Operating Instructions
Proline Promass E 100

Coriolis flowmeter
Modbus RS485

Endress+Hauser

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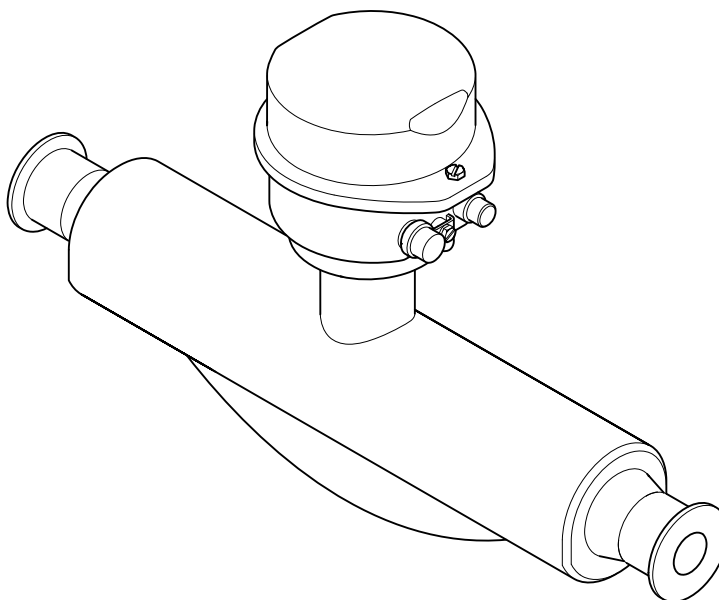
- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific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

Table of contents

1　About this document

1.1　Document function

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

1.2　Symbols

1.2.1　Safety symbols

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

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

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

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.
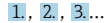
1.2.2　Electrical symbols

Symbol	Meaning
⎓	Direct current
∼	Alternating current
⎓∼	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: • Inner ground terminal: Connects the protectiv earth to the mains supply. • Outer ground terminal: Connects the device to the plant grounding system.

1.2.3　Tool symbols

Symbol	Meaning
⬡⌖	Allen key
🔧	Open-ended wrench

1.2.4 Symbols for certain types of information

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

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1., 2., 3., ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
EX	Hazardous area
⬡	Safe area (non-hazardous area)
≈▶	Flow direction

1.3 Documentation

🛈 For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

🛈 Detailed list of the individual documents along with the documentation code → 🗎 101

1.3.1   Standard documentation

Document type	Purpose and content of the document
Technical Information	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Sensor Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 1** The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device. • Incoming acceptance and product identification • Storage and transport • Installation
Transmitter Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 2** The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value). • Product description • Installation • Electrical connection • Operation options • System integration • Commissioning • Diagnostic information
Description of Device Parameters	**Reference for your parameters** The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. The document provides Modbus-specific information for each individual parameter in the Expert operating menu.

1.3.2   Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

1.4   Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

2   Safety instructions

2.1   Requirements for the personnel

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

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

2.2   Designated use

Application and media
The measuring device described in this manual is intended only for the flow measurement of liquids and gases.

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

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

To ensure that the measuring device remains in proper condition for the operation time:
▸ Keep within the specified pressure and temperature range.
▸ Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
▸ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
▸ Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
▸ If the ambient temperature of the measuring device is outside the atmospheric temperature, it is absolutely essential to comply with the relevant basic conditions as specified in the device documentation → 🕮 6.
▸ Protect the measuring device permanently against corrosion from environmental influences.

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

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

NOTICE

Verification for borderline cases:

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

Residual risks

⚠ WARNING

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

▶ For elevated fluid temperatures, ensure protection against contact to prevent burns.

⚠ WARNING

Danger of housing breaking due to measuring tube breakage!

If a measuring tube ruptures, the pressure inside the sensor housing will rise according to the operating process pressure.

▶ Use a rupture disk.

⚠ WARNING

Danger from medium escaping!

For device versions with a rupture disk: medium escaping under pressure can cause injury or material damage.

▶ Take precautions to prevent injury and material damage if the rupture disk is actuated.

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.

If working on and with the device with wet hands:

▶ Due to the increased risk of electric shock, gloves must be worn.

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 Endress+Hauser.

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 Endress+Hauser only.

2.5   Product safety

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

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

2.6   IT security

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

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

3   Product description

The device consists of a transmitter and a sensor. The Safety Barrier Promass 100 is part of the scope of supply and must be implemented to operate the device.

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

3.1   Product design

3.1.1   Device version with Modbus RS485 communication protocol

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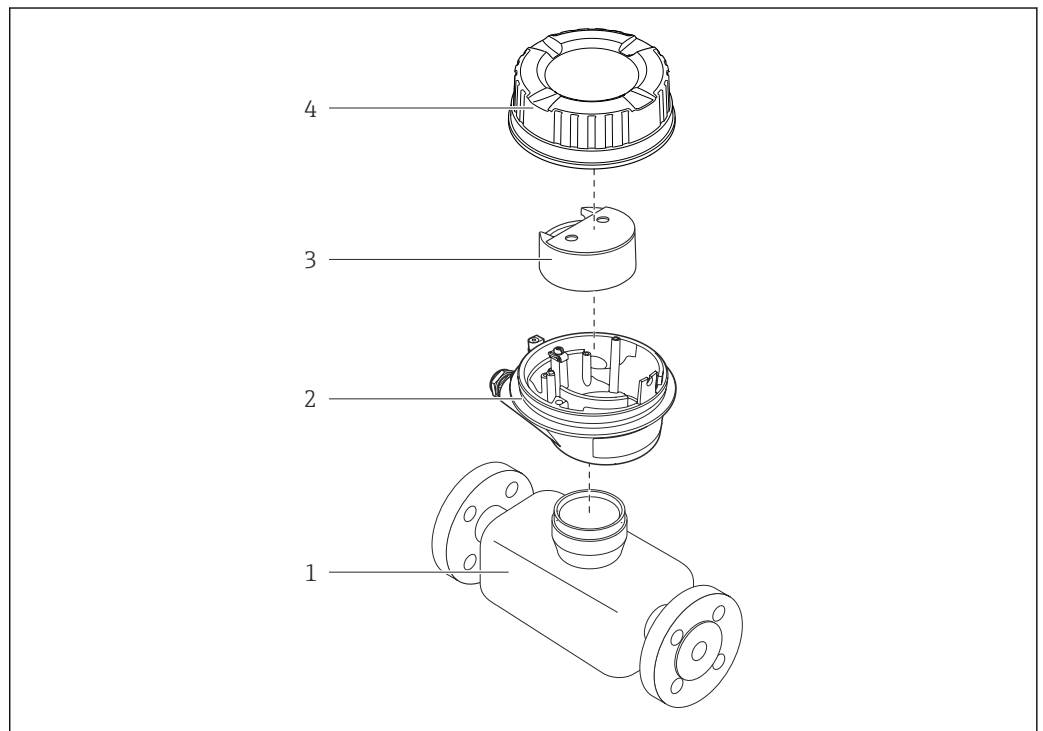
🖾 1   Important components of a measuring device

1   Sensor
2   Transmitter housing
3   Main electronics module
4   Transmitter housing cover

In the case of the device version with Modbus RS485 intrinsically safe, the Safety Barrier Promass 100 forms part of the scope of supply.

4 Incoming acceptance and product identification

4.1 Incoming acceptance
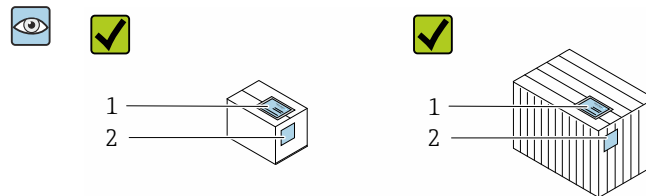
Are the order codes on the delivery note (1) and the product sticker (2) identical?
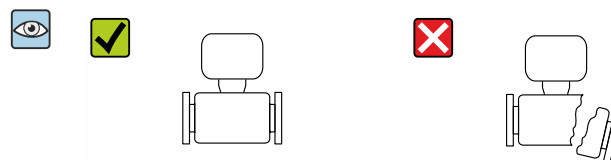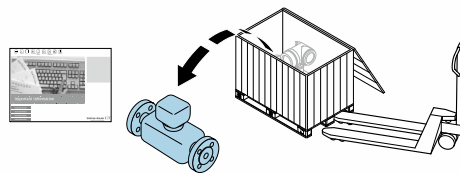
Are the goods undamaged?
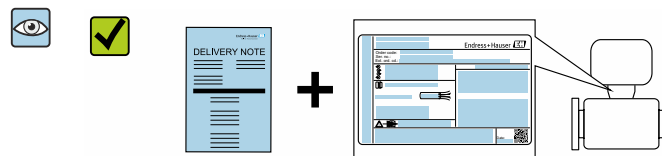
Do the nameplate data match the ordering information on the delivery note?
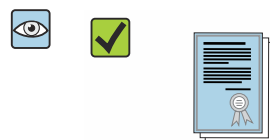
Is the envelope present with accompanying documents?

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 🖻 13.

4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The "Additional standard documentation on the device"→ 🖹 7 and "Supplementary device-dependent documentation"→ 🖹 7 sections
- The *W@M Device Viewer*: enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Transmitter nameplate
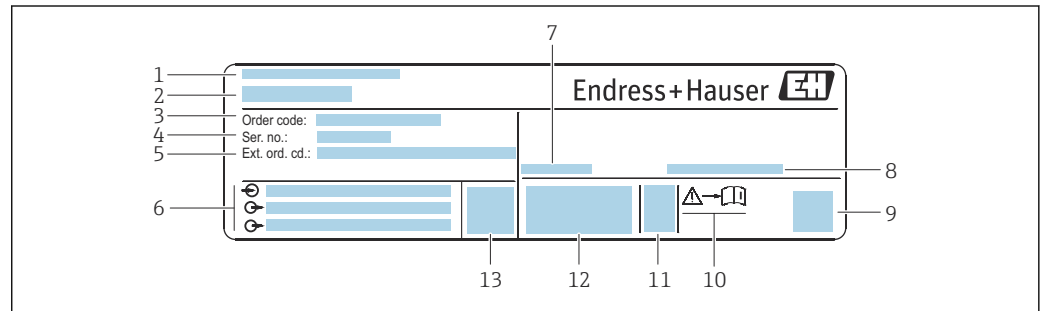
    A0030222

 🖼 *2   Example of a transmitter nameplate*

1   Manufacturing location
2   Name of the transmitter
3   Order code
4   Serial number (Ser. no.)
5   Extended order code (Ext. ord. cd.)
6   Electrical connection data, e.g. available inputs and outputs, supply voltage
7   Permitted ambient temperature (T_a)
8   Degree of protection
9   2-D matrix code
10   Document number of safety-related supplementary documentation → 🖹 102
11   Manufacturing date: year-month
12   CE mark, C-Tick
13   Firmware version (FW)

4.2.2 Sensor nameplate
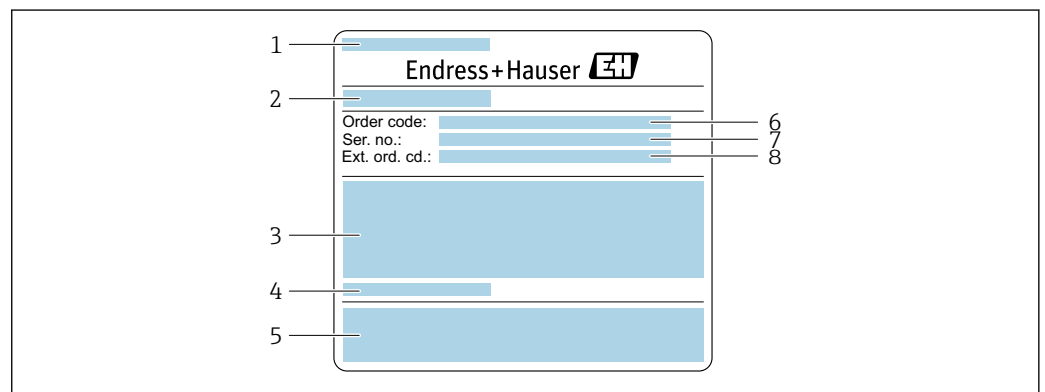
    A0029206

 🖼 *3   Example of a sensor nameplate, part 1*

1   Name of the sensor
2   Manufacturing location
3   Nominal diameter of the sensor; flange nominal diameter/nominal pressure; sensor test pressure; medium temperature range; material of measuring tube and manifold
4   Sensor-specific information
5   CE mark, C-Tick
6   Order code
7   Serial number (ser. no.)
8   Extended order code (Ext. ord. cd.)
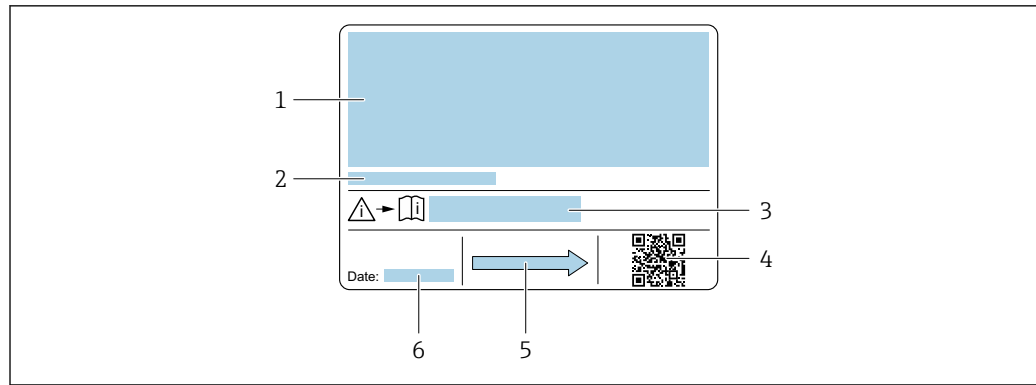
A0029207

⊠ 4   *Example of a sensor nameplate, part 2*

1   Approval information for explosion protection, Pressure Equipment Directive and degree of protection
2   Permitted ambient temperature (T_a)
3   Document number of safety-related supplementary documentation
4   2-D matrix code
5   Flow direction
6   Manufacturing date: year-month

Order code
The measuring device is reordered using the order code.

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

4.2.3 Promass 100 safety barrier nameplate

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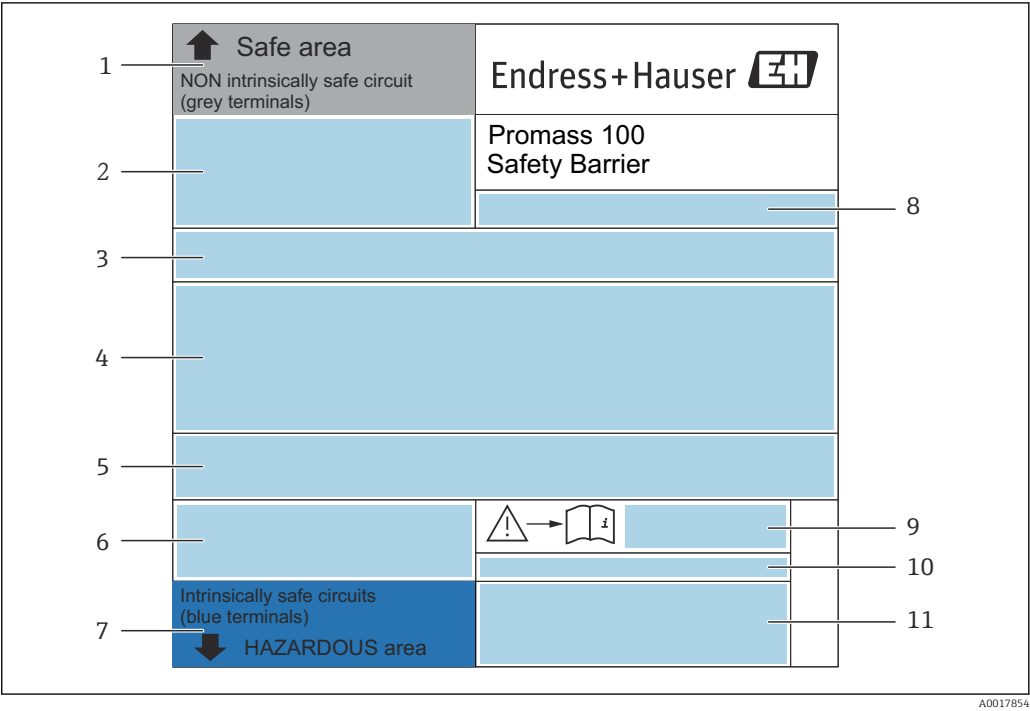
⊠ 5 Example of a Promass 100 safety barrier nameplate

1 Non-hazardous area or Zone 2/Div. 2
2 Serial number, material number and 2-D matrix code of the Promass 100 safety barrier
3 Electrical connection data, e.g. available inputs and outputs, supply voltage
4 Approval information for explosion protection
5 Safety warning
6 Communication-specific information
7 Intrinsically safe area
8 Manufacturing location
9 Document number of safety-related supplementary documentation
10 Permitted ambient temperature (T_a)
11 CE mark, C-Tick

4.2.4 Symbols on measuring device

Symbol	Meaning
⚠	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
📖	**Reference to documentation** Refers to the corresponding device documentation.
⏚	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

5.1 Storage conditions

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

Storage temperature→ 🕮 91

5.2 Transporting the product

Transport the measuring device to the measuring point in the original packaging.
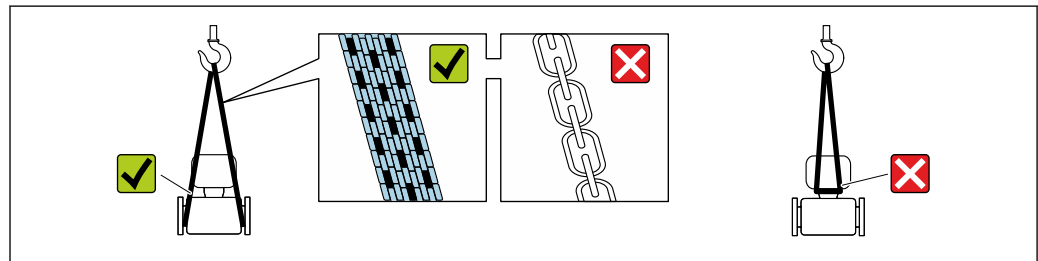
A0029252

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

5.2.1 Measuring devices without lifting lugs

⚠ WARNING

Center of gravity of the measuring device is higher than the suspension points of the webbing slings.
Risk of injury if the measuring device slips.
- ▶ Secure the measuring device against slipping or turning.
- ▶ Observe the weight specified on the packaging (stick-on label).
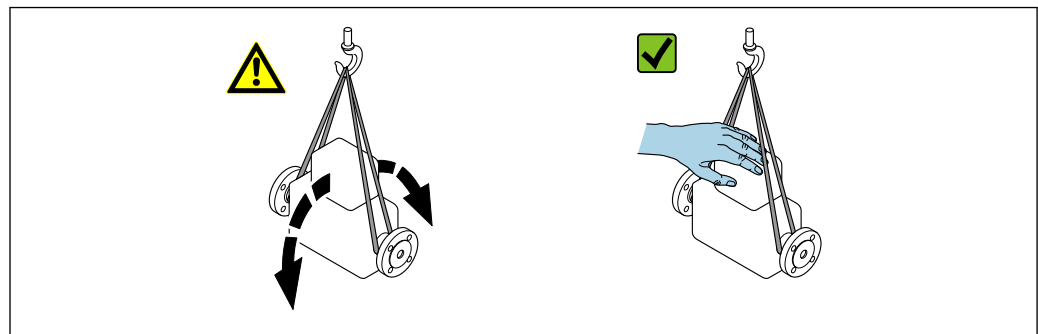
A0029214

5.2.2 Measuring devices with lifting lugs

⚠ CAUTION

Special transportation instructions for devices with lifting lugs

▶ Only use the lifting lugs fitted on the device or flanges to transport the device.
▶ The device must always be secured at two lifting lugs at least.

5.2.3 Transporting with a fork lift

If transporting in wood crates, the floor structure enables the crates to be lifted lengthwise or at both sides using a forklift.

5.3 Packaging disposal

All packaging materials are environmentally friendly and 100 % recyclable:
- Outer packaging of device
  Polymer stretch wrap that complies with EU Directive 2002/95/EC (RoHS)
- Packaging
  - Wooden crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
  - Cardboard box in accordance with European packaging guideline 94/62EC, recyclability confirmed by Resy symbol
- Carrying and securing materials
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Filler material
  Paper pads

6   Installation

6.1   Installation conditions

6.1.1   Mounting position

Mounting location

A0028772
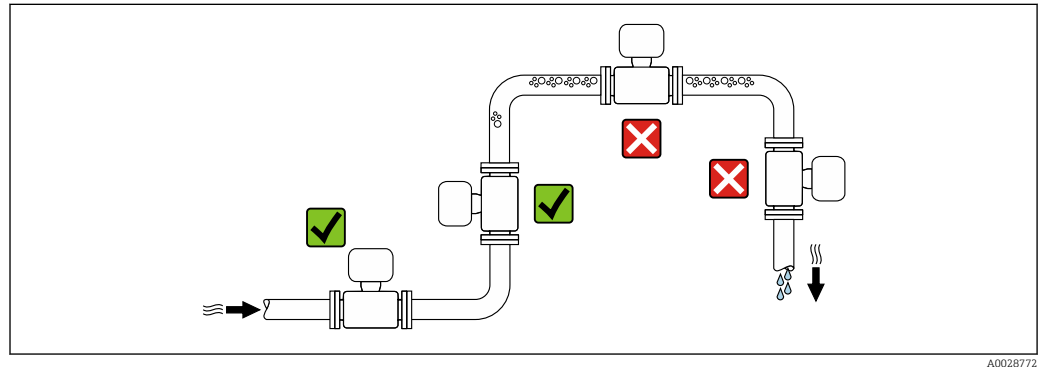
To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

However, the following installation suggestion allows for installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.

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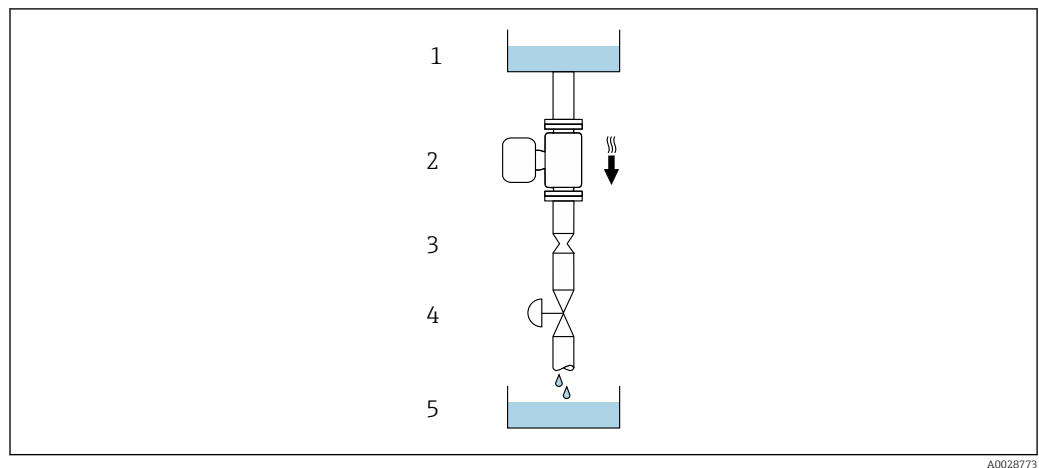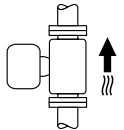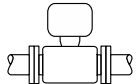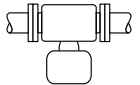
⊡ 6   *Installation in a down pipe (e.g. for batching applications)*

1   Supply tank
2   Sensor
3   Orifice plate, pipe restriction
4   Valve
5   Batching tank

DN		Ø orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
8	⅜	6	0.24
15	½	10	0.40
25	1	14	0.55
40	1½	22	0.87
50	2	28	1.10
80	3	50	1.97

Orientation

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

	Orientation		Recommendation
A	Vertical orientation	 A0015591	✅✅ 1)
B	Horizontal orientation, transmitter at top	 A0015589	✅✅ 2) Exceptions: → 🖻 7, 🖺 19
C	Horizontal orientation, transmitter at bottom	 A0015590	✅✅ 3) Exceptions: → 🖻 7, 🖺 19
D	Horizontal orientation, transmitter at side	 A0015592	❌

1) This orientation is recommended to ensure self-draining.
2) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
3) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

If a sensor is installed horizontally with a curved measuring tube, match the position of the sensor to the fluid properties.
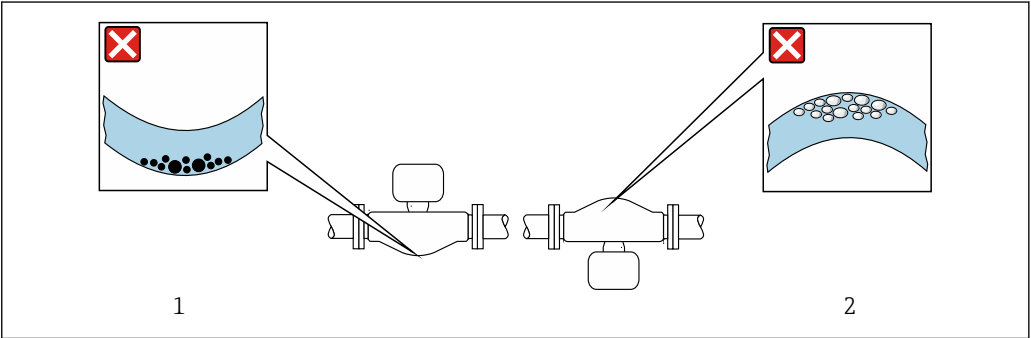
🖻 7   *Orientation of sensor with curved measuring tube*

1   *Avoid this orientation for fluids with entrained solids: Risk of solids accumulating.*
2   *Avoid this orientation for outgassing fluids: Risk of gas accumulating.*

Inlet and outlet runs

No special precautions need to be taken for fittings which create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs → 🖻 20.
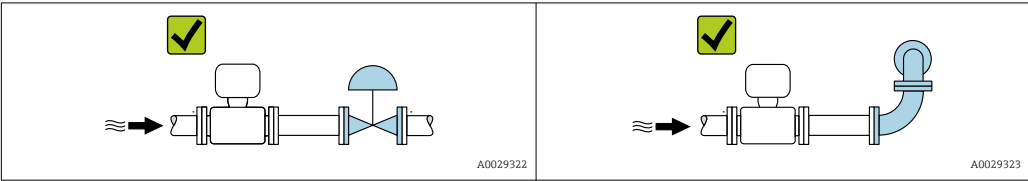
Installation dimensions

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

6.1.2 Environmental and process requirements

Ambient temperature range

Measuring device	• −40 to +60 °C (−40 to +140 °F) • Order code for "Test, certificate", option JM: −50 to +60 °C (−58 to +140 °F)
Safety Barrier Promass 100	−40 to +60 °C (−40 to +140 °F)

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

System pressure

It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas.

Cavitation is caused if the pressure drops below the vapor pressure:
• In liquids that have a low boiling point (e.g. hydrocarbons, solvents, liquefied gases)
• In suction lines

▸ Ensure the system pressure is sufficiently high to prevent cavitation and outgassing.

For this reason, the following mounting locations are recommended:
• At the lowest point in a vertical pipe
• Downstream from pumps (no danger of vacuum)
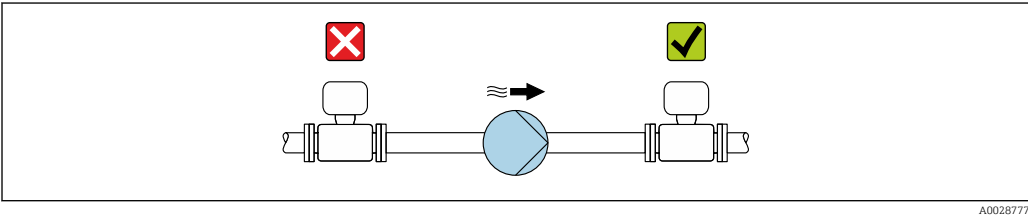
Thermal insulation

In the case of some fluids, it is important to keep the heat radiated from the sensor to the transmitter to a low level. A wide range of materials can be used for the required insulation.

NOTICE

Electronics overheating on account of thermal insulation!

▶ Recommended orientation: horizontal orientation, transmitter housing pointing downwards.

▶ Do not insulate the transmitter housing .

▶ Maximum permissible temperature at the lower end of the transmitter housing: 80 ℃ (176 ℉)

▶ Thermal insulation with extended neck free: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.
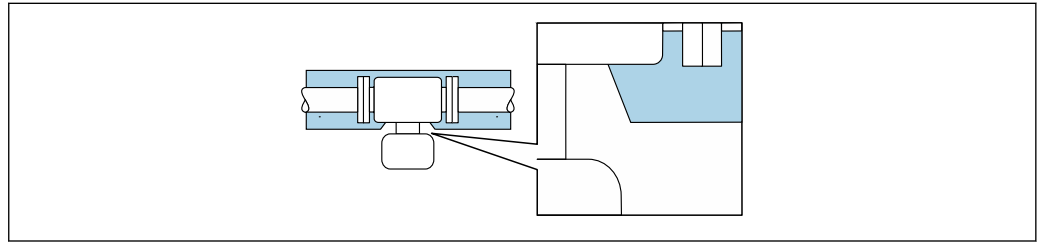
A0034391

🔲 *8   Thermal insulation with extended neck free*

Heating

NOTICE

Electronics can overheat due to elevated ambient temperature!

▶ Observe maximum permitted ambient temperature for the transmitter .

▶ Depending on the fluid temperature, take the device orientation requirements into account .

NOTICE

Danger of overheating when heating

▶ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 ℃ (176 ℉).

▶ Ensure that sufficient convection takes place at the transmitter neck.

▶ Ensure that a sufficiently large area of the transmitter neck remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

▶ When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation. For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

Heating options

If a fluid requires that no heat loss should occur at the sensor, users can avail of the following heating options:
• Electrical heating, e.g. with electric band heaters
• Via pipes carrying hot water or steam
• Via heating jackets

Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

6.1.3   Special mounting instructions

Drainability

The measuring tubes can be completely drained and protected against solids build-up in vertical orientation.

Sanitary compatibility

When installing in hygienic applications, please refer to the information in the "Certificates and approvals/hygienic compatibility" section → 🖺 99

Rupture disk

Information that is relevant to the process: → 🖺 93.

⚠ WARNING

Danger from medium escaping!

Medium escaping under pressure can cause injury or material damage.

▸ Take precautions to prevent danger to persons and damage if the rupture disk is actuated.
▸ Observe information on the rupture disk sticker.
▸ Make sure that the function and operation of the rupture disk is not impeded through the installation of the device.
▸ Do not use a heating jacket.
▸ Do not remove or damage the rupture disk.

▸ After the rupture disk is actuated, do not operate the measuring device any more.

The position of the rupture disk is indicated on a sticker applied over it. If the rupture disk is triggered, the sticker is destroyed. The disk can therefore be visually monitored.
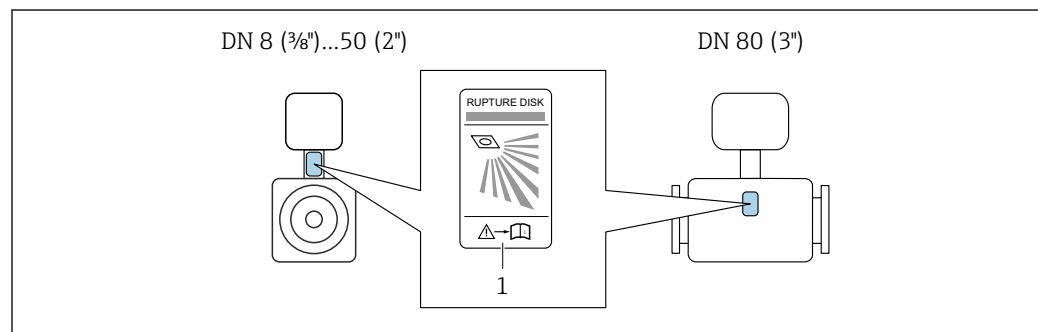
1   Rupture disk label

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions→ 🖺 87. Therefore, a zero point adjustment in the field is generally not required.

Experience shows that zero point adjustment is advisable only in special cases:
• To achieve maximum measuring accuracy even with low flow rates.
• Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

6.2   Mounting the measuring device

6.2.1   Required tools

For sensor

For flanges and other process connections: Corresponding mounting tools

6.2.2   Preparing the measuring device

1. Remove all remaining transport packaging.

2. Remove any protective covers or protective caps present from the sensor.

3. If present, remove transport protection of the rupture disk.

4. 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 inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
> ▸ Ensure that the seals are clean and undamaged.
> ▸ Secure the seals correctly.

1. Ensure that the direction of the arrow on the nameplate of the sensor matches the flow direction of the fluid.

2. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.
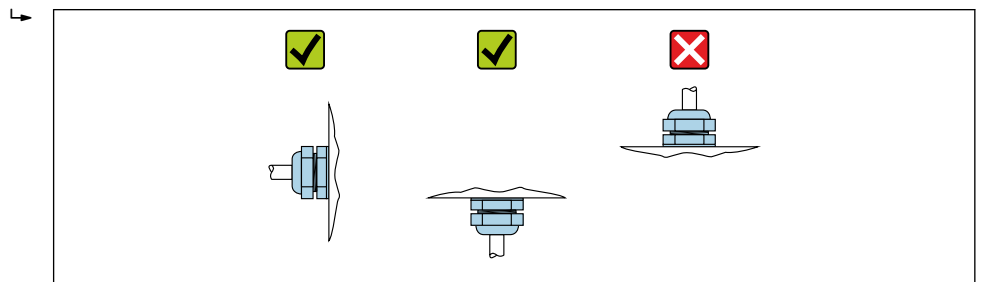
    A0029263

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 → 🖹 92 • Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) • Ambient temperature • Measuring range	❑
Has the correct orientation for the sensor been selected ? • According to sensor type • According to medium temperature • According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping → 🖹 19?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Are the securing screw and securing clamp tightened securely?	❑

7 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

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

7.1 Electrical safety

In accordance with applicable federal/national regulations.

7.2 Connection conditions

7.2.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp (on aluminum housing): Allen screw 3 mm
- For securing screw (for stainless steel housing): open-ended wrench 8 mm
- Wire stripper
- When using stranded cables: crimper for wire end ferrule

7.2.2 Requirements for connecting cable

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

Permitted temperature range

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

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

Standard installation cable is sufficient.

Signal cable

Modbus RS485

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

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm^2 (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Connecting cable between Safety Barrier Promass 100 and measuring device

Cable type	Shielded twisted-pair cable with 2x2 wires. When grounding the cable shield, observe the grounding concept of the plant.
Maximum cable resistance	2.5 Ω, one side

ℹ️ Comply with the maximum cable resistance specifications to ensure the operational reliability of the measuring device.

The maximum cable length for individual wire cross-sections is specified in the table below. Observe the maximum capacitance and inductance per unit length of the cable and the connection values in the Ex documentation .

Wire cross-section		Maximum cable length	
[mm^2]	[AWG]	[m]	[ft]
0.5	20	70	230
0.75	18	100	328
1.0	17	100	328
1.5	16	200	656
2.5	14	300	984

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable ∅ 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
  Wire cross-sections 0.5 to 2.5 mm^2 (20 to 14 AWG)
- With Safety Barrier Promass 100:
  Plug-in screw terminals for wire cross-sections0.5 to 2.5 mm^2 (20 to 14 AWG)

7.2.3   Terminal assignment

Transmitter

Modbus RS485 connection version

ℹ️ For use in the non-hazardous area and Zone 2/Div. 2

Order code for "Output", option **M**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options **A**, **B**	Terminals	Terminals	• Option **A**: coupling M20x1 • Option **B**: thread M20x1 • Option **C**: thread G ½" • Option **D**: thread NPT ½"
Options **A**, **B**	Device plugs → 🕮 28	Terminals	• Option **L**: plug M12x1 + thread NPT ½" • Option **N**: plug M12x1 + coupling M20 • Option **P**: plug M12x1 + thread G ½" • Option **U**: plug M12x1 + thread M20

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B, C	Device plugs → 🖹 28	Device plugs → 🖹 28	Option Q: 2 x plug M12x1
Order code for "Housing": • Option A: compact, coated aluminum • Option B: compact, hygienic, stainless • Option C: ultra-compact, hygienic, stainless			
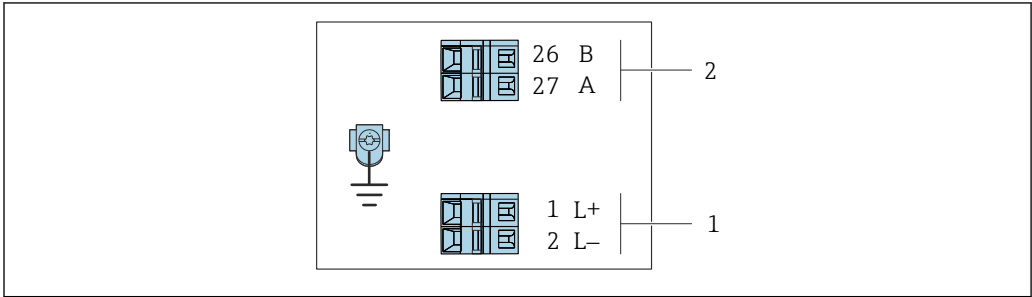
⊞ 9   Modbus RS485 terminal assignment, connection version for use in non-hazardous areas and Zone 2/Div. 2

1   *Power supply: DC 24 V*
2   *Modbus RS485*

Order code "Output"	Terminal number			
	Power supply		Output	
	1 (L+)	2 (L-)	26 (B)	27 (A)
Option M	DC 24 V		Modbus RS485	
Order code for "Output": Option M: Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2				

Modbus RS485 connection version

ℹ️ For use in the intrinsically safe area. Connection via Safety Barrier Promass 100.

Order code for "Output", option M

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B	Terminals	Terminals	• Option A: coupling M20x1 • Option B: thread M20x1 • Option C: thread G ½" • Option D: thread NPT ½"
A, B, C	Device plugs → 🖹 28		Option I: plug M12x1
Order code for "Housing": • Option A: compact, coated aluminum • Option B: compact, hygienic, stainless • Option C ultra-compact, hygienic, stainless			
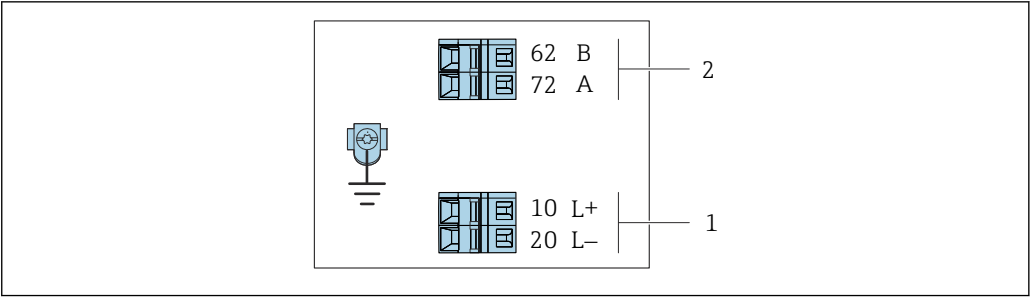
10   Modbus RS485 terminal assignment, connection version for use in intrinsically safe areas (connection via Safety Barrier Promass 100)

1   Intrinsically safe power supply
2   Modbus RS485

Order code "Output"	10 (L+)	20 (L-)	62 (B)	72 (A)
Option **M**	Intrinsically safe supply voltage		Modbus RS485 intrinsically safe	
Order code for "Output": Option **M**: Modbus RS485, for use in the intrinsically safe area (connection via Safety Barrier Promass 100)				
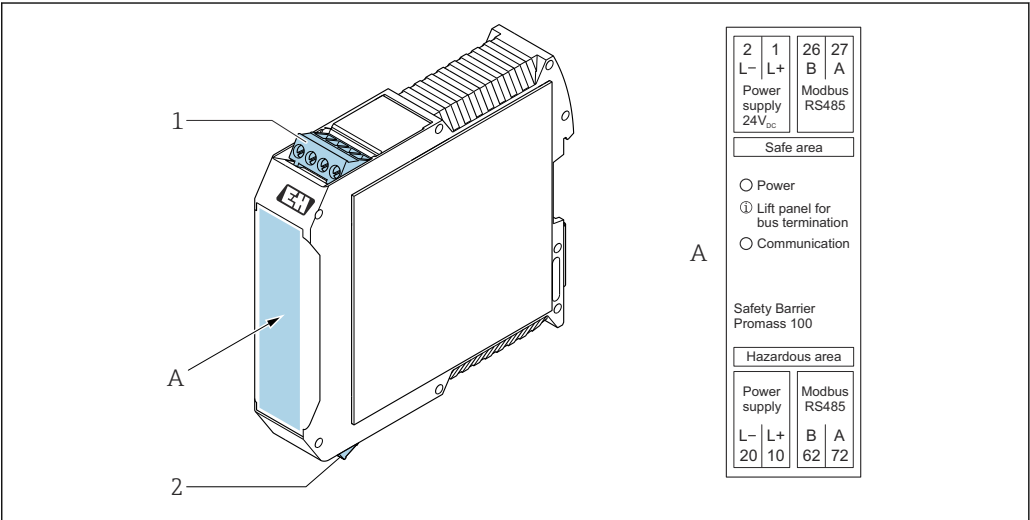
Safety Barrier Promass 100
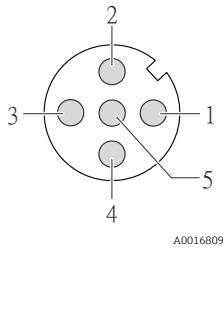
11   Safety Barrier Promass 100 with terminals

1   Non-hazardous area, Zone 2, Class I Division 2
2   Intrinsically safe area

7.2.4   Pin assignment, device plug

Supply voltage
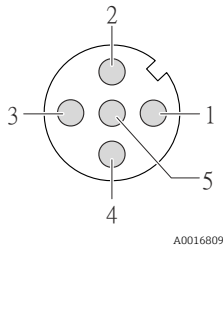
Promass 100

Device plug for signal transmission with supply voltage (device side), MODBUS RS485 (intrinsically safe)

Pin		Assignment
1	L+	Supply voltage, intrinsically safe
2	A	Modbus RS485 intrinsically safe
3	B	
4	L-	Supply voltage, intrinsically safe
5		Grounding/shielding
Coding		**Plug/socket**
A		Plug

Device plug for supply voltage (device side), MODBUS RS485 (not intrinsically safe)

ℹ For use in the non-hazardous area and Zone 2/Div. 2.
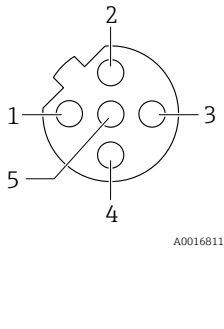
Pin		Assignment
1	L+	DC 24 V
2		Not assigned
3		Not assigned
4	L-	DC 24 V
5		Grounding/shielding
Coding		**Plug/socket**
A		Plug

Signal transmission

Promass

Device plug for signal transmission (device side), MODBUS RS485 (not intrinsically safe)

ℹ For use in the non-hazardous area and Zone 2/Div. 2.

Pin		Assignment
1		Not assigned
2	A	Modbus RS485
3		Not assigned
4	B	Modbus RS485
5		Grounding/shielding
Coding		**Plug/socket**
B		Socket

7.2.5   Shielding and grounding

Shielding and grounding concept

1. Maintain electromagnetic compatibility (EMC).

2. Take explosion protection into consideration.

3. Pay attention to the protection of persons.

4. Comply with national installation regulations and guidelines.

5. Observe cable specifications .

6. Keep the stripped and twisted lengths of cable shield to the ground terminal as short as possible.

7. Shield cables fully.

Grounding of the cable shield

| NOTICE |

In systems without potential matching, the multiple grounding of the cable shield causes mains frequency equalizing currents!
Damage to the bus cable shield.
▶ Only ground the bus cable shield to either the local ground or the protective ground at one end.
▶ Insulate the shield that is not connected.

To comply with EMC requirements:

1. Ensure the cable shield is grounded to the potential matching line at multiple points.

2. Connect every local ground terminal to the potential matching line.

7.2.6   Preparing the measuring device

| NOTICE |

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

1. Remove dummy plug if present.

2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.

3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 🖹 24.

7.3   Connecting the measuring device

| NOTICE |

Limitation of electrical safety due to incorrect connection!
▶ Have electrical connection work carried out by appropriately trained specialists only.
▶ Observe applicable federal/national installation codes and regulations.
▶ Comply with local workplace safety regulations.
▶ Always connect the protective ground cable ⏚ before connecting additional cables.
▶ For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.
▶ The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

7.3.1 Connecting the transmitter

The connection of the transmitter depends on the following order codes:
• Housing version: compact or ultra-compact
• Connection version: device plug or terminals
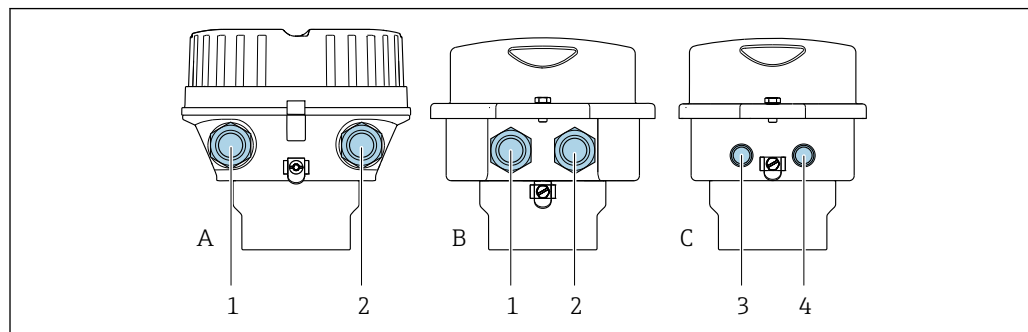
🔲 *12   Housing versions and connection versions*

A   Housing version: compact, coated, aluminum
B   Housing version: compact, hygienic, stainless
1   Cable entry or device plug for signal transmission
2   Cable entry or device plug for supply voltage
C   Housing version: ultra-compact, hygienic, stainless
3   Device plug for signal transmission
4   Device plug for supply voltage
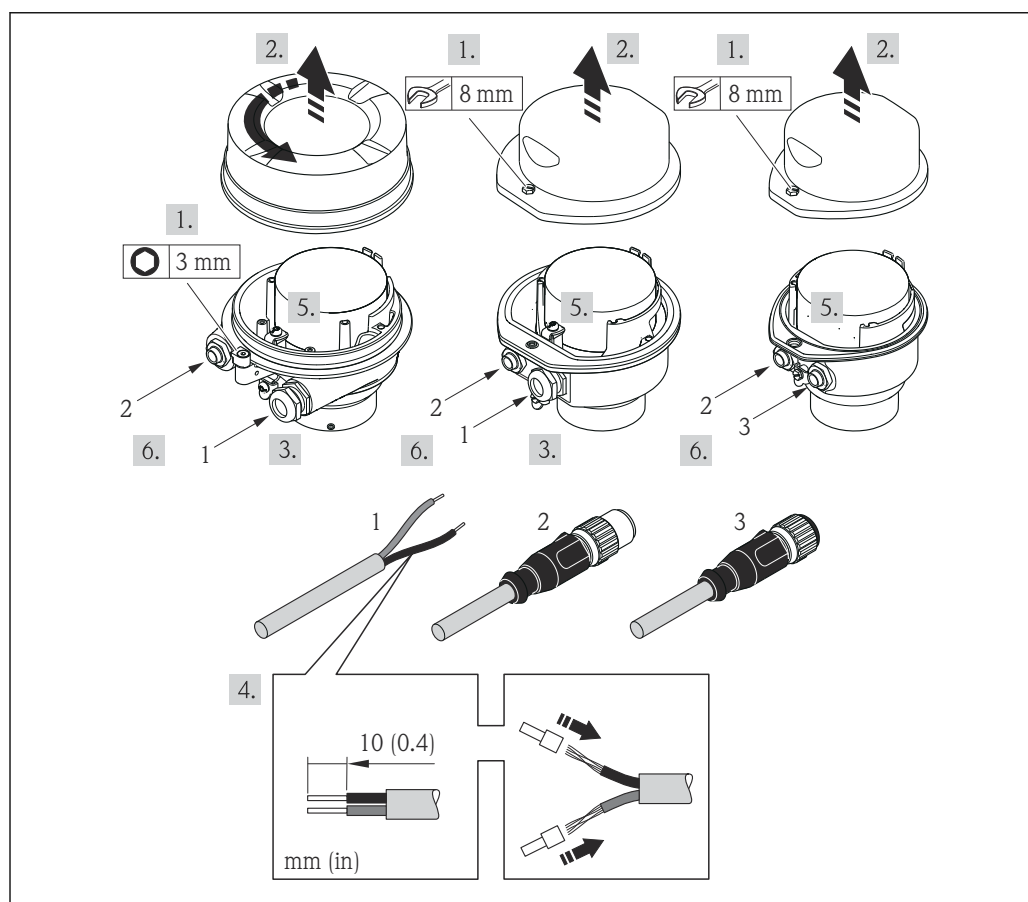
🔲 *13   Device versions with connection examples*

1   Cable
2   Device plug for signal transmission
3   Device plug for supply voltage

For device version with device plug: follow step 6 only.

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.

2. Depending on the housing version, unscrew or open the housing cover.

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

4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.

5. Connect the cable in accordance with the terminal assignment or the device plug pin assignment .

6. Depending on the device version, tighten the cable glands or plug in the device plug and tighten .

7. Enable the terminating resistor if applicable .

8. **⚠ WARNING**

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

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

Reverse the removal procedure to reassemble the transmitter.

7.3.2   Connecting the Safety Barrier Promass 100

In the case of the device version with Modbus RS485 intrinsically safe, the transmitter must be connected to the Safety Barrier Promass 100.

1. Strip the cable ends. In the case of stranded cables, also fit ferrules.

2. Connect the cable in accordance with the terminal assignment → 🕮 25.

3. Where applicable, enable the terminating resistor in the Safety Barrier Promass 100 → 🕮 33.

A0028766
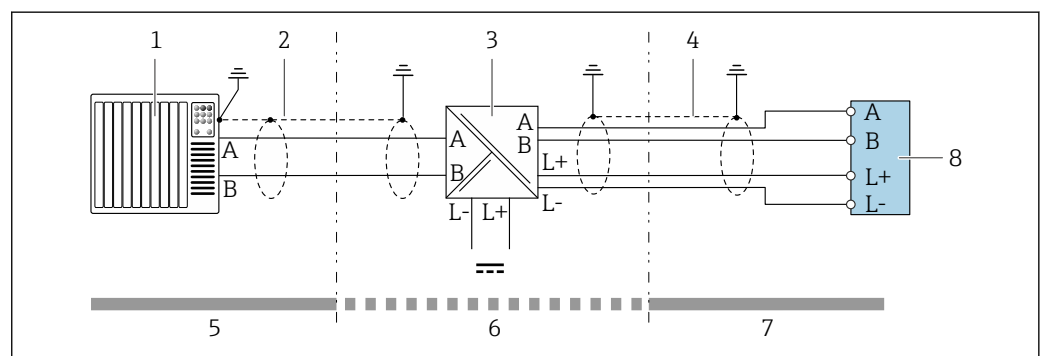
🖾 *14   Electrical connection between the transmitter and Safety Barrier Promass 100*

1   Control system (e.g. PLC)
2   Observe cable specifications → 🕮 24
3   Safety Barrier Promass 100: terminal assignment → 🕮 27
4   Observe cable specifications → 🕮 24
5   Non-hazardous area
6   Non-hazardous area and Zone 2/Div. 2
7   Intrinsically safe area
8   Transmitter: terminal assignment → 🕮 25

7.3.3   Ensuring potential equalization

Requirements

No special measures for potential equalization are required.

For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

7.4   Special connection instructions

7.4.1   Connection examples

Modbus RS485

Modbus RS485, non-hazardous area and Zone 2/Div. 2

A0028765
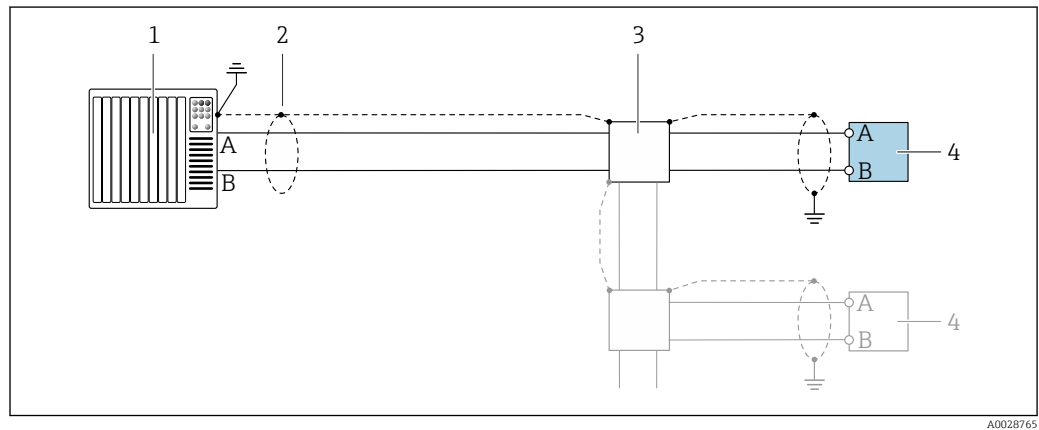
⊠ *15   Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2*

1   Control system (e.g. PLC)
2   Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 🖺 24
3   Distribution box
4   Transmitter

Modbus RS485 intrinsically safe
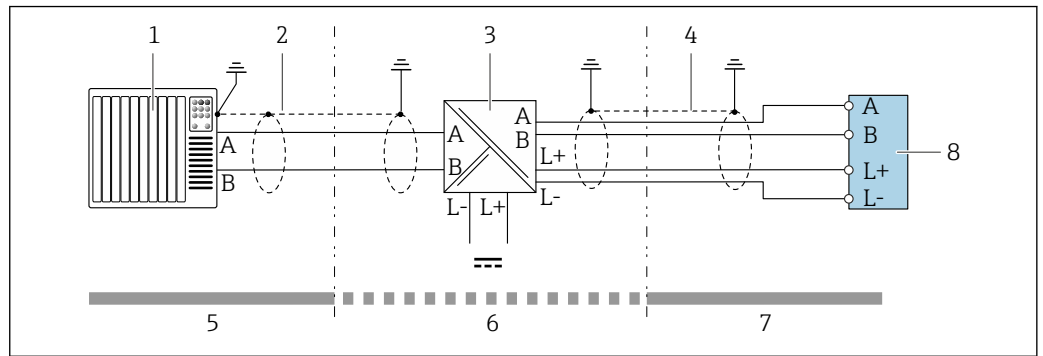
🖼 16   Connection example for Modbus RS485 intrinsically safe

1   Control system (e.g. PLC)
2   Cable shield provided at one end. Observe cable specifications
3   Safety Barrier Promass 100
4   Observe cable specifications
5   Non-hazardous area
6   Non-hazardous area and Zone 2/Div. 2
7   Intrinsically safe area
8   Transmitter

7.5   Hardware settings

7.5.1   Enabling the terminating resistor

Modbus RS485

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

If the transmitter is used in the non-hazardous area or Zone 2/Div. 2
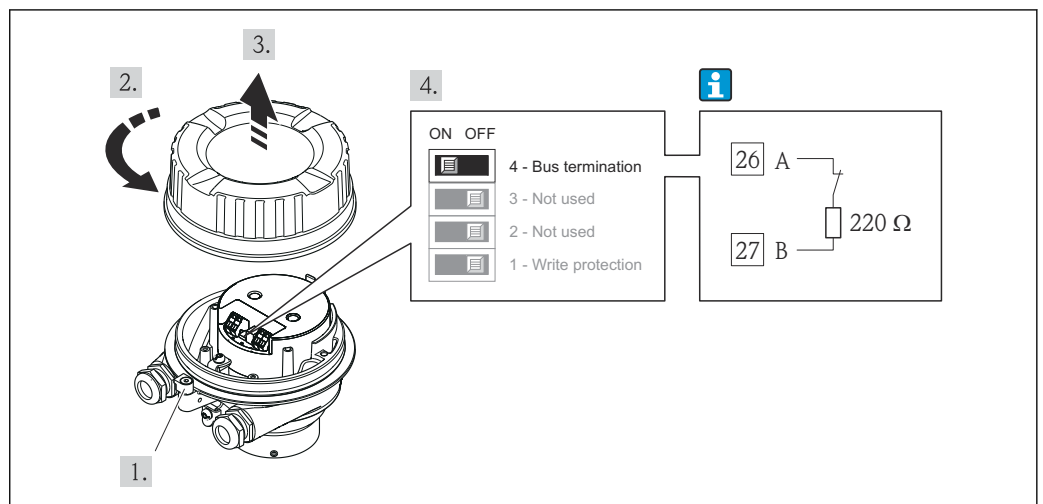
🖼 17   Terminating resistor can be enabled via DIP switch on the main electronics module

If the transmitter is used in the intrinsically safe area

A0030217
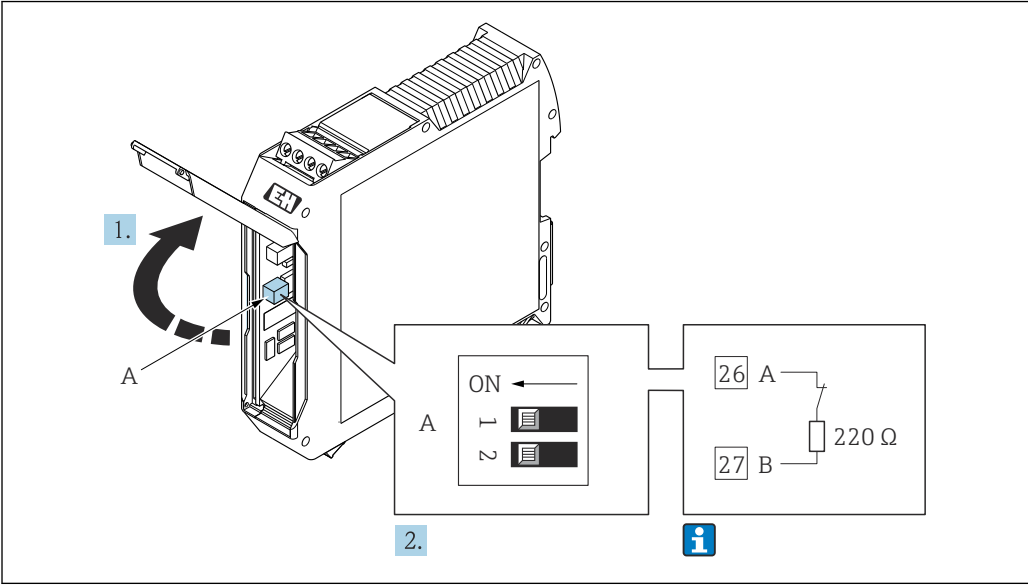
🖾 *18   Terminating resistor can be enabled via DIP switch in the Safety Barrier Promass 100*

7.6   Ensuring the degree of protection

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

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

1. Check that the housing seals are clean and fitted correctly.

2. Dry, clean or replace the seals if necessary.

3. Tighten all housing screws and screw covers.

4. Firmly tighten the cable glands.

5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").

   A0029278
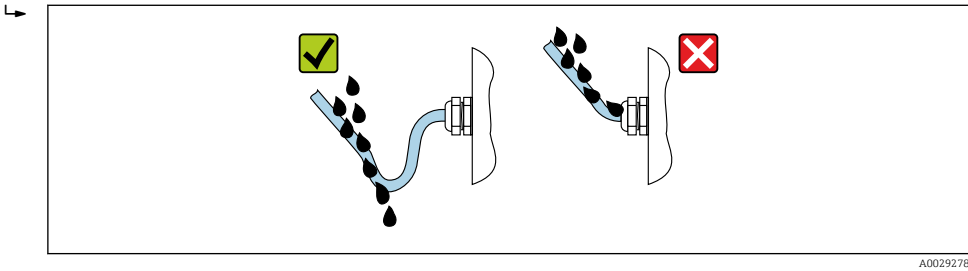
6. Insert dummy plugs into unused cable entries.

7.7   Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used meet the requirements → 🖹 24?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 34?	❑

Depending on the device version: are all the device plugs firmly tightened → 🕮 30?	❏
• Does the supply voltage match the specifications on the transmitter nameplate → 🕮 86? • For device version with Modbus RS485 intrinsically safe: does the supply voltage match the specifications on the nameplate of the Safety Barrier Promass 100 → 🕮 86?	❏
Is the terminal assignment → 🕮 25 or pin assignment of the connector → 🕮 28 correct?	❏
• If supply voltage is present, is the power LED on the electronics module of the transmitter lit green → 🕮 11? • For device version with Modbus RS485 intrinsically safe, if supply voltage is present, is the power LED on the Safety Barrier Promass 100 lit → 🕮 11?	❏
Depending on the device version, is the securing clamp or fixing screw firmly tightened?	❏

8   Operation options

8.1   Overview of operating options
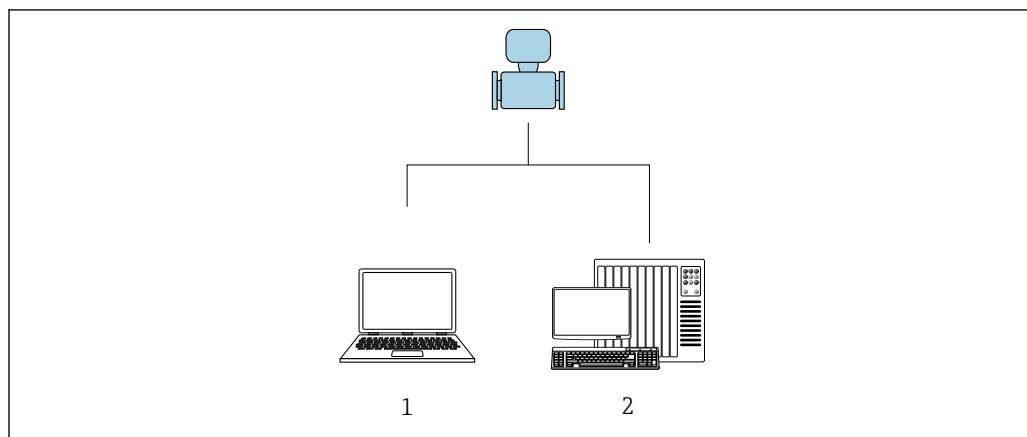
1   Computer with "FieldCare" or "DeviceCare" operating tool via Commubox FXA291 and service interface
2   Control system (e.g. PLC)

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

For an overview of the operating menu for experts: "Description of Device Parameters" document supplied with the device→ 🖺 101
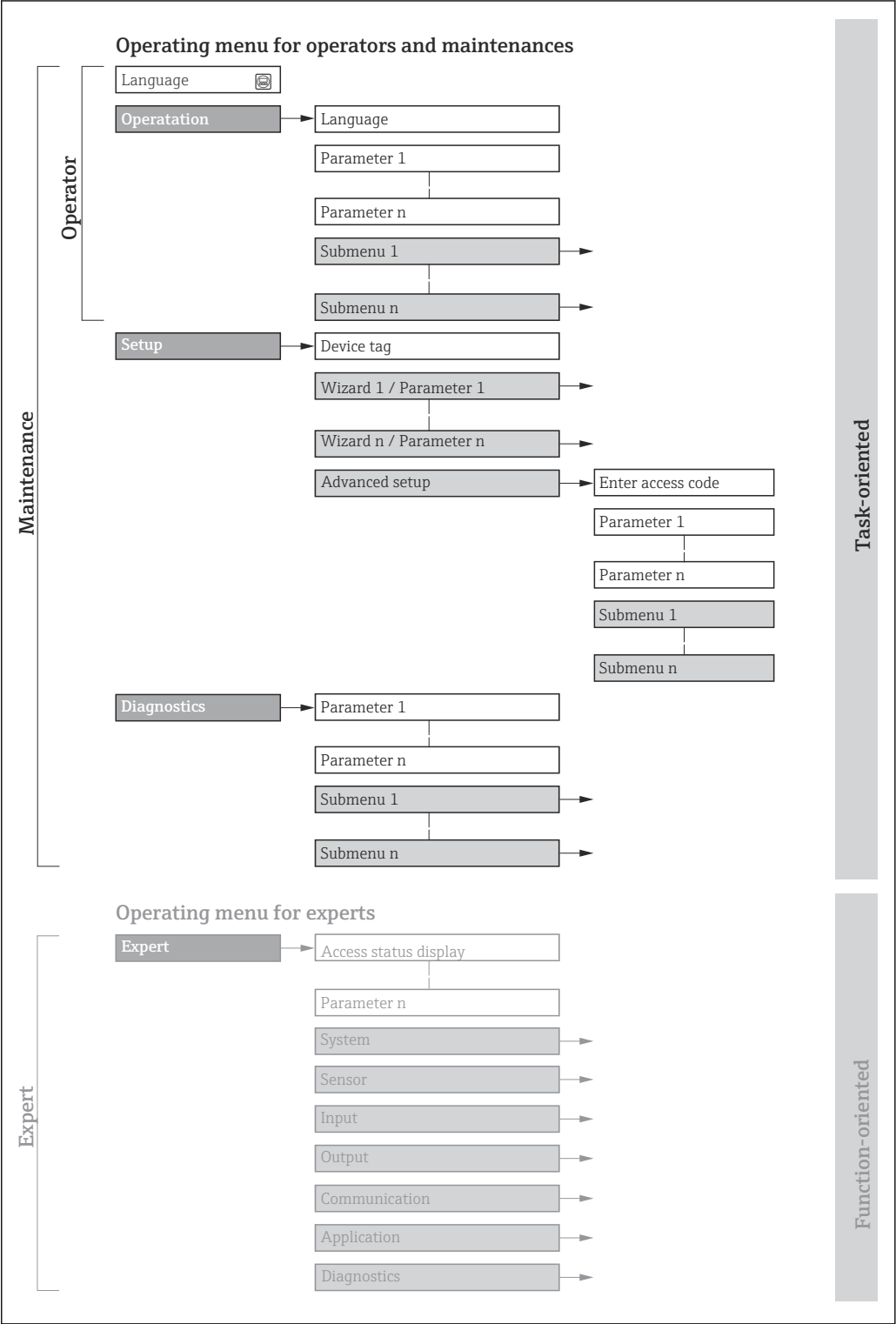
🔲 *19   Schematic structure of the operating menu*

8.2.2   Operating philosophy

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

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	**Role "Operator", "Maintenance"** Tasks during operation: Reading measured values	• Defining the operating language • Resetting and controlling totalizers
Operation			Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: • Configuration of the measurement • Configuration of the communication interface	Submenus for fast commissioning: • Setting the system units • Defining the medium • Configuration of the digital communication interface • Configuration of the operational display • Setting the low flow cut off • Configuring partial and empty pipe detection Advanced setup • For more customized configuration of the measurement (adaptation to special measuring conditions) • Configuration of totalizers • Administration (define access code, reset measuring device)

Diagnostics		**"Maintenance" role**
		Fault elimination:
		• Diagnostics and elimination of process and device errors
		• Measured value simulation
			Contains all parameters for error detection and analyzing process and device errors:
			• Diagnostic list
			  Contains up to 5 currently pending diagnostic messages.
			• Event logbook
			  Contains event messages that have occurred.
			• Device information
			  Contains information for identifying the device.
			• Measured values
			  Contains all current measured values.
			• Heartbeat
			  The functionality of the device is checked on demand and the verification results are documented.
			• Simulation
			  Is used to simulate measured values or output values.

Expert	function-oriented	Tasks that require detailed knowledge of the function of the device:
		• Commissioning measurements under difficult conditions
		• Optimal adaptation of the measurement to difficult conditions
		• Detailed configuration of the communication interface
		• Error diagnostics in difficult cases
			Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device:
			• System
			  Contains all higher-order device parameters which do not concern the measurement or the communication interface.
			• Sensor
			  Configuration of the measurement.
			• Communication
			  Configuration of the digital communication interface.
			• Application
			  Configuration of the functions that go beyond the actual measurement (e.g. totalizer).
			• Diagnostics
			  Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3   Displaying the measured values via the local display (optionally available)

8.3.1   Operational display

The local display is optionally available:

Order code for "Display; operation", option B "4-line, illuminated; via communication".
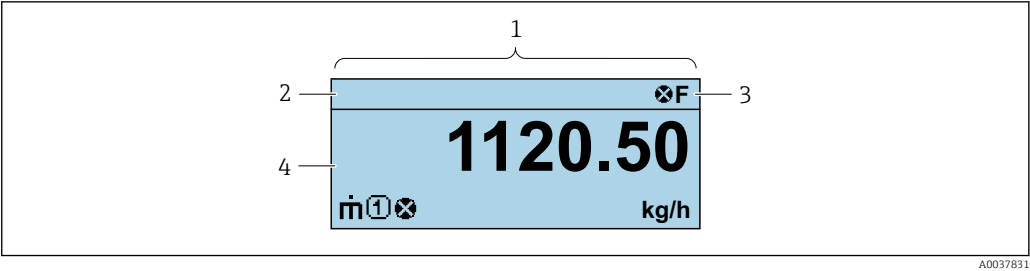
1　Operational display
2　Device tag→ 🖹 57
3　Status area
4　Display area for measured values (4-line)

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior
  - ⊗: Alarm
  - ⚠: Warning
- 🔒: Locking (the device is locked via the hardware → 🖹 61)
- ↩: Communication (communication via remote operation is active)

Display area

In the display area, each measured value is prefaced by certain symbol types for further description:

Measured variable	Measurement channel number	Diagnostic behavior
↓	↓	↓

Example

↦	1	⚠

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

Measured variables

Symbol	Meaning
ṁ	Mass flow
U̇	• Volume flow • Corrected volume flow
ρ	• Density • Reference density
🌡	Temperature

Σ	Totalizer
	ℹ The measurement channel number indicates which of the three totalizers is displayed.
(→	Output
	ℹ

Measurement channel numbers

Symbol	Meaning
① ... ④	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).	

Diagnostic behavior

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable. For information on the symbols

ℹ The number and display format of the measured values can only be configured via the control system.

8.3.2   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 from unauthorized access .

Defining access authorization for user roles

An access code is not yet defined when the device is delivered from the factory. Access authorization (read and write access) to the device is not restricted and corresponds to the "Maintenance" user role.

▸ Define the access code.
   ↳ The "Operator" user role is redefined in addition to the "Maintenance" user role. Access authorization differs for the two user roles.

Access authorization to parameters: "Maintenance" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	✔ [1]

1)   The user only has write access after entering the access code.

Access authorization to parameters: "Operator" user role

Access code status	Read access	Write access
After an access code has been defined.	✔	–– [1]

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

ℹ The user role with which the user is currently logged on is indicated by the . Navigation path:

8.4 Access to the operating menu via the operating tool

8.4.1 Connecting the operating tool

Via service interface (CDI)

Modbus RS485
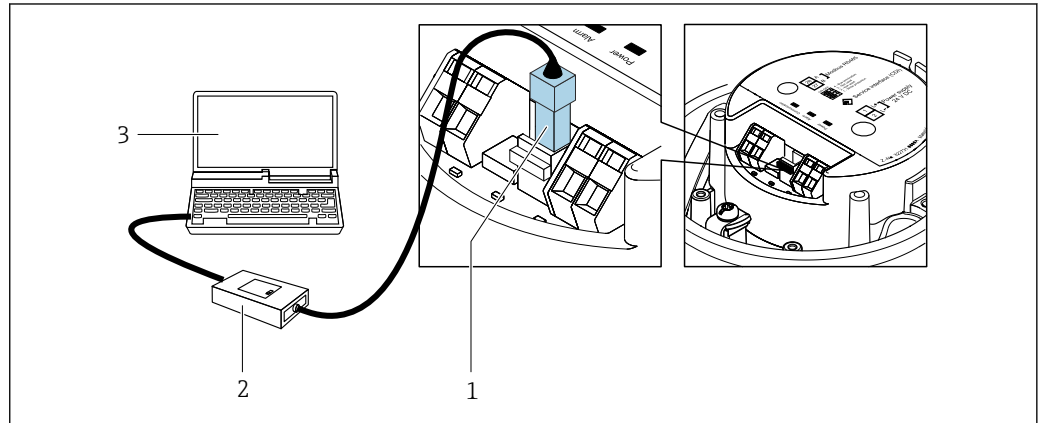
A0030216

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

Via service interface (CDI)
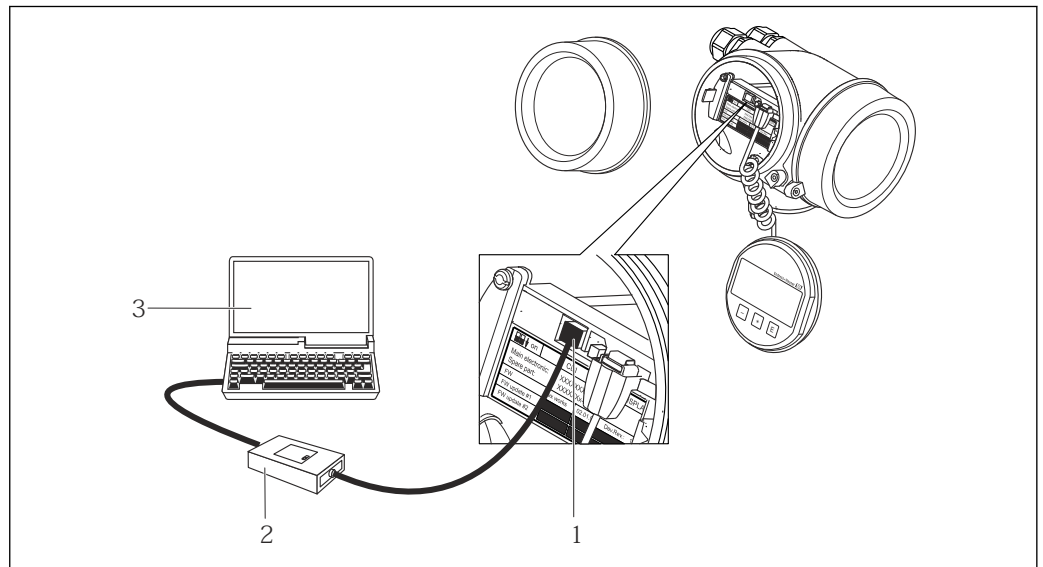
A0014019

1 Service interface (CDI = Endress+Hauser Common Data Interface) of the measuring device
2 Commubox FXA291
3 Computer with FieldCare operating tool with COM DTM CDI Communication FXA291

8.4.2 FieldCare

Function scope

FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.

Access is via:
CDI service interface → 🖥 41

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

📖 For additional information about FieldCare, see Operating Instructions BA00027S and BA00059S

Source for device description files

See information → 🖥 44

Establishing a connection

1. Start FieldCare and launch the project.

2. In the network: Add a device.
   ↳ The **Add device** window opens.

3. Select the **CDI Communication FXA291** option from the list and press **OK** to confirm.

4. Right-click **CDI Communication FXA291** and select the **Add device** option in the context menu that opens.

5. Select the desired device from the list and press **OK** to confirm.

6. Establish the online connection to the device.

📖 For additional information, see Operating Instructions BA00027S and BA00059S

User interface
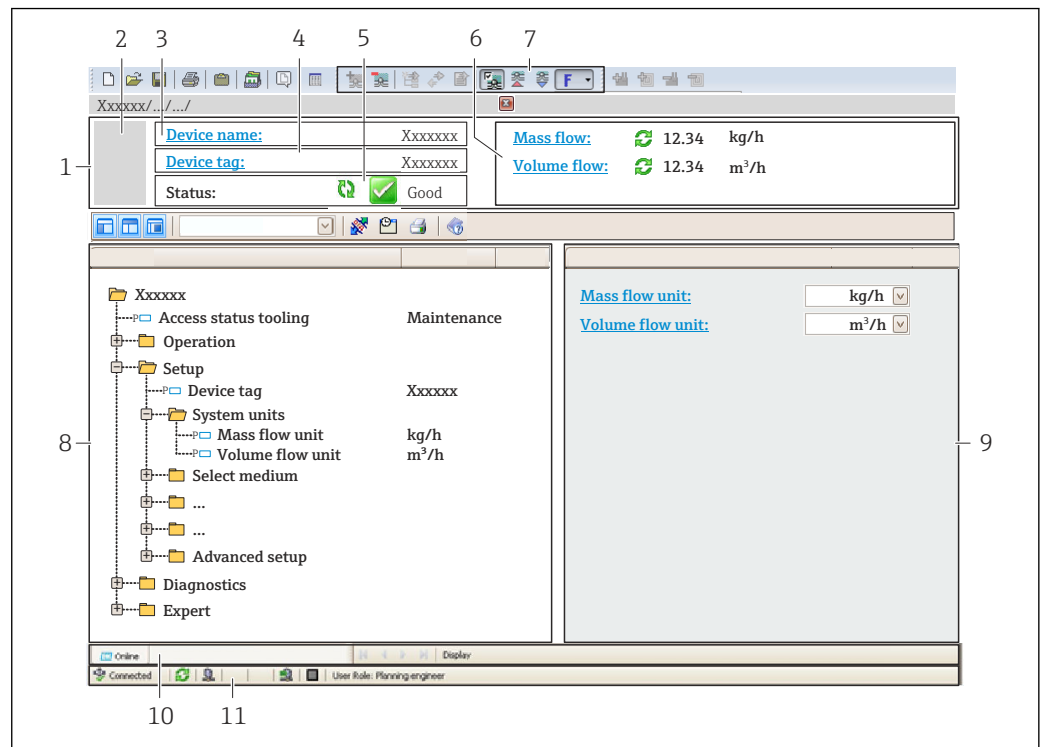
A0021051-EN

1   Header
2   Picture of device
3   Device name
4   Device tag→ 🖹 57
5   Status area with status signal→ 🖹 69
6   Display area for current measured values → 🖹 63
7   Edit toolbar with additional functions such as save/restore, event list and create documentation
8   Navigation area with operating menu structure
9   Working area
10 Range of action
11 Status area

8.4.3   DeviceCare

Function scope

Tool to connect and configure Endress+Hauser field devices.

The fastest way to configure Endress+Hauser field devices is with the dedicated "DeviceCare" tool. Together with the device type managers (DTMs) it presents a convenient, comprehensive solution.

📖 For details, see Innovation Brochure IN01047S

Source for device description files

See information → 🖹 44

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.03.zz	• On the title page of the Operating Instructions • On the transmitter nameplate • Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	10.2014	---

ℹ For an overview of the different firmware versions for the device

9.1.2 Operating tools

The suitable device description file for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

FieldCare	• www.endress.com → Download Area • CD–ROM (contact Endress+Hauser) • DVD (contact Endress+Hauser)
DeviceCare	• www.endress.com → Download Area • CD–ROM (contact Endress+Hauser) • DVD (contact Endress+Hauser)

9.2 Modbus RS485 information

9.2.1 Function codes

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

Code	Name	Description	Application
03	Read holding register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes ℹ The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read and write access Example: Read mass flow
04	Read input register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes ℹ The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read access Example: Read totalizer value

Code	Name	Description	Application
06	Write single registers	Master writes a new value to **one** Modbus register of the measuring device. ℹ️ Use function code 16 to write multiple registers with just 1 telegram.	Write only 1 device parameter Example: reset totalizer
08	Diagnostics	Master checks the communication connection to the measuring device. The following "Diagnostics codes" are supported: • Sub-function 00 = Return query data (loopback test) • Sub-function 02 = Return diagnostics register	
16	Write multiple registers	Master writes a new value to multiple Modbus registers of the device. A maximum of 120 consecutive registers can be written with 1 telegram. ℹ️ If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map → 🖹 47	Write multiple device parameters Example: • Mass flow unit • Mass unit
23	Read/Write multiple registers	Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed **before** read access.	Write and read multiple device parameters Example: • Read mass flow • Reset totalizer

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

9.2.2 Register information

📖 For an overview of device parameters with their respective Modbus register information, please refer to the "Modbus RS485 register information" section in the "Description of device parameters" documentation .

9.2.3 Response time

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

9.2.4 Data types

The measuring device supports the following data types:

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

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

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

9.2.5 Byte transmission sequence

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

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

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

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

STRING				
Presentation taking the example of a device parameter with a data length of 18 bytes.				
	Sequence			
Options	1.	2.	...	17.	18.
1 – **0** – 3 – 2 * 3 – 2 – **1** – **0**	Byte 17 (MSB)	Byte 16	...	Byte 1	Byte 0 (LSB)

0 – 1 – 2 – 3 2 – 3 – 0 – 1	Byte 16	Byte 17 (MSB)	...	Byte 0 (LSB)	Byte 1
* = factory setting, MSB = most significant byte, LSB = least significant byte					

9.2.6 Modbus data map

Function of the Modbus data map

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

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

Structure of the Modbus data map

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

For an overview of device parameters with their respective Modbus register information, please refer to the "Modbus RS485 register information" section in the "Description of device parameters" documentation .

Scan list configuration

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

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

Configuring the scan list via FieldCare or DeviceCare

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

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

Configuring the scan list via Modbus RS485

Carried out using register addresses 5001 - 5016

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

Reading out data via Modbus RS485

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

Master access to data area	Via register addresses 5051-5081

Data area				
Device parameter value	Modbus RS485 register		Data type*	Access**
	Start register	End register (Float only)		
Value of scan list register 0	5051	5052	Integer/float	Read/write
Value of scan list register 1	5053	5054	Integer/float	Read/write
Value of scan list register ...	...	...	...	...
Value of scan list register 15	5081	5082	Integer/float	Read/write
* Data type depends on the device parameters entered in the scan list. ** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.				

10   Commissioning

10.1   Function check

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

- "Post-mounting check" checklist → 🖺 23
- "Post-connection check" checklist → 🖺 34

10.2   Establishing a connection via FieldCare

- For FieldCare connection
- For establishing a connection via FieldCare → 🖺 42
- For FieldCare user interface → 🖺 43

10.3   Configuring the measuring device

The **Setup** menu with its submenus contains all parameters needed for standard operation.

Structure of the "Setup" menu

Setup	→	System units	→ 🖺 49
		Select medium	→ 🖺 52
		Communication	→ 🖺 53
		Low flow cut off	→ 🖺 55
		Partially filled pipe detection	→ 🖺 56

10.3.1   Setting the system units

In the **System units** submenu, you can configure the units of all measured values.

Navigation path
"Setup" menu → Advanced setup → System units

Structure of the submenu

System units	→	Mass flow unit
		Mass unit
		Volume flow unit
		Volume unit
		Corrected volume flow unit
		Corrected volume unit
		Density unit
		Reference density unit

	Temperature unit
	Pressure unit

Parameter overview with brief description

Parameter	Description	Selection/ User entry	Factory setting
Mass flow unit	Select the unit for mass flow. *Result* The selected unit applies for: • Output • Low flow cut off • Simulation process variable	Unit choose list	Country-dependent: • kg/h • lb/min
Mass unit	Select the unit for mass. *Result* The selected unit is taken from: Mass flow unit	Unit choose list	Country-dependent: • kg • lb
Volume flow unit	Select the unit for volume flow. *Result* The selected unit applies for: • Output • Low flow cut off • Simulation process variable	Unit choose list	Country-dependent: • l/h • gal/min (us)
Volume	Select the unit for volume. *Result* The selected unit is taken from: Volume flow unit		Country-dependent • l • gal (us)
Corrected volume flow unit	Select the unit for corrected volume flow. *Result* The selected unit applies for: • Output • Low flow cut off • Simulation process variable	Unit choose list	Country-dependent: • Nl/h • Scf/min
Corrected volume unit	Select the unit for standard volume. *Result* The selected unit is taken from: Corrected volume flow unit	Unit choose list	Country-dependent: • Nl • Scf
Density unit	Select the unit for density. *Result* The selected unit applies for: • Output • Low value partial filled pipe detection • High value partial filled pipe detection • Simulation process variable • Density adjustment (in the **Expert** menu)	Unit choose list	Country-dependent • kg/l • lb/cf
Reference density unit	Select the unit for reference density. *Result* The selected unit applies for: • Output • Low value partial filled pipe detection • High value partial filled pipe detection • Simulation process variable • Fixed reference density • Density adjustment (in the **Expert** menu)	Unit choose list	Country-dependent: • kg/Nl • lb/Scf

Parameter	Description	Selection/ User entry	Factory setting
Temperature unit	Select the unit for temperature. *Result* The selected unit applies for: • Output • Reference temperature • Simulation process variable	Unit choose list	Country-dependent: • ℃ (Celsius) • ℉ (Fahrenheit)
Pressure unit	Select the unit for pipe pressure.	Unit choose list	Country-dependent: • bar a • psi a

10.3.2   Selecting and setting the medium

The **Medium selection** submenu contains parameters that have to be configured for selecting and setting the medium.

Navigation path
"Setup" menu → Medium selection

Structure of the submenu

Medium selection	→	Select medium
		Select gas type
		Reference sound velocity
		Temperature coefficient sound velocity
		Pressure compensation
		Pressure value
		External pressure

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Medium selection	–	Select the medium type.	• Liquid • Gas	Liquid
Select gas type	The following option is selected in the **Medium selection** parameter: Gas	Select the gas type for the measurement application.	Gas type choose list	Air
Reference sound velocity	The following option is selected in the **Select gas type** parameter: Others	Enter the sound velocity of the gas at 0℃ (32℉).	0 to 99 999 m/s	0 m/s
Temperature coefficient sound velocity	The following option is selected in the **Select gas type** parameter: Others	Enter the temperature coefficient of the sound velocity of the gas.	Max. 15-digit, positive floating-point number	0 (m/s)/K
Pressure compensation	The following option is selected in the **Medium selection** parameter: Gas	Enable the automatic pressure correction.	• Off • Fixed value	Off
Pressure value	The following option is selected in the **Pressure compensation** parameter: Fixed value	Enter a value for the process pressure to be used for pressure correction.	0 to 99 999 [bar, psi]	Country-dependent: • 1.01325 bar • 14.7 psi
External pressure	The following option is selected in the **Pressure compensation** parameter: External value	External value	0 to 99 999 [bar, psi]	Country-dependent: • 1.01325 bar • 14.7 psi

10.3.3   Configuring communication interface

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

Navigation path
"Setup" menu → Communication

Structure of the submenu

Communication	→	Bus address
		Baud rate
		Data transfer mode
		Parity
		Byte order
		Assign diagnostic behavior
		Failure mode

Parameter overview with brief description

Parameter	Description	Selection/ User entry	Factory setting
Bus address	Enter device address.	1 to 247	247
Baud rate	Define data transfer speed.	Baud rate list box	19 200 BAUD
Data transfer mode	Select data transfer mode.	• ASCII Transmission of data in the form of readable ASCII characters. Error protection via LRC. • RTU Transmission of data in binary form. Error protection via CRC16.	RTU
Parity	Select parity bits.	**ASCII picklist** • 0 = even • 1 = odd **RTU picklist** • 0 = even • 1 = odd • 2 = no parity bit/1 stop bit • 3 = no parity bit/2 stop bits	Even
Byte order	Select byte transmission sequence.	• 0-1-2-3 • 3-2-1-0 • 1-0-3-2 • 2-3-0-1	1-0-3-2

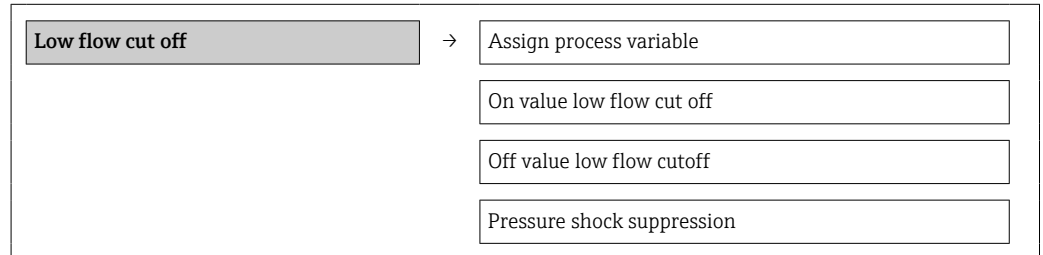| Parameter	Description	Selection/ User entry	Factory setting
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	• Off • Alarm or warning • Warning • Alarm	Alarm
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. ℹ This parameter operates in accordance with the option selected in the **Assign diagnostic behavior** parameter.	• NaN value • Last valid value ℹ NaN ≡ not a number	NaN value

10.3.4   Configuring the low flow cut off

The **Low flow cut off** submenu contains parameters that have to be set for configuring the low flow cut off.

Navigation path
"Setup" menu → Low flow cut off

Structure of the submenu

Low flow cut off	→	Assign process variable
		On value low flow cut off
		Off value low flow cutoff
		Pressure shock suppression

Parameter overview with brief description

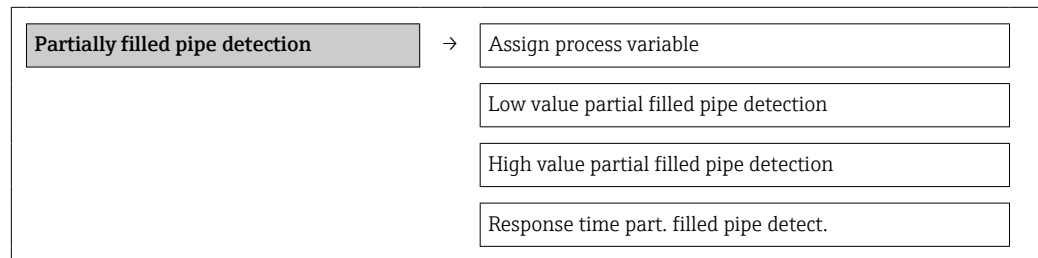| Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Assign process variable	–	Select the process variable for low flow cut off.	• Off • Mass flow • Volume flow • Corrected volume flow	Mass flow
On value low flow cut off	One of the following options is selected in the **Assign process variable** parameter: • Mass flow • Volume flow • Corrected volume flow	Enter the on value for low flow cut off.	Max. 15-digit, positive floating-point number	For liquids: depends on country and nominal diameter
Off value low flow cut off	One of the following options is selected in the **Assign process variable** parameter: • Mass flow • Volume flow • Corrected volume flow	Enter the off value for low flow cut off.	0 to 100 %	50 %
Pressure shock suppression	One of the following options is selected in the **Assign process variable** parameter: • Mass flow • Volume flow • Corrected volume flow	Enter the time interval for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

10.3.5   Configuring the partial filled pipe detection

The **Partially filled pipe detection** submenu contains parameters that have to be set for configuring empty pipe detection.

Navigation path
"Setup" menu → Partial filled pipe detection

Structure of the submenu

Partially filled pipe detection	→	Assign process variable
		Low value partial filled pipe detection
		High value partial filled pipe detection
		Response time part. filled pipe detect.

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Assign process variable	–	Select a process variable to detect empty or partially filled pipes.	■ Off ■ Density ■ Reference density	Density
Low value partial filled pipe detection	One of the following options is selected in the **Assign process variable** parameter: ■ Density ■ Reference density	Enter a lower limit value to activate detection of an empty or partially filled pipe.	Max. 15-digit, positive floating-point number	Country-dependent: ■ 0.2 kg/l ■ 12.5 lb/cf
High value partial filled pipe detection	One of the following options is selected in the **Assign process variable** parameter: ■ Density ■ Reference density	Enter an upper limit value to activate detection of an empty or partially filled pipe.	Max. 15-digit, positive floating-point number	Country-dependent: ■ 6 kg/l ■ 374.6 lb/cf
Response time part. filled pipe detect.	One of the following options is selected in the **Assign process variable** parameter: ■ Density ■ Reference density	Enter the time interval until the diagnostic message ⚠S862 **Partly filled pipe detection** is displayed for an empty or partially filled pipe.	0 to 100 s	1 s

10.4   Advanced settings

The **Advanced setup** menu with its submenus contains all parameters needed for specific settings.

Navigation path

"Setup" menu → Advanced setup

Overview of the parameters and submenus in the "Advanced setup" menu taking the example of the Web browser

Advanced setup	→	Enter access code	
		Device tag	→ 🖹 57
		Calculated values	→ 🖹 57
		Sensor adjustment	→ 🖹 58
		Totalizer 1 to 3	→ 🖹 59

10.4.1   Defining the tag name

To enable quick 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 path

Setup → Advanced setup → Device tag

Parameter overview with brief description

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

The number of characters displayed depends on the characters used.

For information on the tag name in the "FieldCare" operating tool → 🖹 43

10.4.2   Calculated values

The **Calculated values** submenu contains parameters for calculating the corrected volume flow.

Navigation path

"Setup" menu → Advanced setup → Calculated values

Structure of the submenu

Calculated values	→	Corrected volume flow calculation
		External reference density
		Fixed reference density
		Reference temperature

Linear expansion coefficient

Square expansion coefficient

Parameter overview with brief description

| Parameter	Prerequisites	Description	Selection/input	Factory settings
Corrected volume flow calculation	–	Select the reference density for calculating the corrected volume flow.	■ Fixed reference density ■ Calculated reference density ■ Reference density according to API 53 ■ External reference density	Calculated reference density
External reference density	–	Shows external reference density.	Floating-point number with sign	Country-dependent: 0 kg/Nl (0 lb/scf)
Fixed reference density	The following option is selected in the **Corrected volume flow calculation** parameter: Fixed reference density	Enter the fixed value for the reference density.	Positive floating-point number with leading sign	Country-dependent: 0.001 kg/Nl (0.062 lb/scf)
Reference temperature	The following option is selected in the **Corrected volume flow calculation** parameter: Calculated reference density	Enter the reference temperature for calculating the reference density.	Floating-point number with sign	Country-dependent: 20 ℃ (68 ˚F)
Linear expansion coefficient	The following option is selected in the **Corrected volume flow calculation** parameter: Calculated reference density	Enter the linear, medium-specific expansion coefficient for calculating the reference density.	0 to 1	0.0
Square expansion coefficient	–	For media with a non-linear expansion pattern, use this function to enter a quadratic, medium-specific expansion coefficient for calculating the reference density.	0 to 1	0.0

10.4.3   Carrying out a sensor adjustment

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

Navigation path

"Setup" menu → Advanced setup → Sensor adjustment

Structure of the submenu

Sensor adjustment	→	Installation direction
	Zero point adjustment	→	Zero point adjustment control
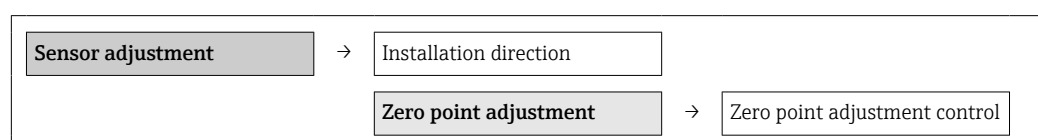
	Progress	

Parameter overview with brief description

Parameter	Description	Selection/ User entry	Factory setting
Installation direction	Change the sign of the direction of flow of the fluid.	• Flow in arrow direction • Flow against arrow direction	Flow in arrow direction
Zero point adjustment control	Start the zero point adjustment.	• Cancel • Start	Cancel
Progress		0...100 %	0

10.4.4   Configuring the totalizer

You can configure each totalizer in the three submenus **Totalizer 1-3**.

Navigation path
"Setup" menu → Advanced setup → Totalizer 1-3

Structure of the submenu

Totalizer 1-3	→	Assign process variable
		Mass unit
		Volume unit
		Corrected volume unit
		Totalizer operation mode
		Failure mode

Parameter overview with brief description

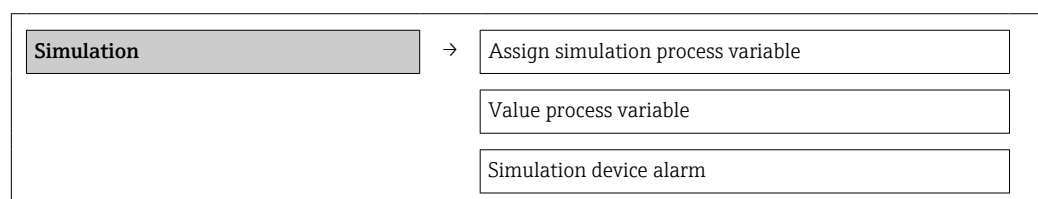| Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Assign process variable	-	Select process variable for totalizer. *Result* The selection determines the choose list of the **Unit** parameter.	• Off • Mass flow • Volume flow • Corrected volume flow ℹ The range of options increases if the measuring device has one or more application packages.	Mass flow
Mass unit	The following option is selected in the **Assign process variable** parameter: Mass flow	Select the unit for mass. *Result* The selected unit is taken from: Mass flow unit	Unit choose list	Country-dependent: • kg • lb

Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Volume unit	The following option is selected in the **Assign process variable** parameter: Volume flow	Select the unit for volume. *Result* The selected unit is taken from: Volume flow unit	Unit choose list	Country-dependent • l • gal (us)
Corrected volume unit	The following option is selected in the **Assign process variable** parameter: Corrected volume flow	Select the unit for standard volume. *Result* The selected unit is taken from: Corrected volume flow unit	Unit choose list	Country-dependent: • Nl • Scf
Totalizer operation mode	One of the following options is selected in the **Assign process variable** parameter: • Mass flow • Volume flow • Corrected volume flow	Select totalizer calculation mode.	• Net flow total • Forward flow total • Reverse flow total	Net flow total
Failure mode	One of the following options is selected in the **Assign process variable** parameter: • Mass flow • Volume flow • Corrected volume flow	Specify the behavior of the totalizer in the event of a device alarm.	• Stop • Actual value • Last valid value	Stop

10.5   Simulation

The **Simulation** submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

Navigation path
"Diagnostics" menu → Simulation

Simulation	→	Assign simulation process variable
		Value process variable
		Simulation device alarm

10.5.1 Parameter overview with brief description

Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Assign simulation process variable	-	Select a process variable for the simulation process that is activated.	• Off • Mass flow • Volume flow • Corrected volume flow • Density • Reference density • Temperature ℹ The range of options increases if the measuring device has one or more application packages.	Off
Value process variable	A process variable is selected in the **Assign simulation process variable** parameter.	Enter the simulation value for the selected process variable.	Depends on the process variable selected	-
Simulation device alarm	-	Switch the device alarm on and off.	• Off • On	Off

10.6 Protecting settings from unauthorized access

The following option exists for protecting the configuration of the measuring device from unintentional modification after commissioning: Write protection via write protection switch

10.6.1 Write protection via write protection switch

The write protection switch makes it possible to block write access to the entire operating menu with the exception of the following parameters:
• External pressure
• External temperature
• Reference density
• All parameters for configuring the totalizer

The parameter values are now read only and cannot be edited any more:
• Via service interface (CDI)
• Via Modbus RS485
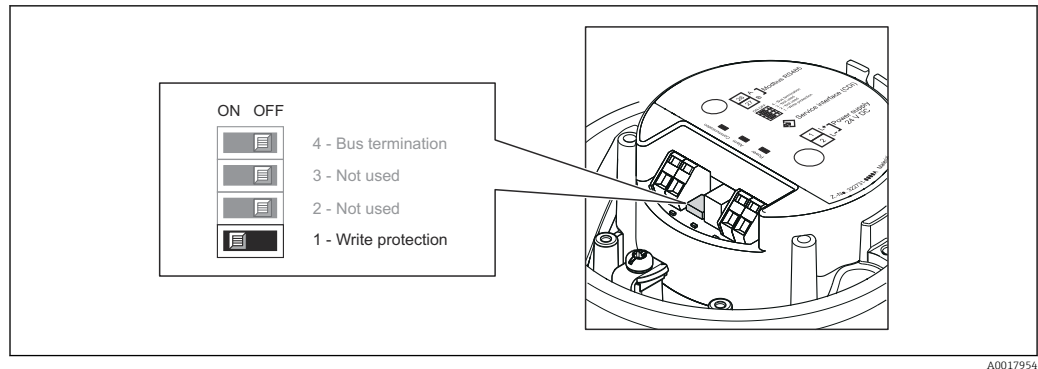
A0017954

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.

2. Depending on the housing version, unscrew or open the housing cover.

3. Setting the write protection switch on the main electronics module to the ON position enables the hardware write protection. Setting the write protection switch on the main electronics module to the OFF position (factory setting) disables the hardware write protection.

   ↳ If hardware write protection is enabled, the **Hardware locked** option is displayed in the **Locking status** parameter → 🖺 63; if disabled, no option is displayed in the **Locking status** parameter → 🖺 63

4. Reverse the removal procedure to reassemble the transmitter.

11 Operation

11.1 Read device locking status

The write protection types that are currently active can be determined using the **Locking status** parameter.

Navigation path
"Display/operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Hardware locked	The write protection switch (DIP switch) for hardware locking is activated on the main electronics module. This prevents write access to the parameters → 🖺 61.
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc). Once the internal processing has been completed, the parameters can be changed once again.

11.2 Reading measured values

You can read all measured values using the **Measured values** menu.

Navigation path
Diagnostics → Measured values

11.2.1 Process variables

The **Process variables** submenu contains all the parameters needed to display the current measured values for every process variable.

Navigation path
"Diagnostics" menu → Measured values → Process variables

Structure of the submenu

Process variable	→	Mass flow
		Volume flow
		Corrected volume flow
		Density
		Reference density
		Temperature
		Pressure value

Parameter overview with brief description

Parameter overview with brief description

Parameter	Prerequisite	Description	Display
Mass flow	–	Displays the mass flow currently measured	Floating-point number with sign
Volume flow	–	Displays the volume flow currently calculated	Floating-point number with sign
Corrected volume flow	–	Displays the corrected volume flow currently calculated	Floating-point number with sign
Density	–	Displays the density currently measured	Floating-point number with sign
Reference density	–	Displays the density currently measured at reference temperature	Floating-point number with sign
Temperature	–	Displays the medium temperature currently measured	Floating-point number with sign
Pressure value	–	Displays either a fixed or external pressure value	Floating-point number with sign

11.2.2　Totalizer

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

Navigation path
"Diagnostics" menu → Measured values → Totalizer

Structure of the submenu

Totalizer 1 to 3	→	Totalizer value 1
		Totalizer overflow 1
		Totalizer value 2
		Totalizer overflow 2
		Totalizer value 3
		Totalizer overflow 3

Parameter overview with brief description

Parameter	Prerequisite	Description	Display
Totalizer value 1-3	One of the following options is selected in the **Assign process variable** parameter of the **Totalizer 1-3** submenu: • Mass flow • Volume flow • Corrected volume flow	Displays the current totalizer counter value.	Floating point number with sign
Totalizer overflow 1-3	One of the following options is selected in the **Assign process variable** parameter of the **Totalizer 1-3** submenu: • Mass flow • Volume flow • Corrected volume flow	Displays the current totalizer overflow.	Integer

11.3 Adapting the measuring device to the process conditions

The following are available for this purpose:
• Basic settings using the **Setup** menu → 🖹 49
• Advanced settings using the **Advanced setup** menu → 🖹 57

11.4 Performing a totalizer reset

In the **Operation** submenu, 2 parameters with various options for resetting the three totalizers are available:
• Control totalizer 1-3
• Reset all totalizers

Navigation path
"Display/operat." menu → Operation

Function scope of the "Control totalizer" parameter

Options	Description
Totalize	The totalizer is started.
Reset + hold	The totaling process is stopped and the totalizer is reset to 0.
Preset + hold	The totaling process is stopped and the totalizer is set to the defined start value in the **Preset** parameter.
Reset + totalize	The totalizer is reset to 0 and the totaling process is restarted.
Preset + totalize	The totalizer is set to the defined start value in the **Preset** parameter and the totaling process is restarted.

Function scope of the "Reset all totalizers" parameter

Options	Description
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

"Operation" submenu

Operation	→	Control totalizer 1
		Preset value 1
		Control totalizer 2
		Preset value 2
		Control totalizer 3
		Preset value 3
		Reset all totalizers

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection/ User entry	Factory setting
Control totalizer 1-3	A process variable is selected in the **Assign process variable** parameter of the **Totalizer 1-3** submenu.	Control totalizer value.	• Totalize • Reset + hold • Preset + hold • Reset + totalize • Preset + totalize	Totalize
Preset value 1-3	A process variable is selected in the **Assign process variable** parameter of the **Totalizer 1-3** submenu.	Specify start value for totalizer.	Floating-point number with sign	Country-dependent: • 0 kg • 0 lb
Reset all totalizers	-	Reset all totalizers to 0 and start.	• Cancel • Reset + totalize	Cancel

12   Diagnostics and troubleshooting

12.1   General troubleshooting

For output signals

Problem	Possible causes	Remedy
Green power LED on the main electronics module of the transmitter is dark	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage → 🖺 30.
Green power LED on the main electronics module of the transmitter is dark	Power supply cable connected incorrectly	Check the terminal assignment .
Green power LED on Safety Barrier Promass 100 is dark	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage → 🖺 30.
Green power LED on Safety Barrier Promass 100 is dark	Power supply cable connected incorrectly	Check the terminal assignment .
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

Problem	Possible causes	Remedy
No write access to parameters	Hardware write protection enabled	Set the write protection switch on the main electronics module to the OFF position → 🖺 61.
No connection via Modbus RS485	Modbus RS485 bus cable connected incorrectly	Check the terminal assignment .
No connection via Modbus RS485	Device plug connected incorrectly	Check the pin assignment of the device plug .
No connection via Modbus RS485	Modbus RS485 cable incorrectly terminated	Check terminating resistor .
No connection via Modbus RS485	Incorrect settings for the communication interface	Check the Modbus RS485 configuration → 🖺 53.
No connection via service interface	Incorrect configuration of USB interface on PC or driver not installed correctly.	Observe the documentation for the Commubox. 📖 FXA291: Document "Technical Information" TI00405C

12.2   Diagnostic information via light emitting diodes

12.2.1   Transmitter

Various light emitting diodes (LEDs) on the main electronics module of the transmitter provide information on device status.

LED	Color	Meaning
Power	Off	Supply voltage is off or too low.
	Green	Supply voltage is ok.

Alarm	Off	Device status is ok.
	Flashing red	A device error of diagnostic behavior "Warning" has occurred.
	Red	• A device error of diagnostic behavior "Alarm" has occurred. • Boot loader is active.
Communication	Flashing white	Modbus RS485 communication is active.

12.2.2 Safety Barrier Promass 100

Various light emitting diodes (LEDs) on the Safety Barrier Promass 100 provide status information.

LED	Color	Meaning
Power	Off	Supply voltage is off or too low.
	Green	Supply voltage is ok.
Communication	Flashing white	Modbus RS485 communication is active.

12.3 Diagnostic information in FieldCare

12.3.1 Diagnostic options

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.

1   Status area with status signal
2   Diagnostic information
3   Remedy information with Service ID

Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:
• Via parameters
• Via submenu → 🖹 73

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
⊗ A0017271	**Failure** A device error has occurred. The measured value is no longer valid.
▽ A0017278	**Function check** The device is in service mode (e.g. during a simulation).
⚠ A0017277	**Out of specification** The device is operated: Outside its technical specification limits (e.g. outside the process temperature range)
◇ A0017276	**Maintenance required** Maintenance is required. The measured value is still valid.

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

Diagnostic information

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault.

Diagnostic information		
Diagnostic code		
Status signal	Diagnostic number	Short text
↓	↓	↓
S A0013958	**842**	**Process limit**
	3-digit number	

Example
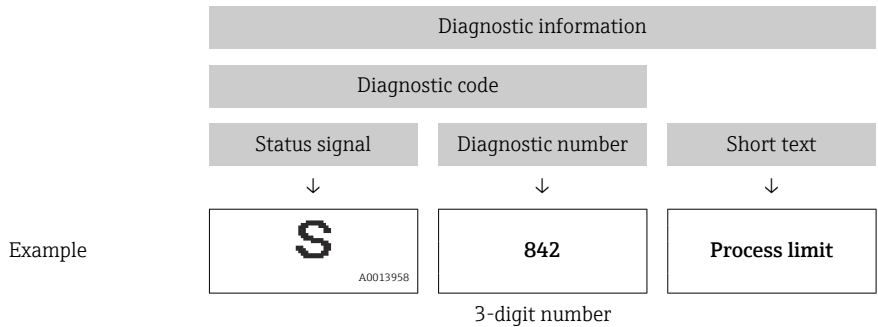
12.3.2 Calling up remedy information

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

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

1. Call up the desired parameter.

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

12.4 Diagnostic information via communication interface

12.4.1 Reading out diagnostic information

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

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

For an overview of diagnostic events with diagnosis number and diagnosis code
→ 🖺 71

12.4.2 Configuring error response mode

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

Navigation path
"Setup" menu → Communication

Parameter overview with brief description

Parameter	Description	Options	Factory setting
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	• Off • Alarm or warning • Warning • Alarm	Alarm
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. ℹ️ This parameter operates in accordance with the option selected in the **Assign diagnostic behavior** parameter.	• NaN value • Last valid value ℹ️ NaN ≡ not a number	NaN value

12.5   Adapting the diagnostic information

12.5.1 Adapting the diagnostic behavior

Each diagnostic number is assigned a certain diagnostic behavior at the factory. The user
can change this assignment for certain diagnostic numbers via the **Diagnostic no. xxx**
parameter.

Navigation path
"Expert" menu → System → Diagnostic handling → Diagnostic behavior → Assign behavior
of diagnostic no. xxx

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

Options	Description
Alarm	Measurement is interrupted. Measured value output via Modbus RS485 and totalizers assume the defined alarm condition. A diagnostic message is generated.
Warning	Measurement is resumed. Measured value output via Modbus RS485 and totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is entered in the Event logbook (events list) submenu only and is not displayed in alternation with the measured value display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.6   Overview of diagnostic information

The amount of diagnostic information increases if the measuring device has one or more application packages.

Diagnostics for the sensor

Diagnostic number	Short text	Remedial measures	Status signal from the factory	Diagnostic behavior from the factory
022	Sensor temperature	1. Change main electronic module. 2. Change sensor.	F	Alarm
044	Sensor drift	1. Check or change main electronics. 2. Change sensor.	S	Alarm*
046	Sensor limit	1. Inspect sensor. 2. Check process conditions.	S	Alarm*
062	Sensor connection	1. Change main electronic module. 2. Change sensor.	F	Alarm
082	Data storage	1. Change main electronic module. 2. Change sensor.	F	Alarm
083	Memory content	1. Restart device. 2. Restore S-DAT data. 3. Change sensor.	F	Alarm
* Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 🖻 70				

Diagnostics for the electronics

Diagnostic number	Short text	Remedial measures	Status signal from the factory	Diagnostic behavior from the factory
242	Software incompatible	1. Check software. 2. Flash or change main electronic module.	F	Alarm
261	Electronic modules	1. Restart device. 2. Check electronic modules. 3. Change I/O module or main electronics.	F	Alarm
270	Main electronic failure	Change main electronic module.	F	Alarm
271	Main electronic failure	1. Restart device. 2. Change main electronic module.	F	Alarm
272	Main electronic failure	1. Restart device. 2. Contact service.	F	Alarm
273	Main electronic failure	Replace electronics.	F	Alarm
274	Main electronic failure	Replace electronics.	S	Warning *
311	Electronic failure	1. Transfer data or reset device. 2. Contact service.	F	Alarm
* Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 🖻 70				

Diagnostics for the configuration

Diagnostic number	Short text	Remedial measures	Status signal from the factory	Diagnostic behavior from the factory
410	Data transfer	1. Check connection. 2. Retry data transfer.	F	Alarm
411	Up-/download active	Up-/download active, please wait	C	Warning
438	Dataset	1. Check data set file. 2. Check device configuration. 3. Up- and download new configuration.	M	Warning
453	Flow override	Deactivate flow override.	C	Warning
484	Simulation failsafe mode	Deactivate simulation.	C	Alarm
485	Simulation process variable	Deactivate simulation.	C	Warning
* Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 🖺 70				

Diagnostics for the process

Diagnostic number	Short text	Remedial measures	Status signal from the factory	Diagnostic behavior from the factory
830	Ambient temperature	Reduce the ambient temperature around the sensor housing.	S	Warning
831	Ambient temperature	Increase the ambient temperature around the sensor housing.	S	Warning
832	Ambient temperature	Reduce ambient temperature.	S	Warning*
833	Ambient temperature	Increase ambient temperature.	S	Warning*
834	Process temperature	Reduce process temperature.	S	Warning*
835	Process temperature	Increase process temperature.	S	Warning*
843	Process limit	Check process conditions.	S	Warning
862	Partly filled pipe	1. Check for gas in process. 2. Check detection limits.	S	Warning
910	Measuring tube does not vibrate	1. Check electronics. 2. Inspect sensor.	F	Alarm
912	Inhomogeneous	Fluid is inhomogeneous, e.g. gas or solid content! 1. Check process conditions. 2. Increase system pressure. ℹ In particular with outgassing media and/or increased gas content, the following measures are recommended to increase system pressure: ▪ Install the instrument at the outlet side of a pump. ▪ Install the instrument at the lowest point of an ascending pipeline. ▪ Install a flow restriction, e.g. reducer or orifice plate, downstream from the instrument.	S	Warning*

Diagnostic number	Short text	Remedial measures	Status signal from the factory	Diagnostic behavior from the factory
913	Inhomogeneous	Oscillation amplitude limit! The fluid properties do not allow a precise measurement. Cause: Process fluid is very inhomogeneous (gas or solid content) 1. Check process conditions. 2. Increase voltage. 3. Check main electronic module or sensor.	S	Alarm*
* Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 🖹 70				

12.7 Pending diagnostic events

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

Navigation path
- "Diagnostics" menu → Actual diagnostics
- "Diagnostics" menu → Previous diagnostics

Parameter overview with brief description

Parameter	Prerequisite	Description	Display
Actual diagnostics	1 diagnostic event has occurred	Displays the current diagnostic event along with the diagnostic information. ℹ️ If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Diagnostic code, short message
Previous diagnostics	2 diagnostic events have already occurred	Displays the diagnostic event that occurred prior to the current diagnostic event along with the diagnostic information.	Diagnostic code, short message

ℹ️ To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool → 🖹 69

ℹ️ Other diagnostic events that are pending can be viewed in the **Diagnostic list** submenu → 🖹 73

12.8 Diagnostic list

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

Navigation path
"Diagnostics" menu → Diagnostic list

ℹ️ To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool → 🖹 69

12.9   Event logbook

12.9.1   Event history

A chronological overview of the event messages that have occurred is provided in the events list which contains a maximum of 20 message entries. This list can be displayed via FieldCare if necessary.

Navigation path
Event list: **F** → Tool box→ Additional functions

> ℹ️   For information on the event list, see the FieldCare user interface

This event history includes entries for:
- Diagnostic events → 🖹 71
- Information events → 🖹 74

In addition to the operation time of its occurrence and possible troubleshooting measures, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostics event
    - ⊅: Event has occurred
    - ⊃: Event has ended
- Information event
    - ⊅: Event has occurred

> ℹ️   To call up the measures to rectify a diagnostic event:
> Via "FieldCare" operating tool → 🖹 69

> ℹ️   For filtering the displayed event messages → 🖹 74

12.9.2   Filtering the event logbook

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

Navigation path
"Diagnostics" menu → Event logbook → Filter options

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

12.9.3   Overview of information events

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

Information event	Event text
I1000	-------- (device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1110	Write protection switch changed
I1111	Density adjust. error

Information event	Event text
I1151	History reset
I1209	Density adjustment OK
I1221	Zero point adjust failure
I1222	Zero point adjustment OK

12.10   Resetting the measuring device

Using the **Device reset** parameter it is possible to reset the entire device configuration or some of the configuration to a defined state.

Navigation path
"Diagnostics" menu → Device reset → Device reset

Function scope of the "Device reset" parameter

Options	Description
Cancel	The user exists the parameter and no action is performed.
To factory defaults	Every parameter is reset to its factory setting.
To delivery settings	Every parameter for which a customized default setting was ordered is reset to that customized value; all other parameters are reset to their factory setting. ⓘ This option is not visible if no customized settings were ordered.
Restart device	Restarting the device resets every parameter whose data are saved in the volatile memory (RAM) to the parameter's factory setting (e.g. measured value data). The device configuration remains unchanged.

12.11   Device information

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

Navigation path
"Diagnostics" menu → Device information

Structure of the submenu

Device information	→	Device tag	→ 🗎 57
		Serial number	
		Firmware version	
		Device name	
		Order code	
		Extended order code 1	
		Extended order code 2	
		Extended order code 3	
		ENP version	

Parameter overview with brief description

Parameter	Prerequisite	Description	Display
Serial number	-	Displays the serial number of the measuring device. ℹ The number can be found on the nameplate of the sensor and transmitter.	Max. 11-digit character string comprising letters and numbers
Firmware version	-	Displays the device firmware version installed.	Character string in the format xx.yy.zz
Device name	-	Displays the name of the transmitter. ℹ The name can be found on the nameplate of the transmitter.	Promass 100
Order code	-	Displays the device order code. ℹ The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field.	Character string composed of letters, numbers and certain punctuation marks
Extended order code 1-3	Depending on the length of the extended order code, the code is divided into a maximum of 3 parameters.	Displays the 1st, 2nd or 3rd part of the extended order code. ℹ The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string
ENP version	-	Displays the version of the electronic nameplate.	Character string in the format xx.yy.zz

12.12 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
04.2013	01.02.00	Option **74**	Update	Operating Instructions	
06.2012	01.01.00	Option **78**	Original firmware	Operating Instructions	

ℹ Flashing the firmware to the current version or to the previous version is possible via the service interface (CDI) .

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

ℹ The manufacturer's information is available:
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download
- Specify the following details:
  - Product root, e.g. 8E1B
  - Text search: Manufacturer's information
  - Search range: documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

13.1.2 Interior cleaning

Observe the following points for CIP and SIP cleaning:
- Use only cleaning agents to which the process-wetted materials are adequately resistant.
- Observe the maximum permitted medium temperature for the measuring device → 🖺 92.

13.2 Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.

ℹ️ Your Endress+Hauser Sales Center can provide detailed information on the services.

List of some of the measuring and testing equipment: → 🖺 80→ 🖺 81

13.3 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

ℹ️ Your Endress+Hauser Sales Center can provide detailed information on the services.

14 Repair

14.1 General notes

14.1.1 Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to other certified devices by Endress+Hauser Service or at the factory.

14.1.2 Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:
▶ Use only original Endress+Hauser spare parts.
▶ Carry out the repair according to the Installation Instructions.
▶ Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
▶ Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

W@M Device Viewer (www.endress.com/deviceviewer):
All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

🛈 Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

🛈 Your Endress+Hauser Sales Center can provide detailed information on the services.

14.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:
   http://www.endress.com/support/return-material

2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

14.5   Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

14.5.1   Removing the measuring device

1.   Switch off the device.

> **⚠ WARNING**
>
> **Danger to persons from process conditions.**
> ▶ Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2.   Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

14.5.2   Disposing of the measuring device

> **⚠ WARNING**
>
> **Danger to personnel and environment from fluids that are hazardous to health.**
> ▶ Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:
▶ Observe valid federal/national regulations.
▶ Ensure proper separation and reuse of the device components.

15 Accessories

Various accessories, which can be ordered with the device or subsequently from Endress +Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

15.1 Device-specific accessories

15.1.1 For the sensor

Accessories	Description

Heating jacket	Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids.
	
	ⓘ If using oil as a heating medium, please consult with Endress+Hauser.
	
	Heating jackets cannot be used with sensors fitted with a rupture disk.
	
	• If ordered together with the measuring device:
	order code for "Enclosed accessories"
	  • Option RB "heating jacket, G 1/2" internal thread"
	  • Option RC "heating jacket, G 3/4" internal thread"
	  • Option RD "Heating jacket, NPT 1/2" internal thread"
	  • Option RE "Heating jacket, NPT 3/4" internal thread"
	• If ordered subsequently:
	Use the order code with the product root DK8003.
	
	📘 Special Documentation SD02151D

15.2 Communication-specific accessories

Accessories	Description
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. 📘 Technical Information TI405C/07
Fieldgate FXA42	Is used to transmit the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices 📘 • Technical Information TI01297S • Operating Instructions BA01778S • Product page: www.endress.com/fxa42
Field Xpert SMT70	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. 📘 • Technical Information TI01342S • Operating Instructions BA01709S • Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. 📘 • Technical Information TI01418S • Operating Instructions BA01923S • Product page: www.endress.com/smt77

15.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: • Choice of measuring devices for industrial requirements • Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. • Graphic illustration of the calculation results • Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: • Via the Internet: https://portal.endress.com/webapp/applicator • As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle. W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. 📖 Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. 📖 Innovation brochure IN01047S
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. 📖 Technical Information TI00405C

15.4 System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick. 📖 • Technical Information TI00133R • Operating Instructions BA00247R
iTEMP	The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature. 📖 "Fields of Activity" document FA00006T

16   Technical data

16.1   Application

The measuring device is intended only for the flow measurement of liquids and gases.

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

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are sufficiently resistant.

16.2   Function and system design

Measuring principle	Mass flow measurement based on the Coriolis measuring principle
Measuring system	The device consists of a transmitter and a sensor. The Safety Barrier Promass 100 is part of the scope of supply and must be implemented to operate the device. The device is available as a compact version: The transmitter and sensor form a mechanical unit. For information on the structure of the device → 🖹 11

16.3   Input

Measured variable	**Direct measured variables**
	• Mass flow
	• Density
	• Temperature
	Calculated measured variables
	• Volume flow
	• Corrected volume flow
	• Reference density

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured variables

- Volume flow
- Corrected volume flow
- Reference density

Measuring range

Measuring ranges for liquids

DN		Measuring range full scale values $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
8	⅜	0 to 2 000	0 to 73.50
15	½	0 to 6 500	0 to 238.9
25	1	0 to 18 000	0 to 661.5
40	1½	0 to 45 000	0 to 1 654
50	2	0 to 70 000	0 to 2 573
80	3	0 to 180 000	0 to 6 615

Measuring ranges for gases

The full scale values depend on the density of the gas and can be calculated with the formula below:

$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x$

$\dot{m}_{max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{max(F)}$	Maximum full scale value for liquid [kg/h]
$\dot{m}_{max(G)} < \dot{m}_{max(F)}$	$\dot{m}_{max(G)}$ can never be greater than $\dot{m}_{max(F)}$
ρ_G	Gas density in [kg/m³] at operating conditions
x	Constant dependent on nominal diameter

DN		x
[mm]	[in]	[kg/m³]
8	⅜	85
15	½	110
25	1	125
40	1½	125
50	2	125
80	3	155

Calculation example for gas

- Sensor: Promass E, DN 50
- Gas: Air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range (liquid): 70 000 kg/h
- x = 125 kg/m³ (for Promass E, DN 50)

Maximum possible full scale value:

$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x = 70\,000\ \text{kg/h} \cdot 60.3\ \text{kg/m}^3 : 125\ \text{kg/m}^3 = 33\,800\ \text{kg/h}$

Recommended measuring range

"Flow limit" section → 🖹 93

Operable flow range	Over 1000 : 1. Flow rates above the preset full scale value do not override the electronics unit, with the result that the totalizer values are registered correctly.

Input signal	**External measured values** To increase the accuracy of certain measured variables or to calculate the corrected volume flow for gases, the automation system can continuously write different measured values to the measuring device: • Operating pressure to increase accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure, e.g. Cerabar M or Cerabar S) • Medium temperature to increase accuracy (e.g. iTEMP) • Reference density for calculating the corrected volume flow for gases ℹ️ Various pressure transmitters and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 🖹 81 It is recommended to read in external measured values to calculate the following measured variables: • Mass flow • Corrected volume flow *Digital communication* The measured values are written from the automation system to the measuring device via Modbus RS485.

16.4   Output

Output signal	**Modbus RS485**

Physical interface	In accordance with EIA/TIA-485-A standard
Terminating resistor	• For device version used in non-hazardous areas or Zone 2/Div. 2: integrated and can be activated via DIP switches on the transmitter electronics module • For device version used in intrinsically safe areas: integrated and can be activated via DIP switches on the Safety Barrier Promass 100

Signal on alarm	Depending on the interface, failure information is displayed as follows: **Modbus RS485**

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

Interface/protocol

- Via digital communication:
  Modbus RS485
- Via service interface
  CDI-RJ45 service interface

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes
	The following information is displayed depending on the device version: • Supply voltage active • Data transmission active • Device alarm/error has occurred
	ⓘ Diagnostic information via light emitting diodes → 🖺 67

Low flow cut off	The switch points for low flow cut off are user-selectable.

Galvanic isolation	The following connections are galvanically isolated from each other: • Outputs • Power supply

Protocol-specific data

Protocol-specific data

Protocol	Modbus Applications Protocol Specification V1.1
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	• 03: Read holding register • 04: Read input register • 06: Write single registers • 08: Diagnostics • 16: Write multiple registers • 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: • 06: Write single registers • 16: Write multiple registers • 23: Read/write multiple registers
Supported baud rate	• 1 200 BAUD • 2 400 BAUD • 4 800 BAUD • 9 600 BAUD • 19 200 BAUD • 38 400 BAUD • 57 600 BAUD • 115 200 BAUD
Data transfer mode	• ASCII • RTU
Data access	Each device parameter can be accessed via Modbus RS485. ⓘ For Modbus register information, see "Description of device parameters" documentation

16.5   Power supply

| Terminal assignment | • → 🗐 26 |
| | • → 🗐 25 |

Pin assignment, device plug   → 🗐 28

Supply voltage   The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

Transmitter

• Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2:
  DC 20 to 30 V
• Modbus RS485, for use in intrinsically safe areas:
  Power supply via Safety Barrier Promass 100

Promass 100 safety barrier

DC 20 to 30 V

Power consumption   **Transmitter**

Order code for "Output"	Maximum Power consumption
Option **M** Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2	3.5 W
Option **M**: Modbus RS485, for use in intrinsically safe areas	2.45 W

Promass 100 safety barrier

Order code for "Output"	Maximum Power consumption
Option **M**: Modbus RS485, for use in intrinsically safe areas	4.8 W

Current consumption   **Transmitter**

Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option **M** Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2	90 mA	10 A (< 0.8 ms)
Option **M**: Modbus RS485, for use in intrinsically safe areas	145 mA	16 A (< 0.4 ms)

Promass 100 safety barrier

Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option **M**: Modbus RS485, for use in intrinsically safe areas	230 mA	10 A (< 0.8 ms)

Power supply failure	• Totalizers stop at the last value measured. • Depending on the device version, the configuration is retained in the device memory or in the pluggable data memory (HistoROM DAT). • Error messages (incl. total operated hours) are stored.
Electrical connection	→ 🖹 29
Potential equalization	→ 🖹 32
Terminals	**Transmitter** Spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG) **Promass 100 safety barrier** Plug-in screw terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

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

Cable specification	→ 🖹 24

16.6   Performance characteristics

Reference operating conditions	• Error limits based on ISO 11631 • Water with +15 to +45 ℃ (+59 to +113 ℉) at 2 to 6 bar (29 to 87 psi) • Specifications as per calibration protocol • Accuracy based on accredited calibration rigs that are traced to ISO 17025. ℹ️ To obtain measured errors, use the *Applicator* sizing tool → 🖹 81
Maximum measured error	o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature **Base accuracy** ℹ️ Design fundamentals → 🖹 90 *Mass flow and volume flow (liquids)* • ±0.15 % o.r. ±0.10 % o.r. (order code for "Calibration flow", option A, B, C, for mass flow) • ±0.25 % o.r. *Mass flow (gases)* ±0.50 % o.r. *Density (liquids)*

Under reference conditions	Standard density calibration
[g/cm³]	[g/cm³]
±0.0005	±0.002

Temperature

±0.5 ℃ ± 0.005 · T ℃ (±0.9 ℉ ± 0.003 · (T − 32) ℉)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
8	⅜	0.20	0.007
15	½	0.65	0.024
25	1	1.80	0.066
40	1½	4.50	0.165
50	2	7.0	0.257
80	3	18.0	0.6615

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
8	2 000	200	100	40	20	4
15	6 500	650	325	130	65	13
25	18 000	1 800	900	360	180	36
40	45 000	4 500	2 250	900	450	90
50	70 000	7 000	3 500	1 400	700	140
80	180 000	18 000	9 000	3 600	1 800	360

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[inch]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
⅜	73.50	7.350	3.675	1.470	0.735	0.147
½	238.9	23.89	11.95	4.778	2.389	0.478
1	661.5	66.15	33.08	13.23	6.615	1.323
1½	1 654	165.4	82.70	33.08	16.54	3.308
2	2 573	257.3	128.7	51.46	25.73	5.146
3	6 615	661.5	330.8	132.3	66.15	13.23

Accuracy of outputs

> The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

The outputs have the following base accuracy specifications.

Repeatability   o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature

Base repeatability

🛈 Design fundamentals → 🕮 90

Mass flow and volume flow (liquids)

±0.075 % o.r.
±0.05 % o.r. (calibration option, for mass flow)

Mass flow (gases)

±0.35 % o.r.

Density (liquids)

±0.00025 g/cm³

Temperature

±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0015 · (T–32) °F)

Response time	The response time depends on the configuration (damping).

Influence of medium temperature	**Mass flow and volume flow**

o.f.s. = of full scale value

When there is a difference between the temperature for zero point adjustment and the process temperature, the additional measured error of the sensor is typically ±0.0002 % o.f.s./°C (±0.0001 % o. f.s./°F).

The effect is reduced if zero point adjustment is performed at process temperature.

Density
When there is a difference between the density calibration temperature and the process temperature, the typical measured error of the sensor is
±0.0001 g/cm³ /°C (±0.00005 g/cm³ /°F). Field density calibration is possible.

🖻 *20   Field density calibration, for example at +20 °C (+68 °F)*

Temperature
±0.005 · T °C (± 0.005 · (T − 32) °F)

Influence of medium pressure	The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

o.r. = of reading

It is possible to compensate for the effect by:
- Reading in the current pressure measured value via the current input.
- Specifying a fixed value for the pressure in the device parameters.

Operating Instructions .

DN		[% o.r./bar]	[% o.r./psi]
[mm]	[in]		
8	⅜	no influence	
15	½	no influence	
25	1	no influence	
40	1½	no influence	
50	2	−0.009	−0.0006
80	3	−0.020	−0.0014

Design fundamentals

o.r. = of reading, o.f.s. = of full scale value

BaseAccu = base accuracy in % o.r., BaseRepeat = base repeatability in % o.r.

MeasValue = measured value; ZeroPoint = zero point stability

Calculation of the maximum measured error as a function of the flow rate

Flow rate	Maximum measured error in % o.r.
$\geq \dfrac{ZeroPoint}{BaseAccu} \cdot 100$ A0021332	$\pm\, BaseAccu$ A0021339
$< \dfrac{ZeroPoint}{BaseAccu} \cdot 100$ A0021333	$\pm\, \dfrac{ZeroPoint}{MeasValue} \cdot 100$ A0021334

Calculation of the maximum repeatability as a function of the flow rate

Flow rate	Maximum repeatability in % o.r.
$\geq \dfrac{½ \cdot ZeroPoint}{BaseRepeat} \cdot 100$ A0021335	$\pm\, BaseRepeat$ A0021340
$< \dfrac{½ \cdot ZeroPoint}{BaseRepeat} \cdot 100$ A0021336	$\pm\, ½ \cdot \dfrac{ZeroPoint}{MeasValue} \cdot 100$ A0021337

Example for maximum measured error
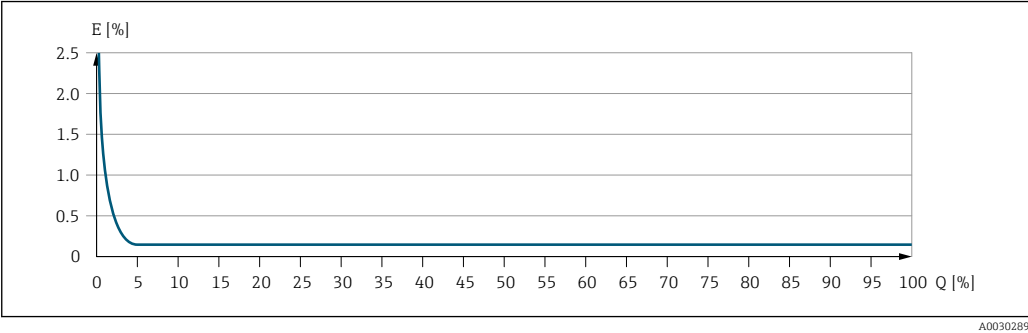
E   *Maximum measured error in % o.r. (example)*
Q   *Flow rate in % of maximum full scale value*

16.7   Installation

Installation conditions   → 🕮 18

16.8   Environment

Ambient temperature
range
→ 🕮 20→ 🕮 20

Temperature tables

🛈   Observe the interdependencies between the permitted ambient and fluid
temperatures when operating the device in hazardous areas.

📖   For detailed information on the temperature tables, see the separate document
entitled "Safety Instructions" (XA) for the device.

Storage temperature   –40 to +80 ℃ (–40 to +176 ℉), preferably at +20 ℃ (+68 ℉)

Climate class   DIN EN 60068-2-38 (test Z/AD)

Degree of protection   **Transmitter and sensor**
- As standard: IP66/67, type 4X enclosure
- With the order code for "Sensor options", option CM: IP69 can also be ordered
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Safety Barrier Promass 100
IP20

Vibration resistance
- Oscillation, sinusoidal, following IEC 60068-2-6
  - 2 to 8.4 Hz, 3.5 mm peak
  - 8.4 to 2 000 Hz, 1 g peak
- Oscillation, broadband noise following IEC 60068-2-64
  - 10 to 200 Hz, 0.003 g^2/Hz
  - 200 to 2 000 Hz, 0.001 g^2/Hz
  - Total: 1.54 g rms

Shock resistance	Shock, half-sine according to IEC 60068-2-27 6 ms 30 g
Shock resistance	Shock due to rough handling following IEC 60068-2-31
Interior cleaning	• SIP cleaning • CIP cleaning
Electromagnetic compatibility (EMC)	• As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) • Complies with emission limits for industry as per EN 55011 (Class A) Details are provided in the Declaration of Conformity.

16.9   Process

Medium temperature range	−40 to +150 ℃ (−40 to +302 ℉)

Dependency of ambient temperature on medium temperature

A0031121
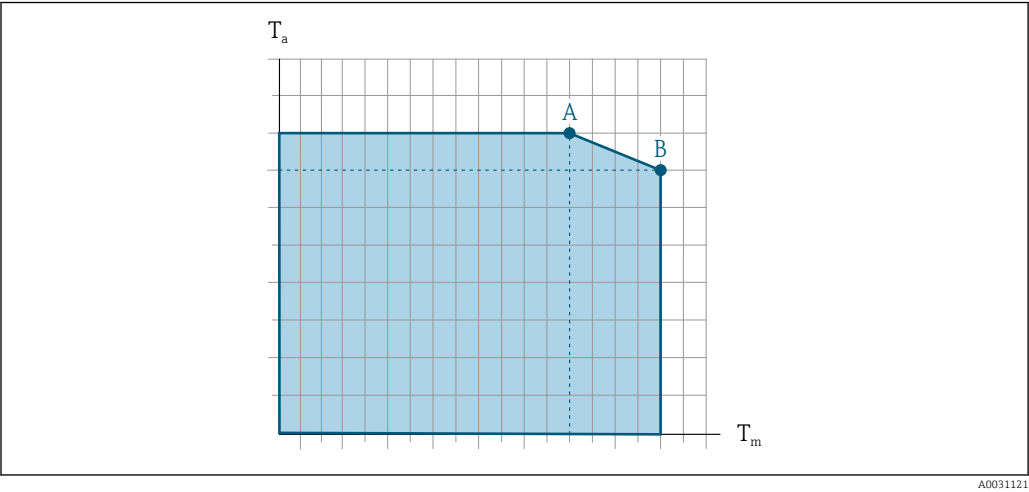
🖻 *21   Exemplary representation, values in the table below.*

T$_a$ Ambient temperature range
T$_m$ Medium temperature
A   Maximum permitted medium temperature T$_m$ at T$_{a\,max}$ = 60 ℃ (140 ℉); higher medium temperatures T$_m$ require a reduced ambient temperature T$_a$
B   Maximum permitted ambient temperature T$_a$ for the maximum specified medium temperature T$_m$ of the sensor

Values for devices used in the hazardous area:
Separate Ex documentation (XA) for the device .

Density	0 to 5 000 kg/m³ (0 to 312 lb/cf)
Pressure-temperature ratings	An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document

Sensor housing	The sensor housing is filled with dry nitrogen gas and protects the electronics and mechanics inside.

> ℹ️ If a measuring tube fails (e.g. due to process characteristics like corrosive or abrasive fluids), the fluid will initially be contained by the sensor housing.

In the event of a tube failure, the pressure level inside the sensor housing will rise according to the operating process pressure. If the user judges that the sensor housing burst pressure does not provide an adequate safety margin, the device can be fitted with a rupture disk. This prevents excessively high pressure from forming inside the sensor housing. Therefore, the use of a rupture disk is strongly recommended in applications involving high gas pressures, and particularly in applications in which the process pressure is greater than 2/3 of the sensor housing burst pressure.

Burst pressure of the sensor housing

If the device is fitted with a rupture disk (order code for "Sensor option", option CA "Rupture disk"), the rupture disk trigger pressure is decisive .

The sensor housing burst pressure refers to a typical internal pressure which is reached prior to mechanical failure of the sensor housing and which was determined during type testing. The corresponding type test declaration can be ordered with the device (order code for "Additional approval", option LN "Sensor housing burst pressure, type test").

DN		Sensor housing burst pressure	
[mm]	[in]	[bar]	[psi]
8	⅜	250	3 620
15	½	250	3 620
25	1	250	3 620
40	1½	200	2 900
50	2	180	2 610
80	3	120	1 740

> 📖 For information on the dimensions: see the "Mechanical construction" section of the "Technical Information" document

Rupture disk	To increase the level of safety, a device version with a rupture disk with a trigger pressure of 10 to 15 bar (145 to 217.5 psi)can be used (order code for "Sensor option", option CA "rupture disk").

The use of rupture disks cannot be combined with the separately available heating jacket.

Flow limit	Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.

> ℹ️ For an overview of the full scale values for the measuring range, see the "Measuring range" section → 🔲 83

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value
- In most applications, 20 to 50 % of the maximum full scale value can be considered ideal
- A low full scale value must be selected for abrasive media (such as liquids with entrained solids): flow velocity < 1 m/s (< 3 ft/s).
- For gas measurement the following rules apply:
  - The flow velocity in the measuring tubes should not exceed half the sound velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula → 🖹 83

To calculate the flow limit, use the *Applicator* sizing tool → 🖹 81

Pressure loss		To calculate the pressure loss, use the *Applicator* sizing tool → 🖹 81

System pressure	→ 🖹 20

16.10   Mechanical construction

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

Weight	All values (weight exclusive of packaging material) refer to devices with EN/DIN PN 40 flanges. Weight specifications including transmitter: order code for "Housing", option A "Compact, aluminum coated".

Weight in SI units

DN [mm]	Weight [kg]
8	4.5
15	4.8
25	6.4
40	10.4
50	15.5
80	29

Weight in US units

DN [in]	Weight [lbs]
3/8	10
½	11
1	14
1 ½	23
2	34
3	64

Safety Barrier Promass 100

49 g (1.73 ounce)

Materials	**Transmitter housing** • Order code for "Housing", option **A** "Compact, aluminum coated": Aluminum, AlSi10Mg, coated • Order code for "Housing", option **B** "Compact, hygienic, stainless": Hygienic version, stainless steel 1.4301 (304) • Order code for "Housing", option **C** "Ultra-compact, hygienic, stainless": Hygienic version, stainless steel 1.4301 (304)

Cable entries/cable glands
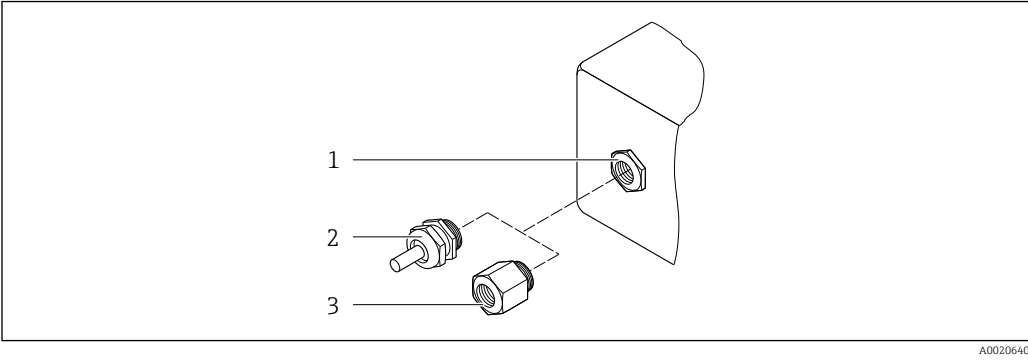
⚉ *22   Possible cable entries/cable glands*

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

Order code for "Housing", option A "Compact, aluminum, coated"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Nickel-plated brass
Adapter for cable entry with female thread G ½"	
Adapter for cable entry with female thread NPT ½"	

Order code for "Housing", option B "Compact, hygienic, stainless"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Stainless steel, 1.4404 (316L)
Adapter for cable entry with female thread G ½"	
Adapter for cable entry with female thread NPT ½"	

Device plug

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

Sensor housing
- Acid and alkali-resistant outer surface
- Stainless steel 1.4301 (304)

Measuring tubes

Stainless steel, 1.4539 (904L); manifold: stainless steel, 1.4404 (316L)

Process connections

- Flanges according to EN 1092-1 (DIN2501) / according to ASME B 16.5 / as per JIS B2220:
  Stainless steel, 1.4404 (F316/F316L)
- All other process connections:
  Stainless steel, 1.4404 (316/316L)

Seals

Welded process connections without internal seals

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

Safety Barrier Promass 100

Housing: Polyamide

Process connections	• Fixed flange connections: • EN 1092-1 (DIN 2501) flange • EN 1092-1 (DIN 2512N) flange • Namur lengths in accordance with NE 132 • ASME B16.5 flange • JIS B2220 flange • DIN 11864-2 Form A flange, DIN 11866 series A, flange with notch • Clamp connections: Tri-Clamp (OD tubes), DIN 11866 series C • Thread: • DIN 11851 thread, DIN 11866 series A • SMS 1145 thread • ISO 2853 thread, ISO 2037 • DIN 11864-1 Form A thread, DIN 11866 series A • VCO connections: • 8-VCO-4 • 12-VCO-4 ℹ Process connection materials → 🕮 95
Surface roughness	All data relate to parts in contact with fluid. The following surface roughness quality can be ordered. • Not polished • Ra_{max} = 0.76 µm (30 µin) • Ra_{max} = 0.38 µm (15 µin)

16.11   Human interface

Service interface	**Via service interface (CDI)**
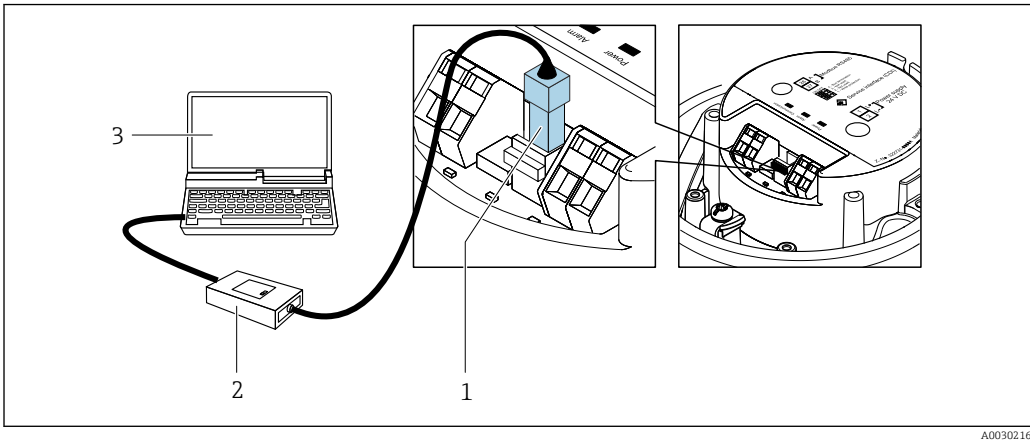
Modbus RS485

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

Languages	Can be operated in the following languages:
	Via "FieldCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

16.12   Certificates and approvals

Currently available certificates and approvals can be called up via the product configurator.

CE mark	The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.
	Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

RCM-tick symbol	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.

Sanitary compatibility	• 3-A approval
	  • Only measuring devices with the order code for "Additional approval", option LP "3A" have 3-A approval.
	  • The 3-A approval refers to the measuring device.
	  • When installing the measuring device, ensure that no liquid can accumulate on the outside of the measuring device.
	    Remote transmitters must be installed in accordance with the 3-A Standard.
	  • Accessories (e.g. heating jacket, weather protection cover, wall holder unit) must be installed in accordance with the 3-A Standard.
	    Each accessory can be cleaned. Disassembly may be necessary under certain circumstances.
	• EHEDG-tested
	Only devices with the order code for "Additional approval", option LT "EHEDG" have been tested and meet the requirements of the EHEDG.
	To meet the requirements for EHEDG certification, the device must be used with process connections in accordance with the EHEDG position paper entitled "Easy Cleanable Pipe Couplings and Process Connections" (www.ehedg.org).

Pharmaceutical compatibility	• FDA 21 CFR 177
	• USP <87>
	• USP <88> Class VI 121 ℃
	• TSE/BSE Certificate of Suitability
	• cGMP
	
	  ℹ️ Devices with order code for "Test, certificate", option JG "Compliance with requirements derived from cGMP, declaration" are in accordance with cGMP requirements relating to the surfaces of wetted parts, design, FDA 21 CFR material conformity, USP Class VI tests and TSE/BSE-compliance.
	
	    A manufacturer's declaration specific to the serial number is supplied with the device.

Modbus RS485 certification	The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.
Pressure Equipment Directive	• With the identification PED/G1/x (x = category) on the sensor nameplate, Endress+Hauser confirms conformity with the "Essential Safety Requirements" specified in Appendix I of the Pressure Equipment Directive 2014/68/EU. • Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Article 4 paragraph 3 of the Pressure Equipment Directive 2014/68/EU. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU.
Other standards and guidelines	• EN 60529 Degrees of protection provided by enclosures (IP code) • IEC/EN 60068-2-6 Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal). • IEC/EN 60068-2-31 Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices. • EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements • IEC/EN 61326 Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).

- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 80
  The application of the pressure equipment directive to process control devices
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications
- NAMUR NE 132
  Coriolis mass meter

16.13   Application packages

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

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

Detailed information on the application packages:
Special Documentation for the device → 🗎 102

Heartbeat Technology	Package	Description
	Heartbeat Verification +Monitoring	**Heartbeat Verification** Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment". • Functional testing in the installed state without interrupting the process. • Traceable verification results on request, including a report. • Simple testing process via local operation or other operating interfaces. • Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. • Extension of calibration intervals according to operator's risk assessment. **Heartbeat Monitoring** Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to: • Draw conclusions - using these data and other information - about the impact process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. • Schedule servicing in time. • Monitor the process or product quality, e.g. gas pockets.

Concentration

Package	Description
Concentration	**Calculation and outputting of fluid concentrations**
	The measured density is converted to the concentration of a substance of a binary mixture using the "Concentration" application package:
	• Choice of predefined fluids (e.g. various sugar solutions, acids, alkalis, salts, ethanol etc.)
	• Common or user-defined units (°Brix, °Plato, % mass, % volume, mol/l etc.) for standard applications.
	• Concentration calculation from user-defined tables.
	The measured values are output via the digital and analog outputs of the device.

16.14 Accessories

Overview of accessories available for order → 🔖 80

16.15 Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Standard documentation **Brief Operating Instructions**

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Promass E	KA01260D

Transmitter Brief Operating Instructions

Measuring device	Documentation code
Proline Promass 100	KA01335D

Technical Information

Measuring device	Documentation code
Proline Promass E 100	TI01351D

Description of Device Parameters

Measuring device	Documentation code
Proline Promass 100	GP01035D

Supplementary device-
dependent documentation

Safety Instructions

Content	Documentation code
ATEX/IECEx Ex i	XA00159D
ATEX/IECEx Ex nA	XA01029D
cCSAus IS	XA00160D
INMETRO Ex i	XA01219D
INMETRO Ex nA	XA01220D

Special Documentation

Content	Documentation code
Information on the Pressure Equipment Directive	SD00142D
Modbus RS485 Register Information	SD00154D
Concentration measurement	SD01152D
Heartbeat Technology	SD01153D

Installation Instructions

Contents	Comment
Installation instructions for spare part sets and accessories	• Access the overview of all the available spare part sets via *W@M Device Viewer* → 🖺 78 • Accessories available for order with Installation Instructions → 🖺 80

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