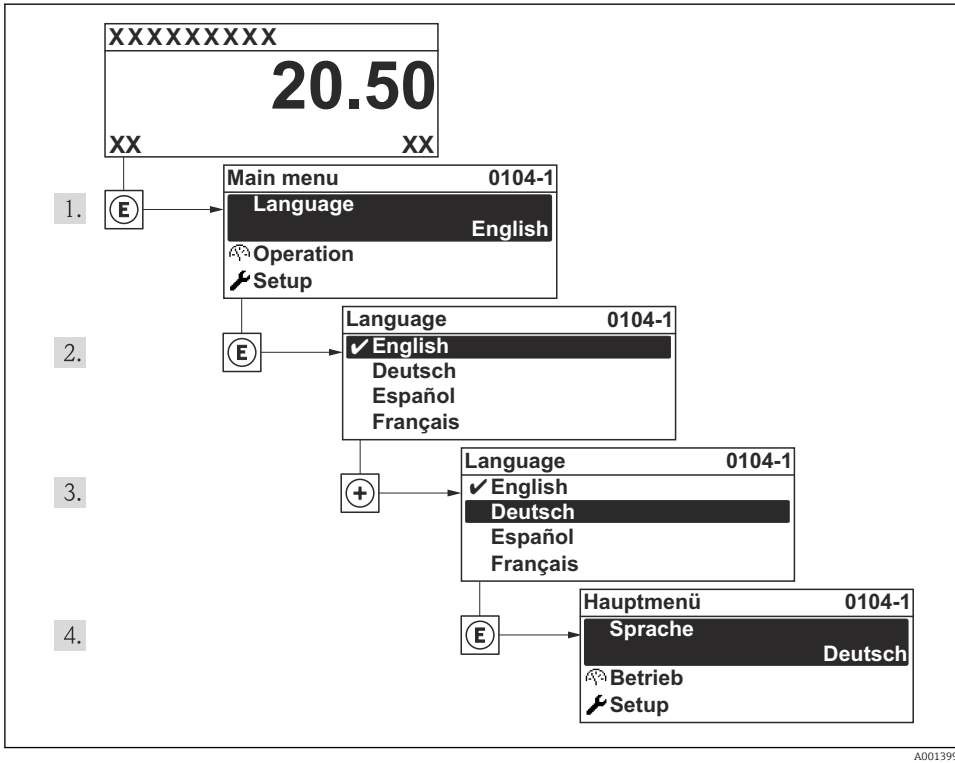
After a successful function check, switch on the measuring device.

After a successful startup, the local display switches automatically from the startup display to the measured value display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the device's operating instructions which can be found on the CD-ROM supplied with the device.

10.3 Setting the operating language

Factory setting: English or ordered local language



10.4 Configuring the measuring device

The **Setup** menu contains all the parameters that are needed for standard measuring operation.

Navigation
"Setup" menu

Overview "Setup" menu

Options	Meaning

Device tag	Enter the name for the measuring point.
Temperature	Displays the temperature currently measured.
Pipe inner diameter	Enter the inner diameter of the pipe.
Installation factor	Enter the factor to adjust the installation conditions.
Assign status input	Select the function for the status input.
Assign current output	Select process variable for current output.
4 mA value	Enter 4 mA value.
20 mA value	Enter 20 mA value.
Operating mode	Specify the output as a pulse, frequency or switch output.
Assign frequency output	Select the process variable for the frequency output.
Measuring value at minimum frequency	Enter the measured value at the minimum frequency.
Measuring value at maximum frequency	Specify the measured value at maximum frequency.
Switch output function	Select the function for the switch output.
Assign limit	Select the process variable for the limit function.
Switch-off value	Enter the measured value for the switch-off value.
Switch-on value	Enter the measured value for the switch-on value.
Assign status	Select the device status for the switch output.
Assign diagnostic behavior	Select the diagnostic behavior for the switch output.
Assign pulse output	Select the process variable for the pulse output.
Value per pulse	Enter the measured value for the pulse output.

10.5 Defining the tag name

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

Navigation

"Setup" menu → Device tag

Parameter overview with brief description

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

10.6 Protecting settings from unauthorized access

The following options exist for protecting the configuration of the measuring device from unintentional modification after commissioning:

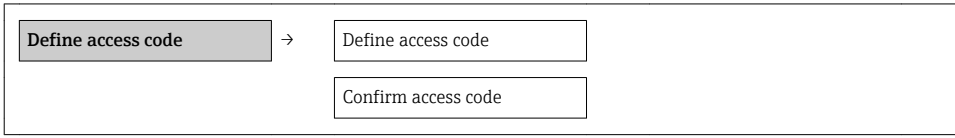
- Write protection via access code
- Write protection via write protection switch
- Write protection via keypad lock

10.6.1 Write protection via access code

With the customer-specific access code, the parameters for the measuring device configuration are write-protected and their values can no longer be changed via local operation.

Navigation
"Setup" menu → Advanced setup → Administration → Def. access code

Structure of the submenu



Defining the access code via local display

Define access code

1. Navigate to the **Enter access code** parameter.
2. Define a max. 4-digit numeric code as an access code.
3. Enter the access code again to confirm the code.
   ↳ The 🔒-symbol appears in front of all write-protected parameters.

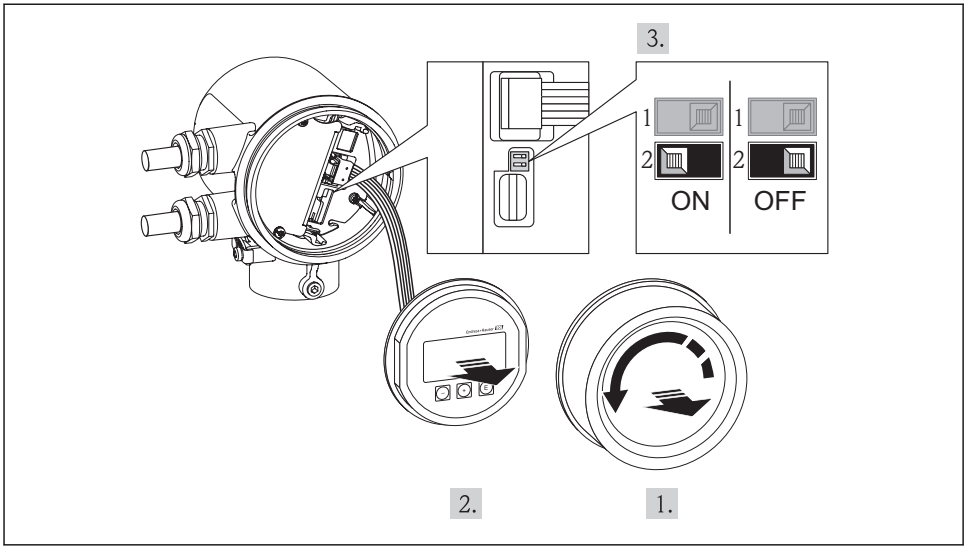
The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing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

- If write access is activated via access code, it can be also be deactivated only via the access code (→ 🖹 37).
- The user role with which the user is currently logged on via the local display (→ 🖹 37) is indicated by the **Access status display** parameter. "Operation" menu → Access stat.disp

10.6.2 Write protection via write protection switch

Unlike write protection via user-specific access code, this allows write access to the entire operating menu - other than the **Contrast display** parameter - to be locked.

The parameter values are now read only and cannot be edited any more (exception **Contrast display** parameter):
- Via local display
- Via service interface (CDI)
- Via HART protocol

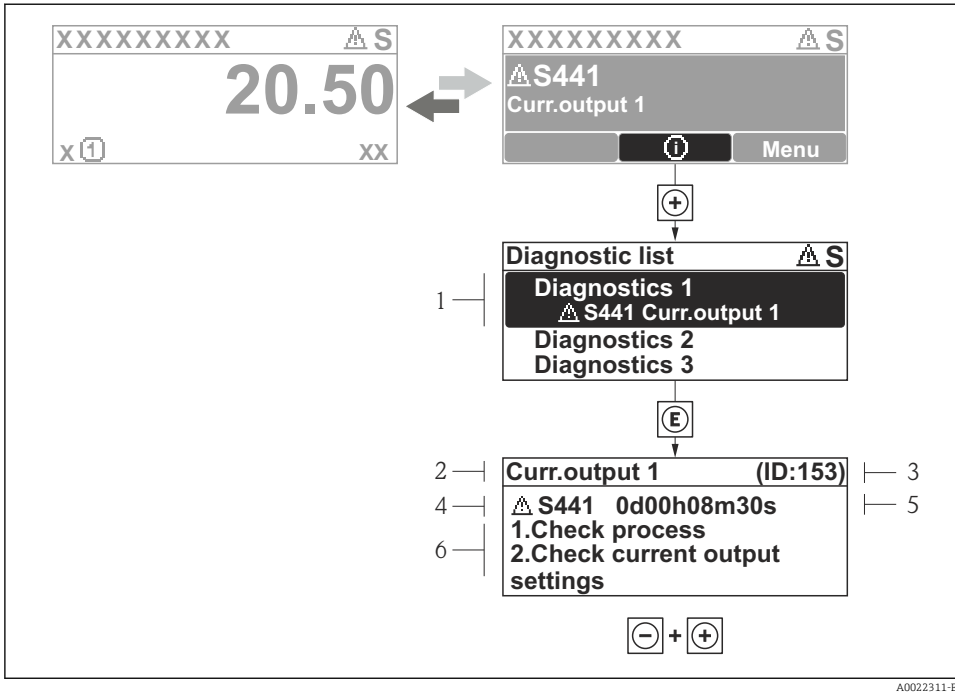


A0017255

1. Unscrew the electronics compartment cover.
2. Pull out the display module with a gentle rotational movement. To make it easier to access the lock switch, attach the display module to the edge of the electronics compartment.
   ↳ Display module is attached to the edge of the electronics compartment.
3. Setting the write protection switch (WP) on the main electronics module to the ON position enables the hardware write protection.
   ↳ In the **Locking status** parameter the **Hardware locked** option is displayed. In addition, on the local display the 🔒-symbol appears in front of the parameters in the header of the operational display and in the navigation view.
4. Feed the cable into the gap between the housing and electronics module and plug the display module into the electronics compartment in the desired direction until it engages.
5. Screw down the electronics compartment cover.

11 Diagnostic information and remedial measures

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 on the remedial measures can be called up from the diagnostic message, and contains important information on the fault.



8 Message for 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

The user is in the diagnostic message.

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

www.addresses.endress.com

Endress+Hauser

People for Process Automation