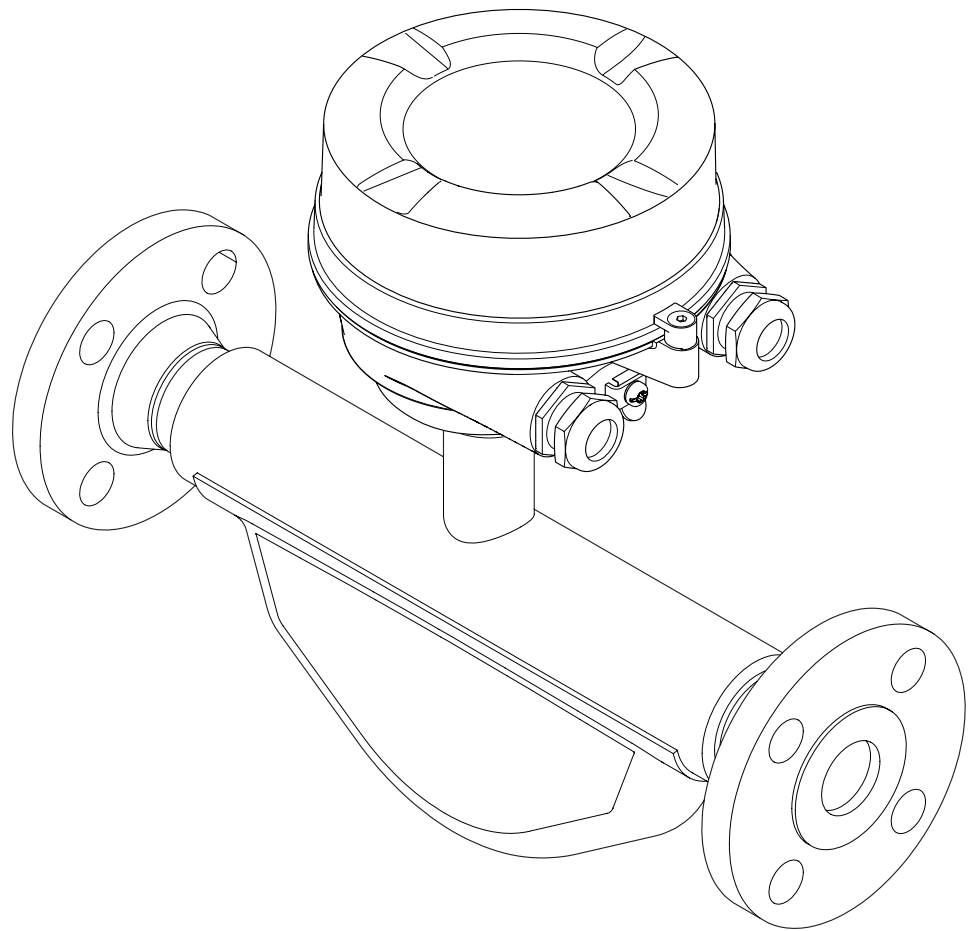


Operating Instructions

LPGmass

Modbus RS485

Coriolis flowmeter



-
- 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.

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1 Document information

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 used



1.2.1 Safety symbols

Symbol	Meaning
	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.
	NOTE! 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 ground connection A terminal which must be connected to ground prior to establishing any other connections.
	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.








1.2.3 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
	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection



1.2.5 Symbols in graphics

Symbol	Meaning
	Item numbers
	Series of steps
	Views
	Sections
	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:

- 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.

 For a detailed list of the individual documents along with the documentation code
→  85

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	<p>Planning aid for your device</p> <p>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.</p>
Sensor Brief Operating Instructions	<p>Guides you quickly to the 1st measured value - Part 1</p> <p>The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device.</p> <ul style="list-style-type: none"> ▪ Incoming acceptance and product identification ▪ Storage and transport ▪ Installation
Transmitter Brief Operating Instructions	<p>Guides you quickly to the 1st measured value - Part 2</p> <p>The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value).</p> <ul style="list-style-type: none"> ▪ Product description ▪ Installation ▪ Electrical connection ▪ Operation options ▪ System integration ▪ Commissioning ▪ Diagnostic information
Description of Device Parameters	<p>Reference for your parameters</p> <p>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.</p> <p>The document provides Modbus-specific information for each individual parameter in the Expert operating menu.</p>

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.

Microsoft®

Registered trademark of the Microsoft Corporation, Redmond, Washington, USA

2 Basic safety instructions

2.1 Requirements for 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 these Instructions is intended only for 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:

- ▶ 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 measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section → 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!

- ▶ Verify the compatibility of the process fluid with the sensor material.
- ▶ Ensure the resistance of all fluid-wetted materials in the process.
- ▶ Keep within the specified pressure and temperature range.

Verification for borderline cases:

- ▶ For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any

warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks



The 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.

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

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

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

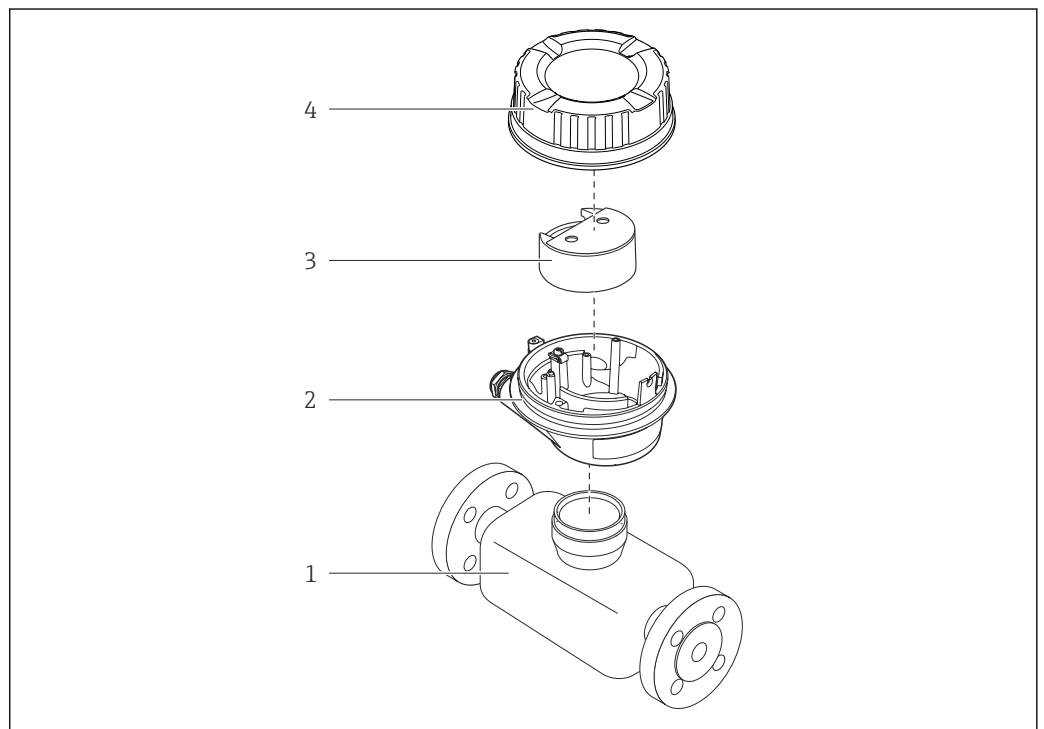
3 Product description


The device consists of a transmitter and a sensor. If a device is ordered with Modbus RS485 intrinsically safe, the Safety Barrier Promass 100 is part of the scope of supply and must be implemented to operate the device.

One device version is available: compact version, transmitter and sensor form a mechanical unit.


3.1 Product design

3.1.1 Device version with Modbus RS485 communication type



 1 Important components of a measuring device

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

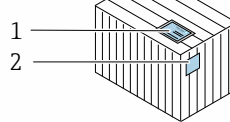
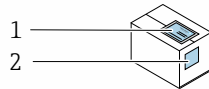
 In the case of the device version with Modbus RS485 intrinsically safe, the Safety Barrier Promass 100 forms part of the scope of supply.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

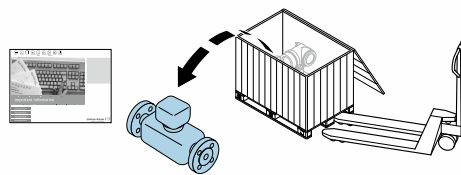


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Are the order codes on the delivery note (1) and the product sticker (2) identical?

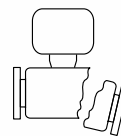
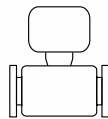
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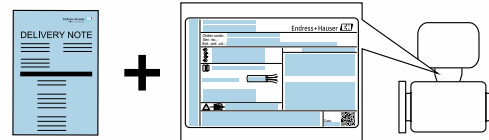


Are the goods undamaged?

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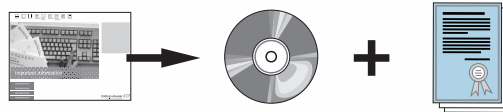


Do the nameplate data match the ordering information on the delivery note?

A0029317



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

A0029318



- i** ■ 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

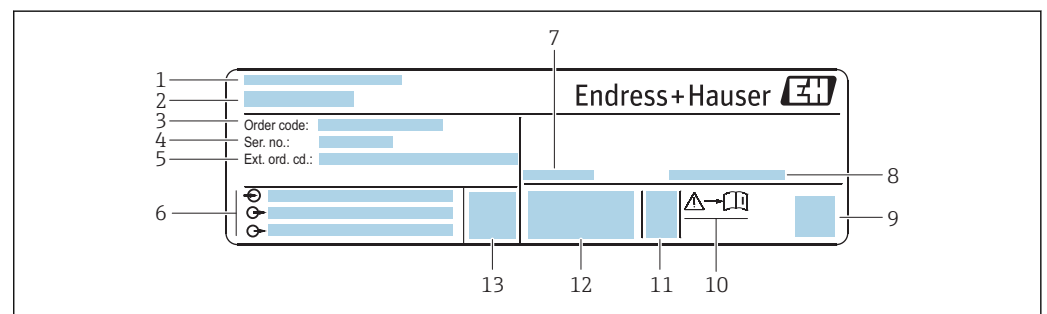
The following options are available for identification of the measuring device:


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


For an overview of the scope of the associated Technical Documentation, refer to the following:

- The chapters "Additional standard documentation on the device" →  7 and "Supplementary device-dependent documentation" →  7
- 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.

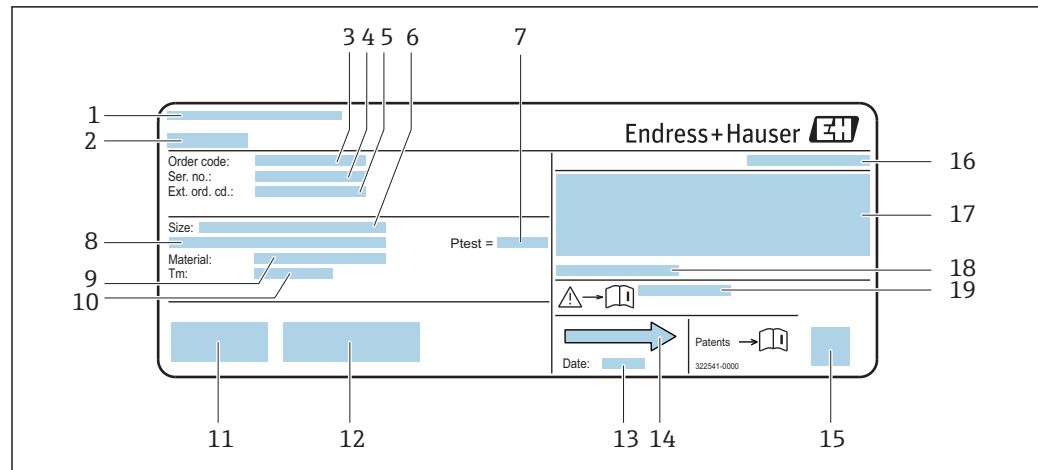
4.2.1 Transmitter nameplate



 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 →  85
- 11 Manufacturing date: year-month
- 12 CE mark, C-Tick
- 13 Firmware version (FW)

4.2.2 Sensor nameplate



A0013907

3 Example of a sensor nameplate

- 1 Manufacturing location
- 2 Name of the sensor
- 3 Order code
- 4 Serial number (ser. no.)
- 5 Extended order code (Ext. ord. cd.)
- 6 Nominal diameter of sensor
- 7 Test pressure of the sensor
- 8 Flange nominal diameter/nominal pressure
- 9 Material of measuring tube and manifold
- 10 Medium temperature range
- 11 CE mark, C-Tick
- 12 Additional information on version: certificates, approvals
- 13 Manufacturing date: year-month
- 14 Flow direction
- 15 2-D matrix code
- 16 Degree of protection
- 17 Approval information for explosion protection and Pressure Equipment Directive
- 18 Permitted ambient temperature (T_a)
- 19 Document number of safety-related supplementary documentation

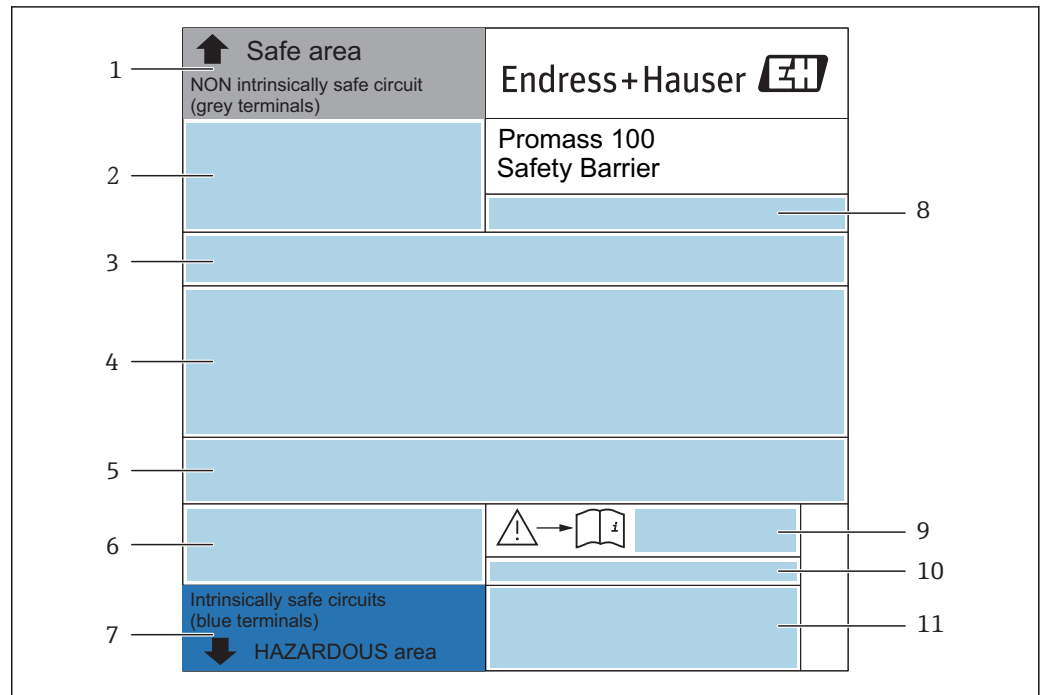
Order code

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



A0017854

4 Example of a Safety Barrier Promass 100 nameplate

- 1 Non-hazardous area or zone 2/div. 2
- 2 Serial number, material number and 2-D matrix code of the Safety Barrier Promass 100
- 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

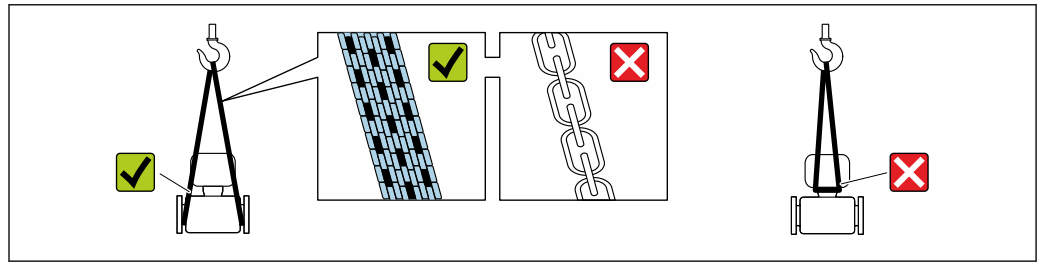
Observe the following notes for storage:

- 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: -50 to $+80$ °C (-58 to $+176$ °F),

5.2 Transporting the product

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



A0029252

- i** 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.

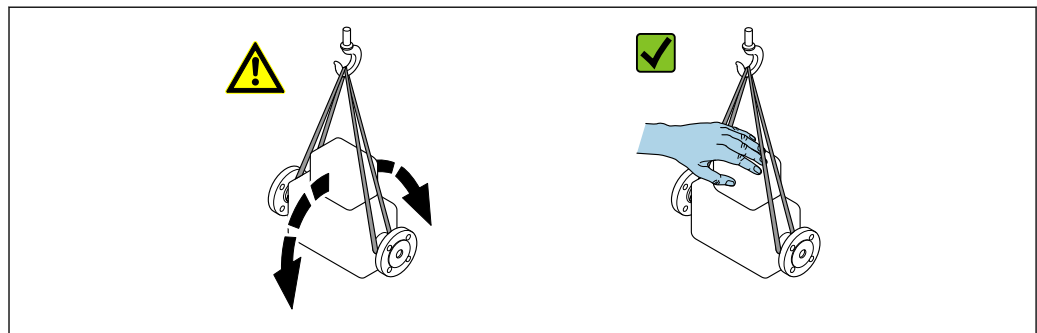
5.2.1 Measuring devices without lifting lugs

⚠ 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:

- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
 - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
 - or
 - Carton in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed RESY symbol.
- Seaworthy packaging (optional): Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
- Carrying and mounting hardware:
 - Disposable plastic pallet
 - Plastic straps
 - Plastic adhesive strips
- Dunnage: Paper cushion

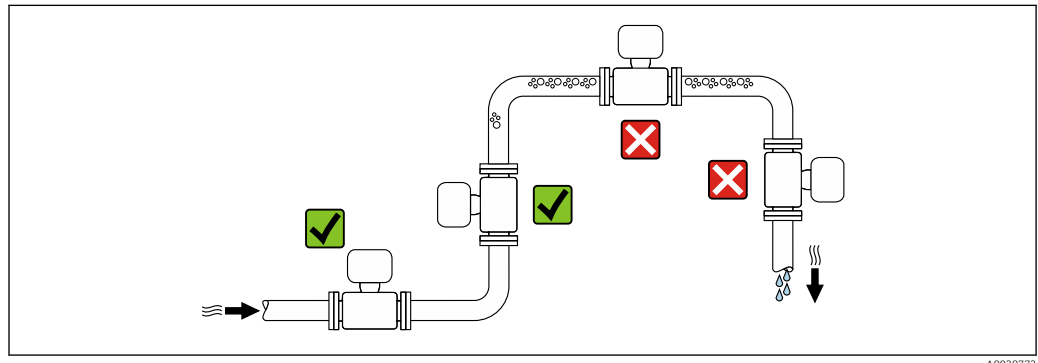
6 Installation

6.1 Installation conditions

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

6.1.1 Mounting position

Mounting location



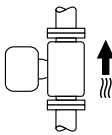
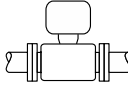
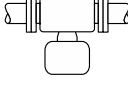

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To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:

- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

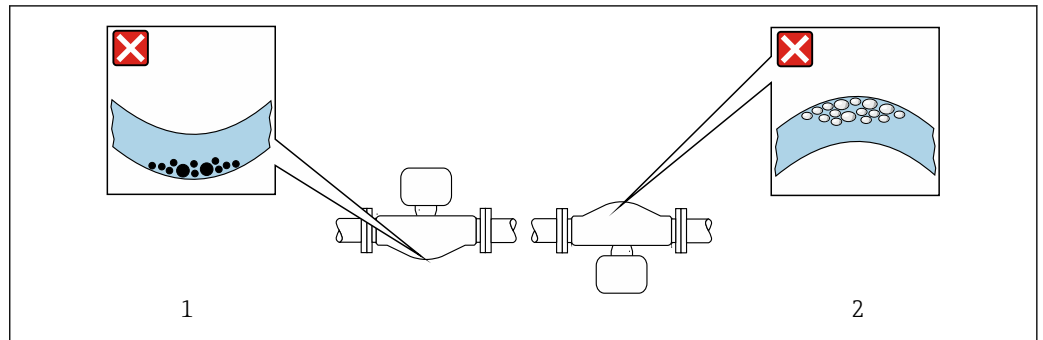
Orientation

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	✓✓
B	Horizontal orientation, transmitter head up	 A0015589	✓✓ ¹⁾ Exceptions: → 5, 19
C	Horizontal orientation, transmitter head down	 A0015590	✓✓ ²⁾ Exceptions: → 5, 19
D	Horizontal orientation, transmitter head at side	 A0015592	✗

- 1) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
- 2) 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.

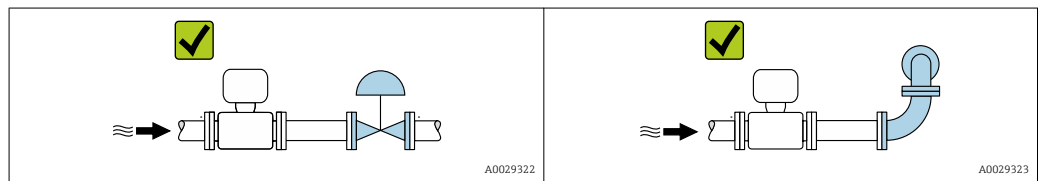


5 Orientation of sensor with curved measuring tube

- 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 → 19.



Installation dimensions

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

6.1.2 Requirements from environment and process

Ambient temperature range

Measuring device	-40 to +60 °C (-40 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

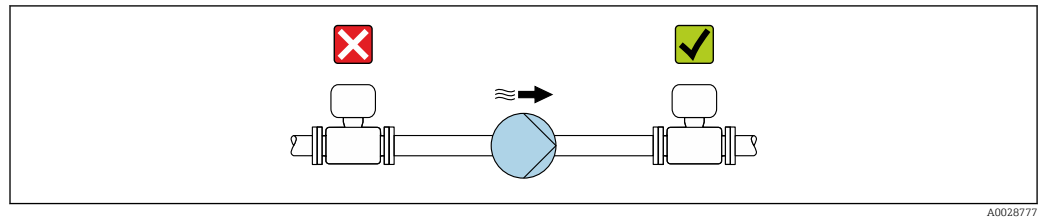
It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas.

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)



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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

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 77. 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. Remove stick-on label on the electronics compartment cover.

6.2.3 Mounting the measuring device

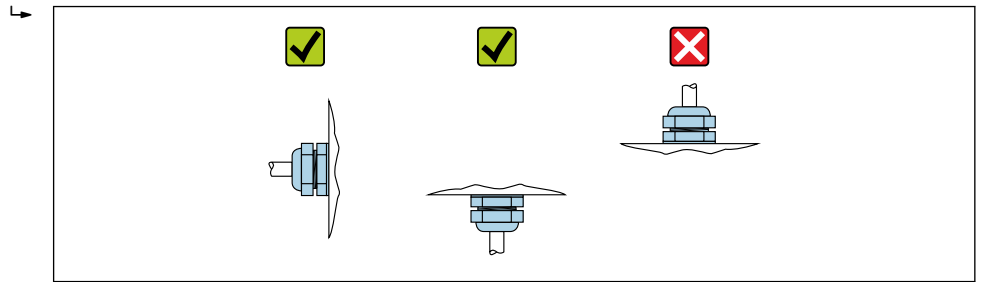
⚠ WARNING

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 gaskets are clean and undamaged.
- ▶ Install the gaskets 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.



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6.3 Post-installation check

Is the device undamaged (visual inspection)?	<input type="checkbox"/>
Does the measuring device conform to the measuring point specifications? For example: <ul style="list-style-type: none"> ▪ Process temperature → 81 ▪ Process pressure (refer to the chapter on "Pressure-temperature ratings" of the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range 	<input type="checkbox"/>
Has the correct orientation for the sensor been selected ? <ul style="list-style-type: none"> ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids) 	<input type="checkbox"/>
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping → 18?	<input type="checkbox"/>
Are the measuring point identification and labeling correct (visual inspection)?	<input type="checkbox"/>
Is the device adequately protected from precipitation and direct sunlight?	<input type="checkbox"/>
Are the securing screw and securing clamp tightened securely?	<input type="checkbox"/>

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 Connection conditions

7.1.1 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

7.1.2 Requirements for connecting cable

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

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

- -40 °C (-40 °F) to $+80\text{ °C}$ ($+176\text{ °F}$)
- Minimum requirement: cable temperature range \geq ambient temperature $+20\text{ K}$

Power supply cable

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	\leq 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

 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 Ø 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
Wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- With Safety Barrier Promass 100:
Plug-in screw terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

7.1.3 Terminal assignment

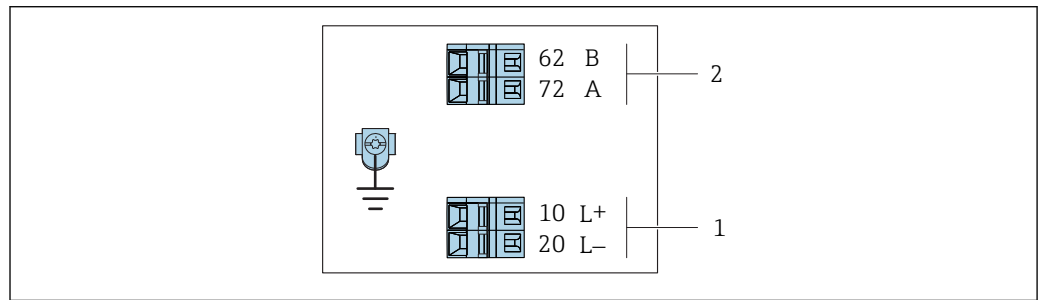
Transmitter

Modbus RS485 connection version


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

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

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A	terminals	terminals	<ul style="list-style-type: none"> ▪ Option B: thread M20x1 ▪ Option C: thread G ½" ▪ Option D: thread NPT ½"
Order code for "Housing": Option A : compact, coated aluminum			



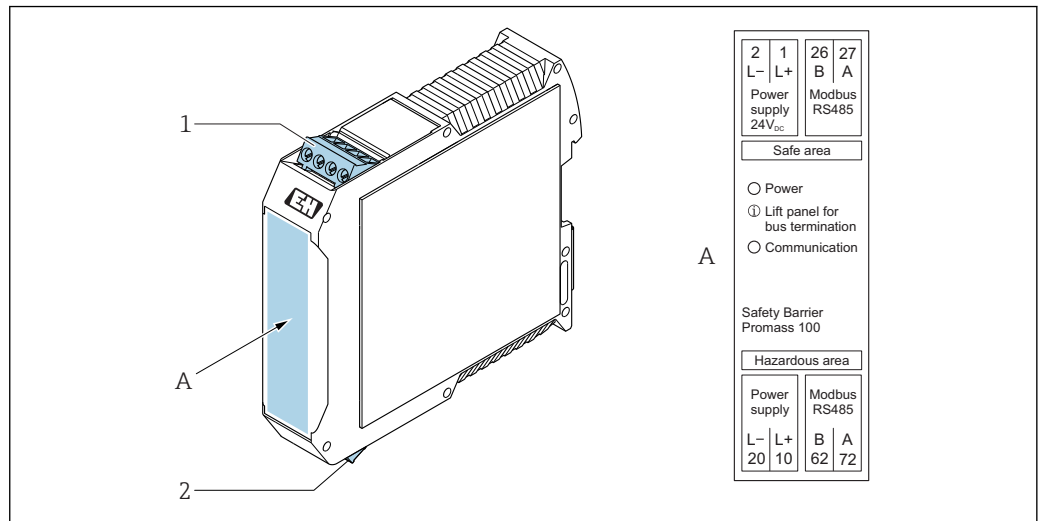
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 6 Modbus RS485 terminal assignment, connection version for use in intrinsically safe areas (connection via Safety Barrier Promass 100)

- 1 Intrinsically safe power supply
- 2 Modbus RS485

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

Safety Barrier Promass 100



A0030220

7 Safety Barrier Promass 100 with terminals

- 1 Non-hazardous area and Zone 2/Div. 2
- 2 Intrinsically safe area

7.1.4 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 → 22.

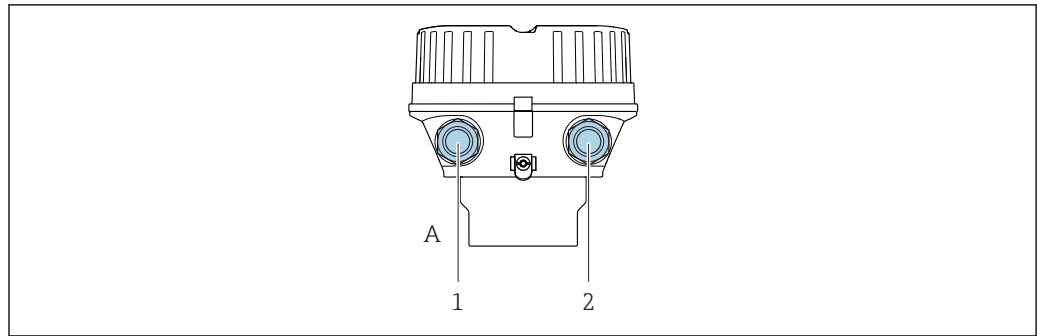
7.2 Connecting the measuring device

NOTICE

Limitation of electrical safety due to incorrect connection!

- ▶ Have electrical connection work carried out by correspondingly trained specialists only.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.
- ▶ 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).

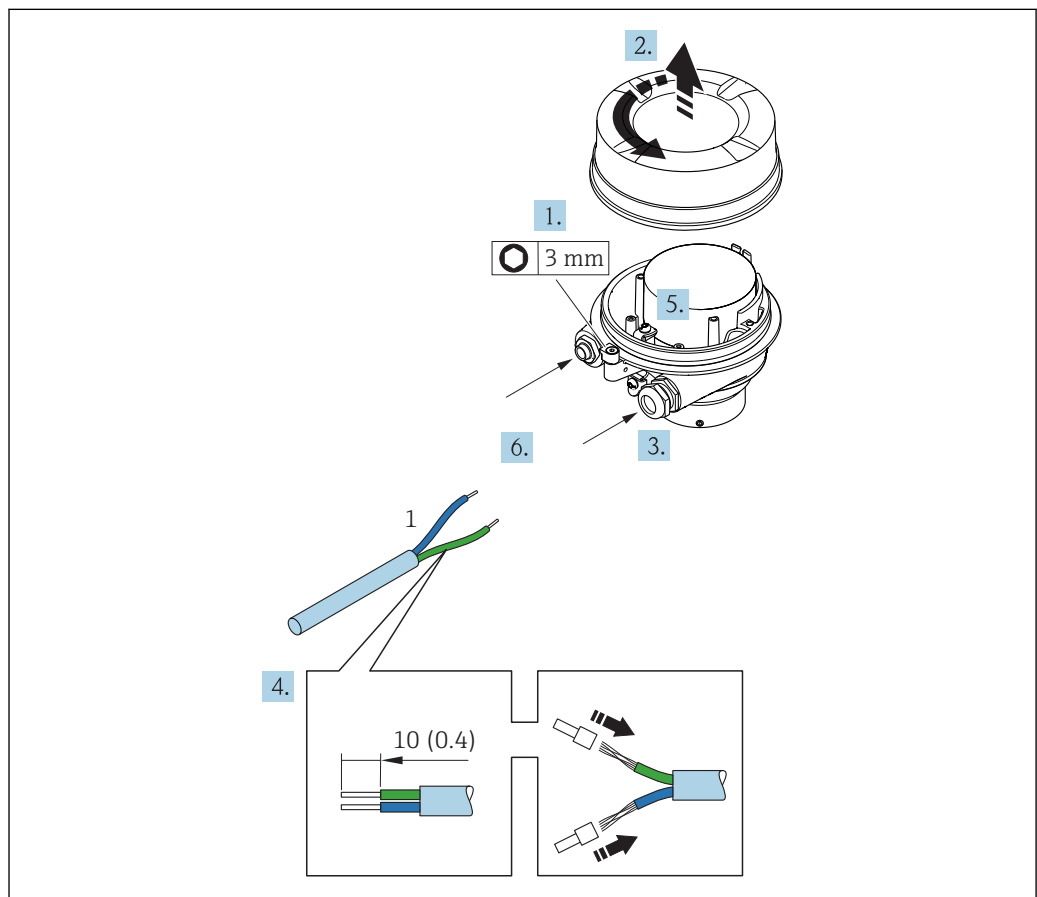
7.2.1 Connecting the transmitter



A0030221

8 Housing versions and connection versions

- A Housing version: compact, aluminum coated
 1 Cable entry for signal transmission
 2 Cable entry for supply voltage



A0030223

9 Device versions with connection example. Engineering unit mm (in)

- 1 Cable

- Loosen the securing clamp of the housing cover.
- Unscrew the housing cover.
- Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
- Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
- Connect cable in accordance with terminal assignment → 24.
- Firmly tighten cable glands .

7. Enable the terminating resistor if applicable → 28.

8. **⚠ WARNING**

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

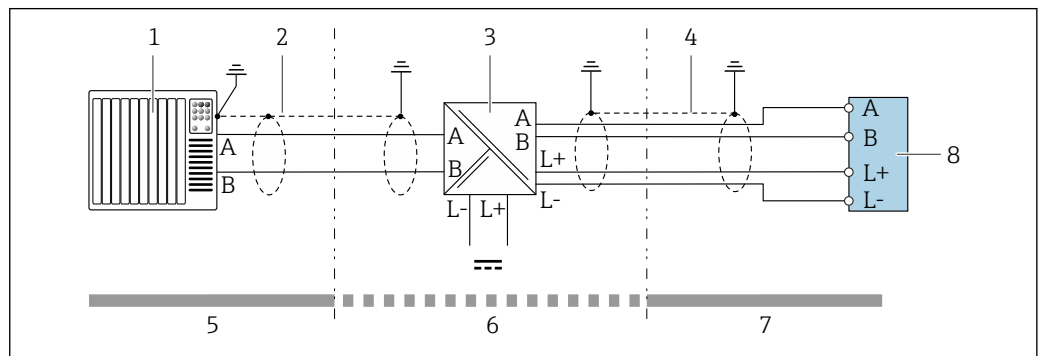
- ▶ Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

Reverse the removal procedure to reassemble the transmitter.

7.2.2 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 → 24.
3. Where applicable, enable the terminating resistor in the Safety Barrier Promass 100 → 28.



10 Electrical connection between the transmitter and Safety Barrier Promass 100

- 1 Control system (e.g. PLC)
- 2 Observe cable specifications → 22
- 3 Safety Barrier Promass 100: terminal assignment → 25
- 4 Observe cable specifications → 22
- 5 Non-hazardous area
- 6 Non-hazardous area and Zone 2/Div. 2
- 7 Intrinsically safe area
- 8 Transmitter: terminal assignment → 24

7.2.3 Ensure potential equalization

Requirements

No special measures for potential equalization are required.

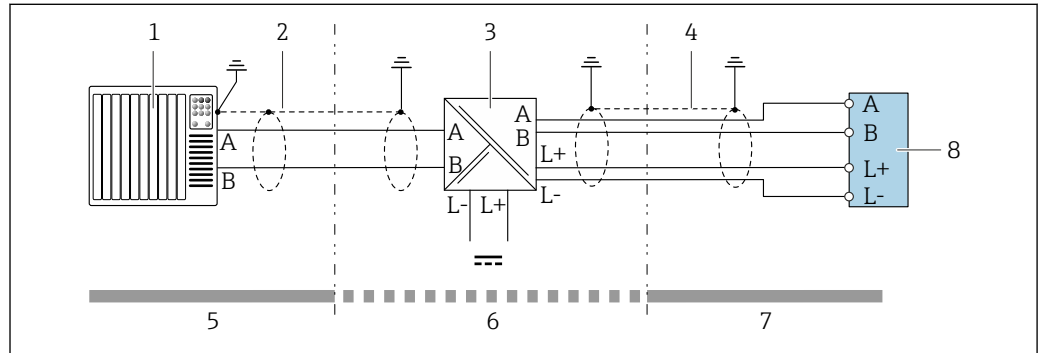
- For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

7.3 Special connection instructions

7.3.1 Connection examples

Modbus RS485

Modbus RS485 intrinsically safe



11 Connection example for Modbus RS485 intrinsically safe

- 1 Control system (e.g. PLC)
- 2 Cable shield, 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

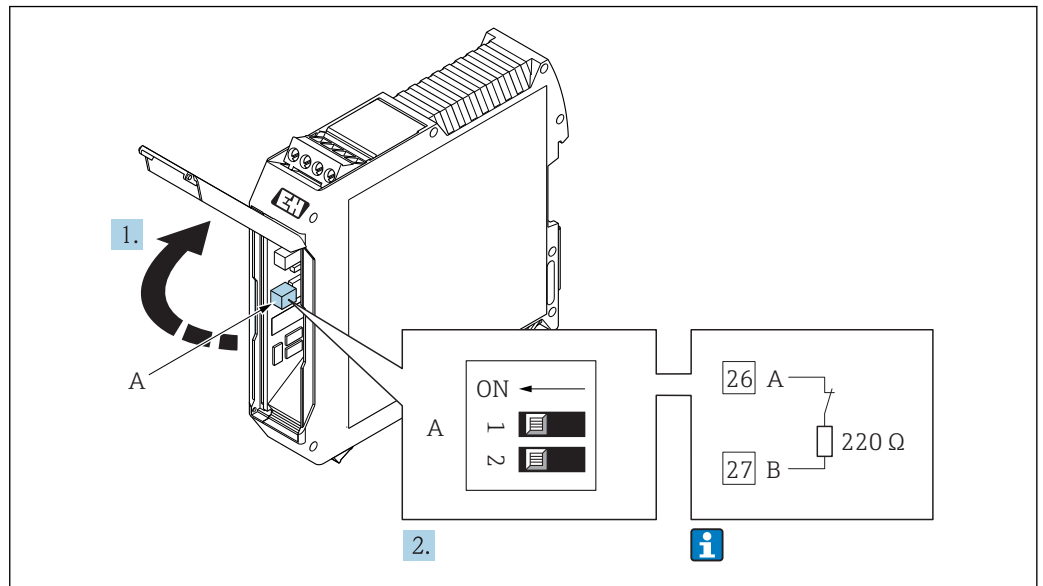
7.4 Hardware settings

7.4.1 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 intrinsically safe area



A0030217

12 Terminating resistor can be enabled via DIP switch in the Safety Barrier Promass 100

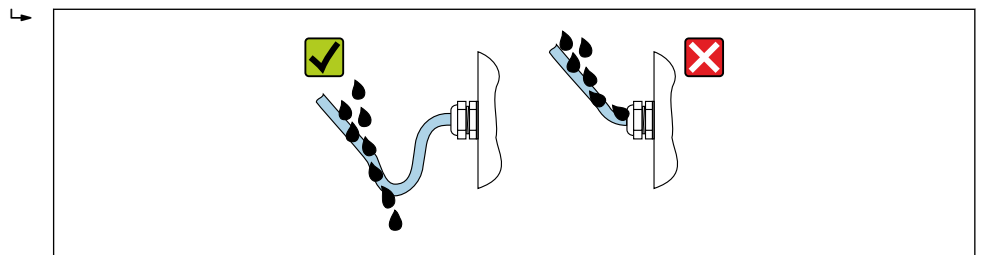
7.5 Ensuring the degree of protection

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

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

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



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6. Insert dummy plugs into unused cable entries.

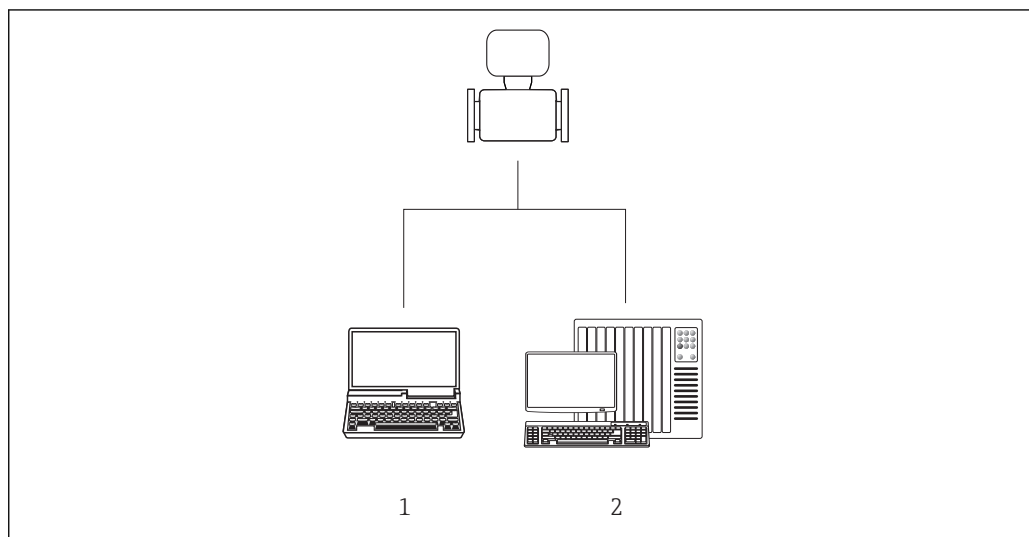
7.6 Post-connection check

Are cables or the device undamaged (visual inspection)?	<input type="checkbox"/>
Do the cables used meet the requirements → 22?	<input type="checkbox"/>
Do the cables have adequate strain relief?	<input type="checkbox"/>
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 29?	<input type="checkbox"/>

<ul style="list-style-type: none">▪ Does the supply voltage match the specifications on the transmitter nameplate → 76?▪ For device version with Modbus RS485 intrinsically safe: does the supply voltage match the specifications on the nameplate of the Safety Barrier Promass 100 → 76?	<input type="checkbox"/>
Is the terminal assignment → 24 correct?	<input type="checkbox"/>
<ul style="list-style-type: none">▪ If supply voltage is present, is the power LED on the electronics module of the transmitter lit green ?▪ For device version with Modbus RS485 intrinsically safe, if supply voltage is present, is the power LED on the Safety Barrier Promass 100 lit ?	<input type="checkbox"/>
Depending on the device version, is the securing clamp or fixing screw firmly tightened?	<input type="checkbox"/>

8 Operation options

8.1 Overview of operating options





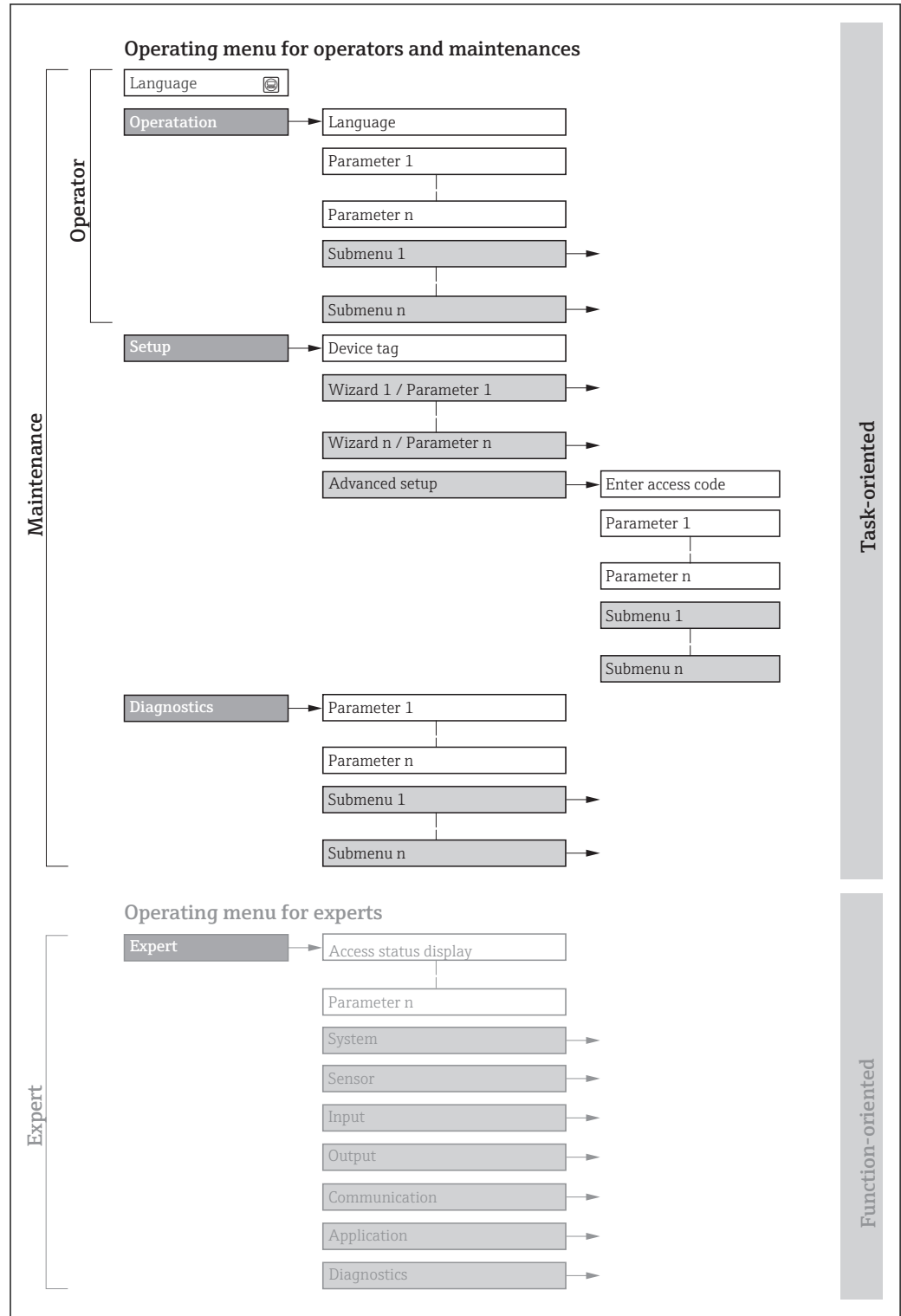
- 1 Computer with "FieldCare" or "DeviceCare" operating tool via Commubox FXA291 and service interface
2 Control system (e.g. PLC)


A0017760

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 →  85



 13 Schematic structure of the operating menu

A0018237-EN

8.2.2 Operating philosophy

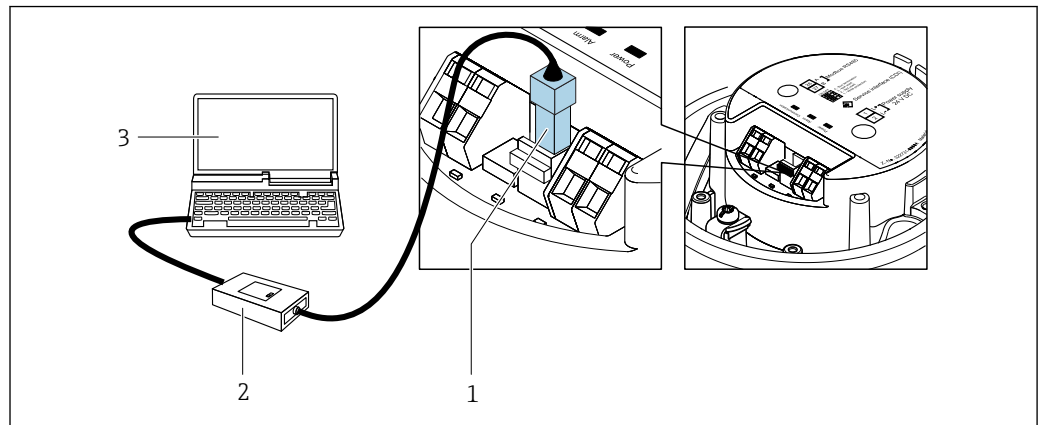
The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	Role "Operator", "Maintenance" Tasks during operation: Reading measured values	<ul style="list-style-type: none"> ▪ Defining the operating language ▪ Resetting and controlling totalizers
Operation			Resetting and controlling totalizers
Setup		"Maintenance" role Commissioning: <ul style="list-style-type: none"> ▪ Configuration of the measurement ▪ Configuration of the communication interface 	Submenus for fast commissioning: <ul style="list-style-type: none"> ▪ Set the system units ▪ Define the medium ▪ Configuration of the digital communication interface ▪ Configuring the operational display ▪ Set the low flow cut off ▪ Configure partial and empty pipe detection Advanced setup <ul style="list-style-type: none"> ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configure the WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		"Maintenance" role Fault elimination: <ul style="list-style-type: none"> ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation 	Contains all parameters for error detection and analyzing process and device errors: <ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> ▪ 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 Configure 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 Access to the operating menu via the operating tool

8.3.1 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 COM DTM "CDI Communication FXA291"

8.3.2 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

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 → 36

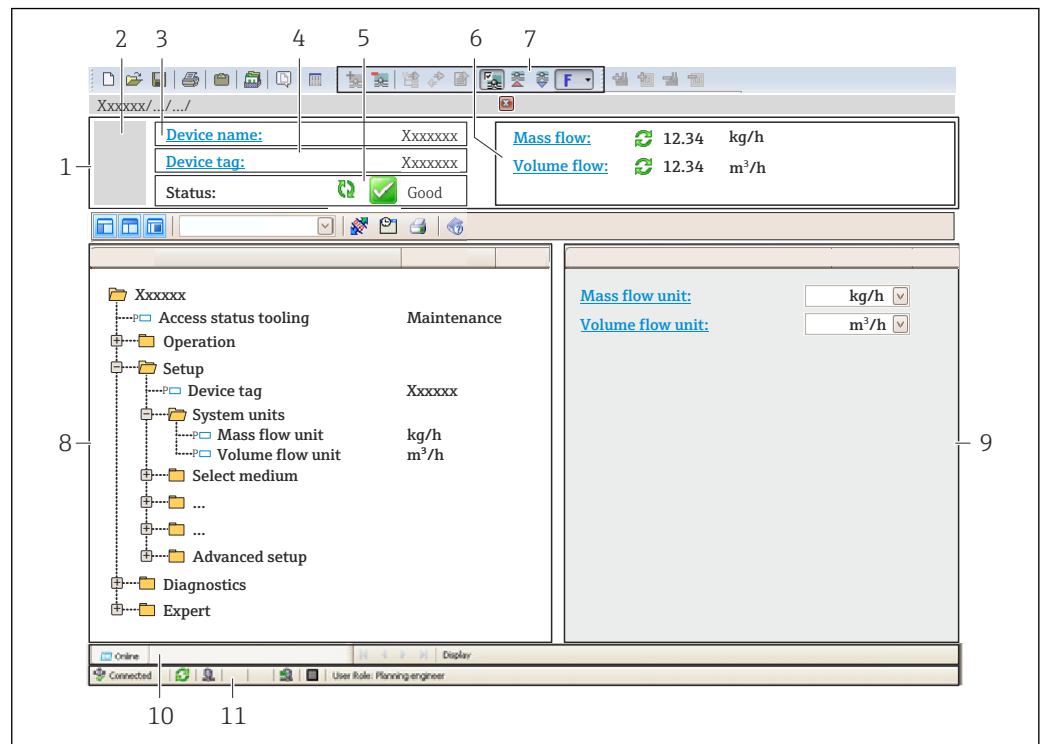
Establishing a connection

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 Tag name
- 5 Status area with status signal → 60
- 6 Display area for current measured values
- 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

8.3.3 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 →  36

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.03.zz	<ul style="list-style-type: none"> ▪ 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	---

 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	<ul style="list-style-type: none"> ▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	<ul style="list-style-type: none"> ▪ 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	<p>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</p> <p> The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.</p>	<p>Read device parameters with read and write access</p> <p>Example: Read mass flow</p>
04	Read input register	<p>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</p> <p> The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.</p>	<p>Read device parameters with read access</p> <p>Example: Read totalizer value</p>

Code	Name	Description	Application
06	Write single registers	Master writes a new value to one Modbus register of the measuring device.  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: <ul style="list-style-type: none"> ▪ 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.  If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map →  37	Write multiple device parameters Example: <ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> ▪ Read mass flow ▪ Reset totalizer

 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 →  85.

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 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 →  85.

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: <ul style="list-style-type: none"> ■ 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**
Value of scan list register 0	5051	Integer/float	Read/write
Value of scan list register 1	5053	Integer/float	Read/write
Value of scan list register
Value of scan list register 15	5081	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 measuring device:

- ▶ Make sure that the post-installation and post-connection checks have been performed.
- "Post-installation check" checklist →  21
- "Post-connection check" checklist →  29

10.2 Establishing a connection via FieldCare

- For FieldCare connection
- For establishing a connection via FieldCare →  34
- For FieldCare user interface →  35

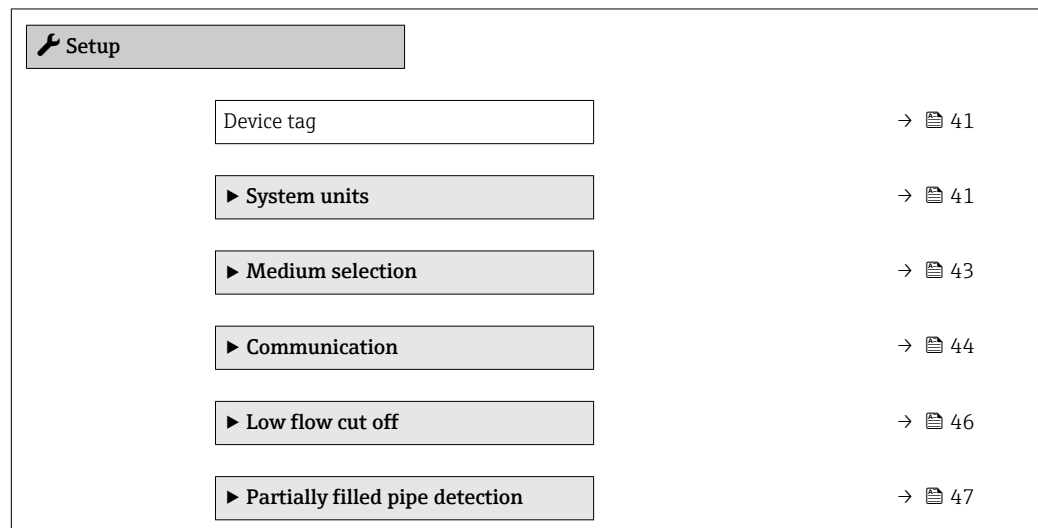
10.3 Setting the operating language

Factory setting: English or ordered local language

The operating language can be set in FieldCare or DeviceCare: Operation → Display language

10.4 Configuring the measuring device

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



10.4.1 Defining the tag name

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

-  ▪ The number of characters displayed depends on the characters used.
- Enter the tag name in the "FieldCare" operating tool →  35

Navigation


"Setup" menu → Device tag

Parameter overview with brief description

Parameter	Description	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. @, %, /).	LPGmass

10.4.2 Setting the system units

In the **System units** submenu the units of all the measured values can be set.

 Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Navigation

"Setup" menu → Advanced setup → System units

▶ System units

Mass flow unit	→ ⓘ 41
Mass unit	→ ⓘ 41
Volume flow unit	→ ⓘ 42
Volume unit	→ ⓘ 42
Corrected volume flow unit	→ ⓘ 42
Corrected volume unit	→ ⓘ 42
Density unit	→ ⓘ 42
Reference density unit	→ ⓘ 42
Temperature unit	→ ⓘ 42
Pressure unit	→ ⓘ 42

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Mass flow unit	Select mass flow unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ▪ Output ▪ Low flow cut off ▪ Simulation process variable 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ kg/min ▪ lb/min
Mass unit	Select mass unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ kg ▪ lb

Parameter	Description	Selection	Factory setting
Volume flow unit	Select volume flow unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ▪ Output ▪ Low flow cut off ▪ Simulation process variable 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ l/min ▪ gal/min (us)
Volume unit	Select volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ l ▪ gal (us)
Corrected volume flow unit	Select corrected volume flow unit. <i>Result</i> The selected unit applies for: Corrected volume flow parameter (→ ⓘ 55)	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ NI/min ▪ Sft³/min
Corrected volume unit	Select corrected volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ NI ▪ Sft³
Density unit	Select density unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ▪ Output ▪ Simulation process variable ▪ Density adjustment (Expert menu) 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ kg/l ▪ g/cm³
Reference density unit	Select reference density unit.	Unit choose list	Country-dependent <ul style="list-style-type: none"> ▪ kg/NI ▪ g/Scm³
Temperature unit	Select temperature unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ▪ Electronic temperature parameter (6053) ▪ Maximum value parameter (6051) ▪ Minimum value parameter (6052) ▪ External temperature parameter (6080) ▪ Maximum value parameter (6108) ▪ Minimum value parameter (6109) ▪ Carrier pipe temperature parameter (6027) ▪ Maximum value parameter (6029) ▪ Minimum value parameter (6030) ▪ Reference temperature parameter (1816) ▪ Temperature parameter 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ °C ▪ °F
Pressure unit	Select process pressure unit. <i>Result</i> The unit is taken from: <ul style="list-style-type: none"> ▪ Pressure value parameter (→ ⓘ 44) ▪ External pressure parameter (→ ⓘ 44) ▪ Pressure value 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ bar g ▪ psi g

10.4.3 Selecting and setting the medium

The **Select medium** wizard submenu contains parameters that must be configured in order to select and set the medium.

Navigation

"Setup" menu → Medium selection

► Medium selection	
Select medium	→ 44
Select gas type	→ 44
Reference sound velocity	→ 44
Temperature coefficient sound velocity	→ 44
Pressure compensation	→ 44
Pressure value	→ 44
External pressure	→ 44

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Select medium	–	Select medium type.	<ul style="list-style-type: none"> ▪ Liquid ▪ Gas 	Liquid
Select gas type	The Gas option is selected in the Select medium parameter.	Select measured gas type.	<ul style="list-style-type: none"> ▪ Air ▪ Ammonia NH3 ▪ Argon Ar ▪ Sulfur hexafluoride SF6 ▪ Oxygen O2 ▪ Ozone O3 ▪ Nitrogen oxide NOx ▪ Nitrogen N2 ▪ Nitrous oxide N2O ▪ Methane CH4 ▪ Hydrogen H2 ▪ Helium He ▪ Hydrogen chloride HCl ▪ Hydrogen sulfide H2S ▪ Ethylene C2H4 ▪ Carbon dioxide CO2 ▪ Carbon monoxide CO ▪ Chlorine Cl2 ▪ Butane C4H10 ▪ Propane C3H8 ▪ Propylene C3H6 ▪ Ethane C2H6 ▪ Others 	Methane CH4
Reference sound velocity	In the Select gas type parameter, the Others option is selected.	Enter sound velocity of gas at 0 °C (32 °F).	1 to 99 999.9999 m/s	415.0 m/s
Temperature coefficient sound velocity	The Others option is selected in the Select gas type parameter.	Enter temperature coefficient for the gas sound velocity.	Positive floating-point number	0 (m/s)/K
Pressure compensation	–	Select pressure compensation type.	<ul style="list-style-type: none"> ▪ Off ▪ Fixed value ▪ External value 	Off
Pressure value	The Fixed value option is selected in the Pressure compensation parameter.	Enter process pressure to be used for pressure correction.	Positive floating-point number	0 bar
External pressure	The External value option is selected in the Pressure compensation parameter.		Positive floating-point number	0 bar

10.4.4 Configuring the communication interface

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

Navigation

"Setup" menu → Communication

► Communication	
Bus address	→ 45
Baudrate	→ 45
Data transfer mode	→ 45
Parity	→ 45
Byte order	→ 45
Failure mode	→ 45

Parameter overview with brief description

Parameter	Description	User entry / Selection	Factory setting
Bus address	Enter device address.	1 to 247	247
Baudrate	Define data transfer speed.	<ul style="list-style-type: none"> ■ 1200 BAUD ■ 2400 BAUD ■ 4800 BAUD ■ 9600 BAUD ■ 19200 BAUD ■ 38400 BAUD ■ 57600 BAUD ■ 115200 BAUD 	19200 BAUD
Data transfer mode	Select data transfer mode.	<ul style="list-style-type: none"> ■ ASCII ■ RTU 	RTU
Parity	Select parity bits.	Picklist ASCII option: <ul style="list-style-type: none"> ■ 0 = Even option ■ 1 = Odd option Picklist RTU option: <ul style="list-style-type: none"> ■ 0 = Even option ■ 1 = Odd option ■ 2 = None / 1 stop bit option ■ 3 = None / 2 stop bits option 	Even
Byte order	Select byte transmission sequence.	<ul style="list-style-type: none"> ■ 0-1-2-3 ■ 3-2-1-0 ■ 1-0-3-2 ■ 2-3-0-1 	1-0-3-2
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	<ul style="list-style-type: none"> ■ Off ■ Alarm or warning ■ Warning ■ Alarm 	Alarm
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. NaN ¹⁾	<ul style="list-style-type: none"> ■ NaN value ■ Last valid value 	NaN value

1) Not a Number

10.4.5 Configuring the low flow cut off

The **Low flow cut off** submenu contains the parameters that must be set in order to configure the low flow cut off.

Navigation

"Setup" menu → Low flow cut off

► Low flow cut off	
Assign process variable	→ 46
On value low flow cutoff	→ 46
Off value low flow cutoff	→ 46
Pressure shock suppression	→ 46

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	<ul style="list-style-type: none"> ▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow 	Mass flow
On value low flow cutoff	One of the following options is selected in the Assign process variable parameter (→ 46): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow 	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the Assign process variable parameter (→ 46): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow 	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	One of the following options is selected in the Assign process variable parameter (→ 46): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow 	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

10.4.6 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

"Setup" menu → Partially filled pipe detection


► Partially filled pipe detection	
Assign process variable	→ 47
Low value partial filled pipe detection	→ 47
High value partial filled pipe detection	→ 47
Response time part. filled pipe detect.	→ 47

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for partially filled pipe detection.	<ul style="list-style-type: none"> ■ Off ■ Density ■ Reference density 	Off
Low value partial filled pipe detection	One of the following options is selected in the Assign process variable parameter (→ 47): <ul style="list-style-type: none"> ■ Density ■ Reference density 	Enter lower limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ■ 200 kg/m³ ■ 12.5 lb/ft³
High value partial filled pipe detection	One of the following options is selected in the Assign process variable parameter (→ 47): <ul style="list-style-type: none"> ■ Density ■ Reference density 	Enter upper limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ■ 6 000 kg/m³ ■ 374.6 lb/ft³
Response time part. filled pipe detect.	One of the following options is selected in the Assign process variable parameter (→ 47): <ul style="list-style-type: none"> ■ Density ■ Reference density 	Enter time before diagnostic message is displayed for partially filled pipe detection.	0 to 100 s	1 s





10.5 Advanced settings

The **Advanced setup** submenu together with its submenus contains parameters for specific settings.

 The number of submenus can vary depending on the device version, e.g. viscosity is available only with the Promass I.

Navigation

"Setup" menu → Advanced setup







▶ Advanced setup	
Enter access code	
▶ Calculated values	→  48
▶ Sensor adjustment	→  49
▶ Totalizer 1 to n	→  50
▶ Administration	→  51

10.5.1 Calculated values

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

Navigation

"Setup" menu → Advanced setup → Calculated values

▶ Calculated values	
▶ Corrected volume flow calculation	
Corrected volume flow calculation	→  49
External reference density	→  49
Fixed reference density	→  49
Reference temperature	→  49
Linear expansion coefficient	→  49
Square expansion coefficient	→  49

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Corrected volume flow calculation	–	Select reference density for calculating the corrected volume flow.	<ul style="list-style-type: none"> ■ Fixed reference density ■ Calculated reference density ■ Reference density by API table 53 ■ External reference density 	Calculated reference density
External reference density	In the Corrected volume flow calculation parameter, the External reference density option is selected.	Shows external reference density.	Floating point number with sign	–
Fixed reference density	The Fixed reference density option is selected in the Corrected volume flow calculation parameter.	Enter fixed value for reference density.	Positive floating-point number	–
Reference temperature	In the Corrected volume flow calculation parameter, the Calculated reference density option is selected.	Enter reference temperature for calculating the reference density.	–273.15 to 99999 °C	Country-specific: <ul style="list-style-type: none"> ■ +20 °C ■ +68 °F
Linear expansion coefficient	In the Corrected volume flow calculation parameter, the Calculated reference density option is selected.	Enter linear, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	0.0
Square expansion coefficient	In the Corrected volume flow calculation parameter, the Calculated reference density option is selected.	For media with a non-linear expansion pattern: enter the quadratic, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	0.0

10.5.2 Carrying out a sensor adjustment

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

Navigation


"Setup" menu → Advanced setup → Sensor adjustment

▶ Sensor adjustment	
Installation direction	→ ⓘ 49
▶ Zero point adjustment	→ ⓘ 50

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	<ul style="list-style-type: none"> ■ Flow in arrow direction ■ Flow against arrow direction 	Flow in arrow direction

Zero point adjustment

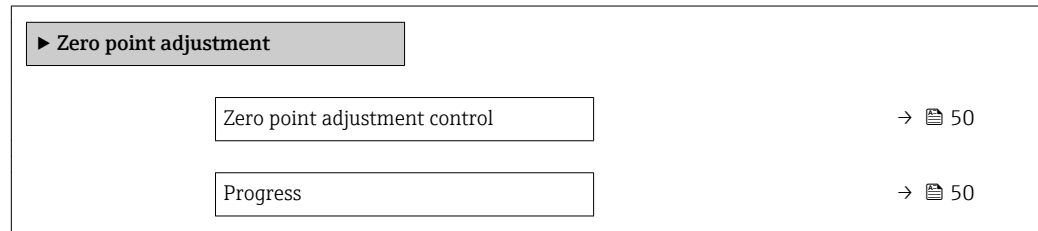
All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions →  77. Therefore, a zero point adjustment in the field is generally not required.

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).

Navigation

"Setup" menu → Advanced setup → Sensor adjustment → Zero point adjustment



Parameter overview with brief description

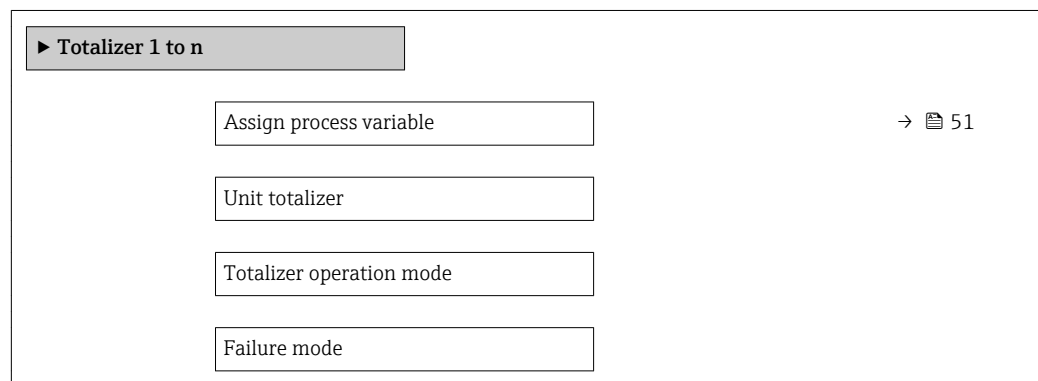
Parameter	Description	Selection / User interface	Factory setting
Zero point adjustment control	Start zero point adjustment.	<ul style="list-style-type: none"> ▪ Cancel ▪ Busy ▪ Zero point adjust failure ▪ Start 	Cancel
Progress	Shows the progress of the process.	0 to 100 %	–

10.5.3 Configuring the totalizer

In the "Totalizer 1 to n" submenu the individual totalizer can be configured.

Navigation

"Setup" menu → Advanced setup → Totalizer 1 to n



Parameter overview with brief description

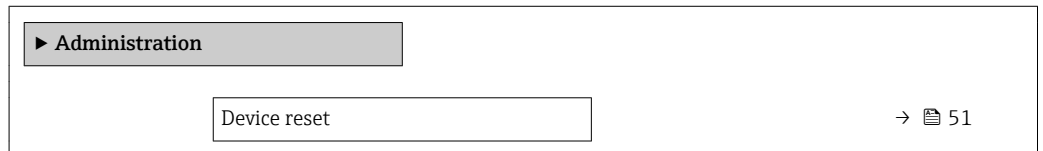
Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable	-	Select process variable for totalizer.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow 	Mass flow
Mass unit	The Mass flow option is selected in the Assign process variable parameter (→ 51) of the Totalizer 1 to n submenu.	Select mass unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ kg ■ lb
Volume unit	The Volume flow option is selected in the Assign process variable parameter (→ 51) of the Totalizer 1 to n submenu.	Select volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ l ■ gal (us)
Corrected volume unit	The Corrected volume flow option is selected in the Assign process variable parameter (→ 51) of the Totalizer 1 to n submenu.	Select corrected volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ NI ■ Sft³

10.5.4 Using parameters for device administration

The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation

"Setup" menu → Advanced setup → Administration



Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	<ul style="list-style-type: none"> ■ Cancel ■ To fieldbus defaults * ■ To delivery settings ■ Restart device 	Cancel

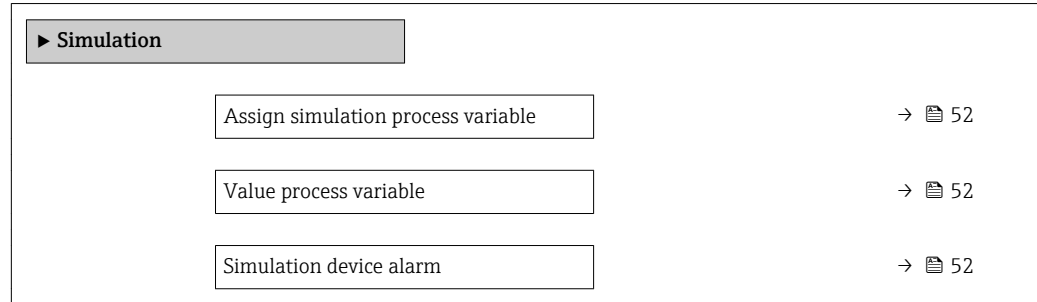
* Visibility depends on communication

10.6 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

"Diagnostics" menu → Simulation

**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.	<ul style="list-style-type: none"> ▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature 	Off
Value process variable	One of the following options is selected in the Assign simulation process variable parameter (→ 52): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature 	Enter the simulation value for the selected process variable.	Depends on the process variable selected	0
Simulation device alarm	-	Switch the device alarm on and off.	<ul style="list-style-type: none"> ▪ Off ▪ On 	Off

10.7 Protecting settings from unauthorized access

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

Write protection via write protection switch → 52

10.7.1 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

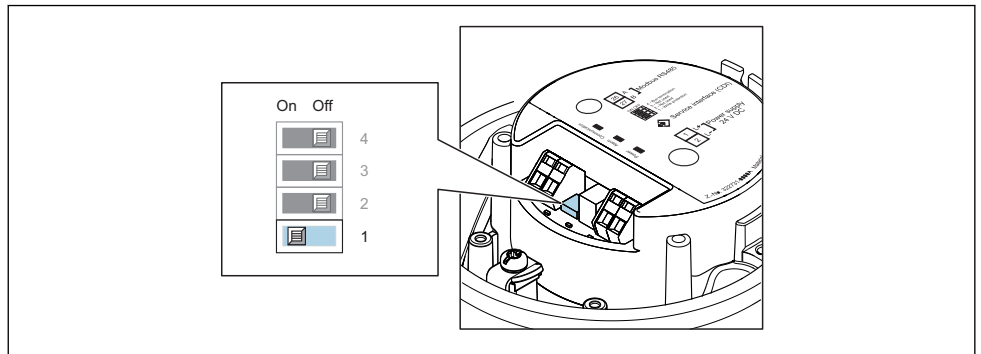
The parameter values are now read only and cannot be edited any more:

- Via service interface (CDI)
- Via Modbus RS485

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.



A0030224

Setting the write protection switch on the main electronics module to the **On** position enables hardware write protection. Setting the write protection switch on the main electronics module to the **Off** position (factory setting) disables hardware write protection.

↳ If hardware write protection is enabled: the **Locking status** parameter displays the **Hardware locked** option ; if disabled, the **Locking status** parameter does not display any option .

4. Reverse the removal procedure to reassemble the transmitter.

11 Operation

11.1 Reading the device locking status

Device active write protection: **Locking status** parameter


Navigation



"Operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Hardware locked	The locking switch (DIP switch) for locking the hardware is activated on the main electronic module. This prevents write access to the parameters .
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 Adjusting the operating language

 Detailed information:



- To configure the operating language →  40
- For information on the operating languages supported by the measuring device →  84

11.3 Reading measured values

With the **Measured values** submenu, it is possible to read all the measured values.

Navigation

"Diagnostics" menu → Measured values


▶ Measured values	
▶ Process variables	→  54
▶ Totalizer	→  55

11.3.1 "Measured variables" submenu

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

Navigation

"Diagnostics" menu → Measured values → Measured variables

▶ Measured variables	
Mass flow	→  55

Volume flow	→ 55
Corrected volume flow	→ 55
Density	→ 55
Reference density	→ 55
Temperature	→ 55
Pressure value	→ 55

Parameter overview with brief description

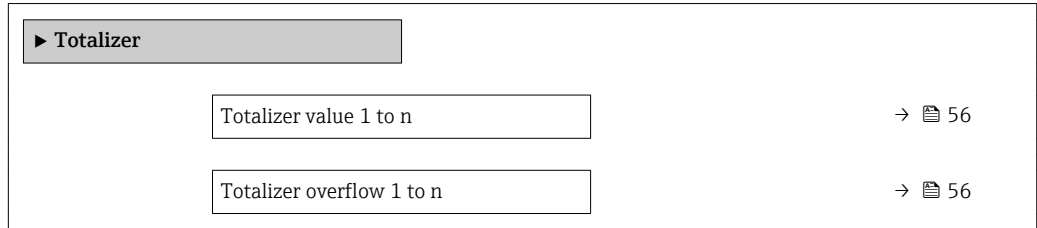
Parameter	Description	User interface
Mass flow	Displays the mass flow currently measured. <i>Dependency</i> The unit is taken from the Mass flow unit parameter (→ 41).	Signed floating-point number
Volume flow	Displays the volume flow currently calculated. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→ 42).	Signed floating-point number
Corrected volume flow	Displays the corrected volume flow currently calculated. <i>Dependency</i> The unit is taken from the Corrected volume flow unit parameter (→ 42).	Signed floating-point number
Density	Shows the density currently measured. <i>Dependency</i> The unit is taken from the Density unit parameter (→ 42).	Signed floating-point number
Reference density	Displays the reference density currently calculated. <i>Dependency</i> The unit is taken from the Reference density unit parameter (→ 42).	Signed floating-point number
Temperature	Shows the medium temperature currently measured. <i>Dependency</i> The unit is taken from the Temperature unit parameter (→ 42).	Signed floating-point number
Pressure value	Displays either a fixed or external pressure value. <i>Dependency</i> The unit is taken from the Pressure unit parameter (→ 42).	Signed floating-point number

11.3.2 "Totalizer" submenu

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

Navigation

"Diagnostics" menu → Measured values → Totalizer



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Totalizer value	One of the following options is selected in the Assign process variable parameter (→ 51) Totalizer 1 to n submenu: <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow 	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow	One of the following options is selected in the Assign process variable parameter (→ 51) Totalizer 1 to n submenu: <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow 	Displays the current totalizer overflow.	Integer with sign

11.4 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu (→ 40)
- Advanced settings using the **Advanced setup** submenu (→ 48)

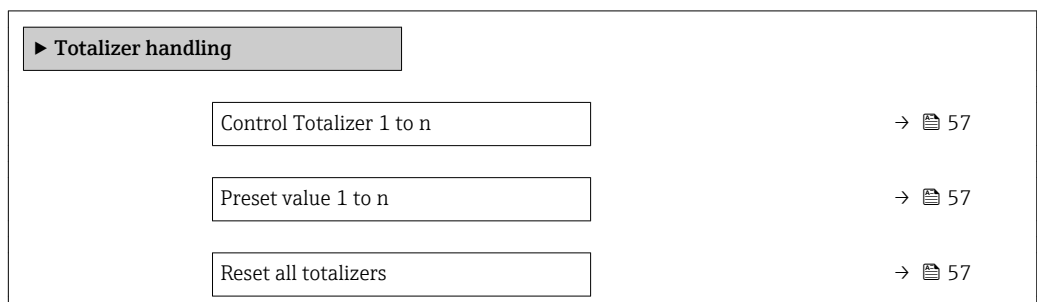
11.5 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:


- Control Totalizer
- Reset all totalizers

Navigation

"Operation" menu → Totalizer handling



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Control Totalizer	One of the following options is selected in the Assign process variable parameter (→ 51) Totalizer 1 to n submenu: <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow 	Control totalizer value.	<ul style="list-style-type: none"> ▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize 	Totalize
Preset value	One of the following options is selected in the Assign process variable parameter (→ 51) Totalizer 1 to n submenu: <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow 	Specify start value for totalizer. <i>Dependency</i>  The unit of the selected process variable is specified for the totalizer depending on the selection made in the Assign process variable parameter: <ul style="list-style-type: none"> ▪ Volume flow option: Volume flow unit parameter ▪ Mass flow option: Mass flow unit parameter ▪ Corrected volume flow option: Corrected volume unit parameter 	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ▪ 0 kg ▪ 0 lb
Reset all totalizers	–	Reset all totalizers to 0 and start.	<ul style="list-style-type: none"> ▪ Cancel ▪ Reset + totalize 	Cancel

11.5.1 Function scope of the "Control Totalizer" parameter

Options	Description
Totalize	The totalizer is started or continues running.
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 its defined start value from the Preset value 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 from the Preset value parameter and the totaling process is restarted.





11.5.2 Function scope of the "Reset all totalizers" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.






12 Diagnostics and troubleshooting

12.1 General troubleshooting

For output signals

Error	Possible causes	Solution
Green power LED on the main electronics module of the transmitter is dark	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage →  26.
Green power LED on the main electronics module of the transmitter is dark	Power supply cable connected incorrectly	Check the terminal assignment →  24.
Green power LED on Safety Barrier Promass 100 is dark	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage →  26.
Green power LED on Safety Barrier Promass 100 is dark	Power supply cable connected incorrectly	Check the terminal assignment →  24.
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

Error	Possible causes	Solution
No write access to parameters	Hardware write protection enabled	Set the write protection switch on main electronics module to the Off position →  52.
No connection via Modbus RS485	Modbus RS485 bus cable connected incorrectly	Check terminal assignment →  24.
No connection via Modbus RS485	Modbus RS485 cable incorrectly terminated	Check terminating resistor →  28.
No connection via Modbus RS485	Incorrect settings for the communication interface	Check the Modbus RS485 configuration →  44.
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
Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

Different LEDs in the transmitter provide information on the device status.

LED	Color	Meaning
Supply voltage	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	<ul style="list-style-type: none"> ▪ 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

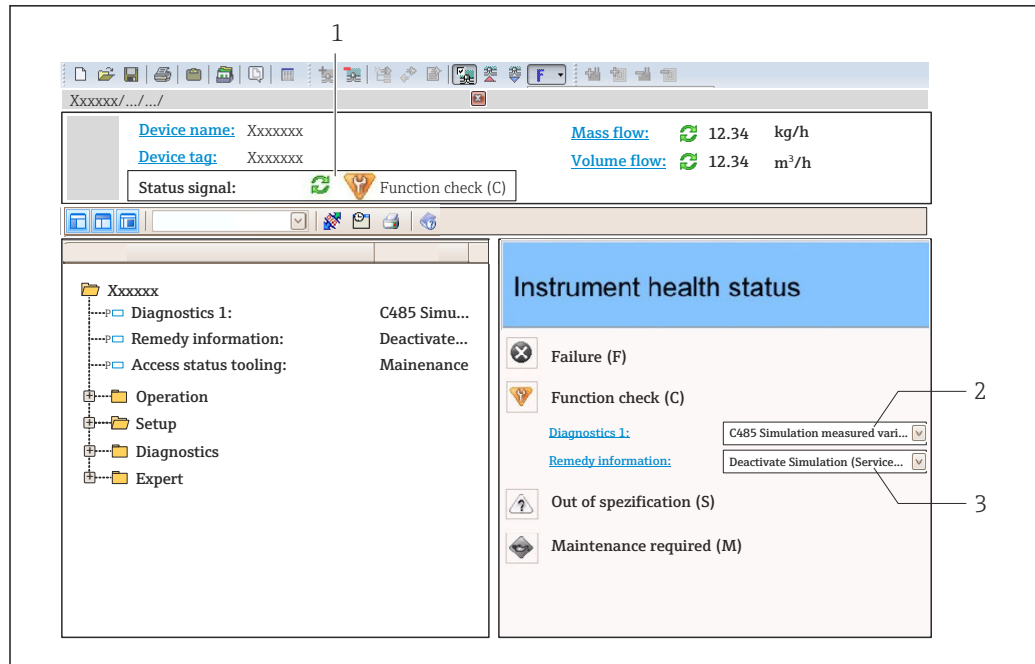
Various light emitting diodes (LEDs) on the Safety Barrier Promass 100 provide status information.

LED	Color	Color
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 DeviceCare or 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.



A0021799-EN

- 1 Status area with status signal
- 2 Diagnostic information → 60
- 3 Remedy information with Service ID

i In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:

- Via parameter
- Via submenu → 65

Status signals

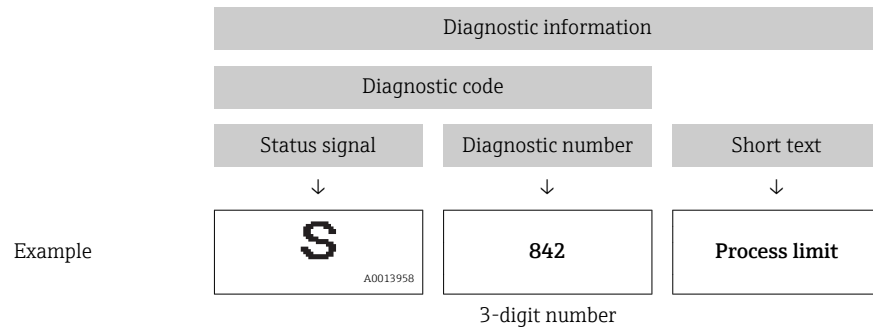
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

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

i 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.



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
→  62



12.4.2 Configuring error response mode

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

Navigation path

Setup → Communication

Parameter overview with brief description

Parameters	Description	Selection	Factory setting
Failure mode	<p>Select measured value output behavior when a diagnostic message occurs via Modbus communication.</p> <p> This effect of this parameter depends on the option selected in the Assign diagnostic behavior parameter.</p>	<ul style="list-style-type: none"> ▪ NaN value ▪ Last valid value <p> NaN ≡ not a number</p>	NaN value

12.5 Adapting the diagnostic information

12.5.1 Adapting the diagnostic behavior



Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic behavior** submenu.

Expert → System → Diagnostic handling → Diagnostic behavior

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

Options	Description
Alarm	The device stops measurement. The measured value output via Modbus RS485 and the totalizers assume the defined alarm condition. A diagnostic message is generated.
Warning	The device continues to measure. The measured value output via Modbus RS485 and the totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is entered only in the Event logbook submenu.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.6 Overview of diagnostic information

 In the case of some items of diagnostic information, the diagnostic behavior can be changed. Change the diagnostic information →  62

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
022	Sensor temperature	1. Change main electronic module 2. Change sensor	F	Alarm
046	Sensor limit exceeded	1. Inspect sensor 2. Check process condition	S	Alarm ¹⁾
062	Sensor connection	1. Change main electronic module 2. Change sensor	F	Alarm
082	Data storage	1. Check module connections 2. Contact service	F	Alarm


Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
083	Memory content	1. Restart device 2. Contact service	F	Alarm
140	Sensor signal	1. Check or change main electronics 2. Change sensor	S	Alarm ¹⁾
144	Measuring error too high	1. Check or change sensor 2. Check process conditions	F	Alarm ¹⁾
190	Special event 1	Contact service	F	Alarm
191	Special event 5	Contact service	F	Alarm
192	Special event 9	Contact service	F	Alarm ¹⁾
Diagnostic of electronic				
242	Software incompatible	1. Check software 2. Flash or change main electronics module	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	Change electronic	F	Alarm
274	Main electronic failure	Change electronic	S	Warning ¹⁾
311	Electronic failure	1. Reset device 2. Contact service	F	Alarm
390	Special event 2	Contact service	F	Alarm
391	Special event 6	Contact service	F	Alarm
392	Special event 10	Contact service	F	Alarm ¹⁾
Diagnostic of configuration				
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 failure mode	Deactivate simulation	C	Alarm
485	Simulation measured variable	Deactivate simulation	C	Warning
590	Special event 3	Contact service	F	Alarm
591	Special event 7	Contact service	F	Alarm
592	Special event 11	Contact service	F	Alarm ¹⁾
Diagnostic of process				
830	Sensor temperature too high	Reduce ambient temp. around the sensor housing	S	Warning
831	Sensor temperature too low	Increase ambient temp. around the sensor housing	S	Warning



Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
832	Electronic temperature too high	Reduce ambient temperature	S	Warning ¹⁾
833	Electronic temperature too low	Increase ambient temperature	S	Warning ¹⁾
834	Process temperature too high	Reduce process temperature	S	Warning ¹⁾
835	Process temperature too low	Increase process temperature	S	Warning ¹⁾
843	Process limit	Check process conditions	S	Warning
862	Partly filled pipe	1. Check for gas in process 2. Adjust detection limits	S	Warning
910	Tubes not oscillating	1. Check electronic 2. Inspect sensor	F	Alarm
912	Medium inhomogeneous	1. Check process cond. 2. Increase system pressure	S	Warning ¹⁾
912	Inhomogeneous		S	Warning ¹⁾
913	Medium unsuitable	1. Check process conditions 2. Check electronic modules or sensor	S	Alarm ¹⁾
944	Monitoring failed	Check process conditions for Heartbeat Monitoring	S	Warning ¹⁾
948	Tube damping too high	Check process conditions	S	Warning
990	Special event 4	Contact service	F	Alarm
991	Special event 8	Contact service	F	Alarm
992	Special event 12	Contact service	F	Alarm ¹⁾



1) Diagnostic behavior can be changed.

12.7 Pending diagnostic events

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




 To call up the measures to rectify a diagnostic event:

- Via "FieldCare" operating tool →  61
- Via "DeviceCare" operating tool →  61

 Other pending diagnostic events can be displayed in the **Diagnostic list** submenu →  65

Navigation

"Diagnostics" menu

 Diagnostics	
Actual diagnostics	→  65
Previous diagnostics	→  65

Operating time from restart	→ ⓘ 65
Operating time	→ ⓘ 65

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occurred diagnostic event along with its diagnostic information. ⓘ If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Symbol for diagnostic behavior, diagnostic code and short message.
Previous diagnostics	Two diagnostic events have already occurred.	Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.
Operating time from restart	-	Shows the time the device has been in operation since the last device restart.	Days (d), hours (h), minutes (m) and seconds (s)
Operating time	-	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)

12.8 Diagnostic list

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

Navigation path

Diagnostics → Diagnostic list



To call up the measures to rectify a diagnostic event:

- Via "FieldCare" operating tool → ⓘ 61
- Via "DeviceCare" operating tool → ⓘ 61

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

Edit tool bar: **F** → Additional functions → Events list




For information on the event list, see the FieldCare user interface → ⓘ 34



This event history includes entries for:

- Diagnostic events → ⓘ 62
- Information events → ⓘ 66

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 has ended:

- Diagnostic event
 - ☺: Occurrence of the event
 - ☹: End of the event
- Information event
 - ☺: Occurrence of the event

 To call up the measures to rectify a diagnostic event:

- Via "FieldCare" operating tool →  61
- Via "DeviceCare" operating tool →  61

 For filtering the displayed event messages →  66

12.9.2 Filtering the event logbook

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

Navigation path

Diagnostics → 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.


Info number	Info name
I1000	----- (Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1110	Write protection switch changed
I1111	Density adjust failure
I1151	History reset
I1209	Density adjustment ok
I1221	Zero point adjust failure
I1222	Zero point adjustment ok
I1444	Device verification passed
I1445	Device verification failed
I1446	Device verification active
I1447	Record application reference data
I1448	Application reference data recorded
I1449	Recording application ref. data failed
I1450	Monitoring off

Info number	Info name
I1451	Monitoring on
I1457	Failed:Measured error verification
I1459	Failed: I/O module verification
I1460	Failed: Sensor integrity verification
I1461	Failed: Sensor verification
I1462	Failed:Sensor electronic module verific.

12.10 Resetting the measuring device

Using the **Device reset** parameter (→  51) it is possible to reset the entire device configuration or some of the configuration to a defined state.

12.10.1 Function scope of the "Device reset" parameter







Options	Description
Cancel	No action is executed and the user exits the parameter.
To fieldbus defaults	Every parameter is reset to fieldbus default values.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.  This option is not visible if no customer-specific settings have been ordered.
Restart device	The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.

12.11 Device information

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






Navigation

"Diagnostics" menu → Device information

▶ Device information	
Device tag	→  68
Serial number	→  68
Firmware version	→  68
Device name	→  68
Order code	→  68
Extended order code 1	→  68




Extended order code 2	→ ⓘ 68
Extended order code 3	→ ⓘ 68
ENP version	→ ⓘ 68

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	LPGmass
Serial number	Shows the serial number of the measuring device.	A maximum of 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	–
Device name	Shows the name of the transmitter.  The name can be found on the nameplate of the transmitter.	Max. 32 characters such as letters or numbers.	LPGmass
Order code	Shows the device order code.  It can be found in the "Order code" field on the nameplate.	Character string composed of letters, numbers and certain punctuation marks (e.g. /).	–
Extended order code 1	Shows the 1st part of the extended order code.  It can be found in the "Ext. ord. cd." field on the nameplate.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code.  The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code.  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	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00

12.12 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware Changes	Documentation type	Documentation
07.2016	01.03.zz	Option 72	Original firmware	Operating Instructions	BA01316D/06/EN/01.16

-  It is possible to flash the firmware to the current version or the previous version using the service interface.
-  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.
-  The manufacturer's information is available:
 - In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
 - Specify the following details:
 - Product root: e.g. D8EB
 - Text search: Manufacturer's information
 - Media type: Documentation – Technical 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.

13.2 Measuring and test equipment


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

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

List of some of the measuring and testing equipment: →  73

13.3 Endress+Hauser services

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

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

14 Repairs

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 (→ 68) 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 measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at

<http://www.endress.com/support/return-material>

14.5 Disposal

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 Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> ▪ 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. <p>Applicator is available:</p> <ul style="list-style-type: none"> ▪ Via the Internet: https://wapps.endress.com/applicator ▪ As a downloadable DVD for local PC installation.
W@M	<p>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.</p> <p>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.</p> <p>Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement</p>
FieldCare	<p>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.</p> <p> For details, see Operating Instructions BA00027S and BA00059S</p>
DeviceCare	<p>Tool for connecting and configuring Endress+Hauser field devices.</p> <p> For details, see Innovation brochure IN01047S</p>
Commubox FXA291	<p>Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.</p> <p> For details, see "Technical Information" TI00405C</p>

16 Technical data

16.1 Application

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

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
- Corrected volume

Measuring range

Measuring ranges (not custody transfer mode)

DN		Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
8	$\frac{3}{8}$	0 to 2 000	0 to 73.5
15	$\frac{1}{2}$	0 to 6 500	0 to 238
25	1	0 to 18 000	0 to 660
40	$1\frac{1}{2}$	0 to 45 000	0 to 1 650
50	2	0 to 70 000	0 to 2 570

 The values of the corresponding custody transfer certificate apply in custody transfer mode.

Recommended measuring range

"Flow limit" section →  81

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.

16.4 Output

Output signal

Modbus RS485

Physical interface	In accordance with EIA/TIA-485-A standard
Terminating resistor	Integrated, can be activated via DIP switch on the transmitter electronics module

Signal on alarm

Depending on the interface, failure information is displayed as follows:

Modbus RS485

Failure mode	Choose from: <ul style="list-style-type: none"> ▪ NaN value instead of current value ▪ Last valid value
---------------------	---

Interface/protocol

- Via digital communication:
Modbus RS485
- Via 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: <ul style="list-style-type: none"> ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred
---------------------------	---

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	Modbus Applications Protocol Specification V1.1
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0

Function codes	<ul style="list-style-type: none"> ▪ 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	<p>Supported by the following function codes:</p> <ul style="list-style-type: none"> ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ ASCII ▪ RTU
Data access	<p>Each device parameter can be accessed via Modbus RS485.</p> <p> For Modbus register information, see "Description of device parameters" documentation</p>

16.5 Power supply

Terminal assignment →  24

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

Safety Barrier Promass 100

DC 20 to 30 V

Power consumption

Transmitter

Order code for "Output"	Maximum Power consumption
Option M : Modbus RS485, for use in intrinsically safe areas	2.45 W

Safety Barrier Promass 100

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 intrinsically safe areas	145 mA	16 A (< 0.4 ms)

Safety Barrier Promass 100

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.
- Configuration is retained in the device memory.
- Error messages (incl. total operated hours) are stored.

Electrical connection

→  25

Potential equalization

→  27


Terminals

TransmitterSpring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)**Safety Barrier Promass 100**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 ϕ 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
 - NPT 1/2"
 - G 1/2"
 - M20



Cable specification

→  22

16.6 Performance characteristics

reference operating conditions

- Error limits based on ISO 11631
- Water with +15 to +45 °C (+59 to +113 °F) 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.

 To obtain measured errors, use the *Applicator* sizing tool →  73

Maximum measured error

Base accuracy
 Design fundamentals →  79

Mass flow

±0.2 % o.r.

Volume flow

±0.3 % o.r.

Density

±20 kg/m³ (±0.02 SGU)

Temperature

±0.5 °C ± 0.005 · T °C (±0.9 °F ± 0.003 · (T - 32) °F)

Zero point stability

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

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

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]
³ / ₈	73.50	7.350	3.675	1.470	0.735	0.147
¹ / ₂	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
1 ¹ / ₂	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

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; $1 \text{ g/cm}^3 = 1 \text{ kg/l}$; T = medium temperature



Base repeatability

Mass flow

$\pm 0.10 \% \text{ o.r.}$

Volume flow

$\pm 0.15 \% \text{ o.r.}$

 Design fundamentals →  79

Density

$\pm 10 \text{ kg/m}^3 (\pm 0.01 \text{ SGU})$

Temperature

$\pm 0.25 \text{ }^\circ\text{C} \pm 0.0025 \cdot T \text{ }^\circ\text{C} (\pm 0.45 \text{ }^\circ\text{F} \pm 0.0015 \cdot (T-32) \text{ }^\circ\text{F})$

Response time

- The response time depends on the configuration (damping).
- Response time in the event of erratic changes in the measured variable (mass flow only):
After 100 ms → 95 % of full scale value

Influence of medium temperature

Mass flow
When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is $\pm 0.0003 \%$ of the full scale value/ $^\circ\text{C}$ ($\pm 0.00015 \%$ of the full scale value/ $^\circ\text{F}$).

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

DN		[% o.r./bar]	[% o.r./psi]
[mm]	[in]		
8	$\frac{3}{8}$	no influence	
15	$\frac{1}{2}$	no influence	
25	1	no influence	
40	$1\frac{1}{2}$	no influence	
50	2	-0.009	-0.0006

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

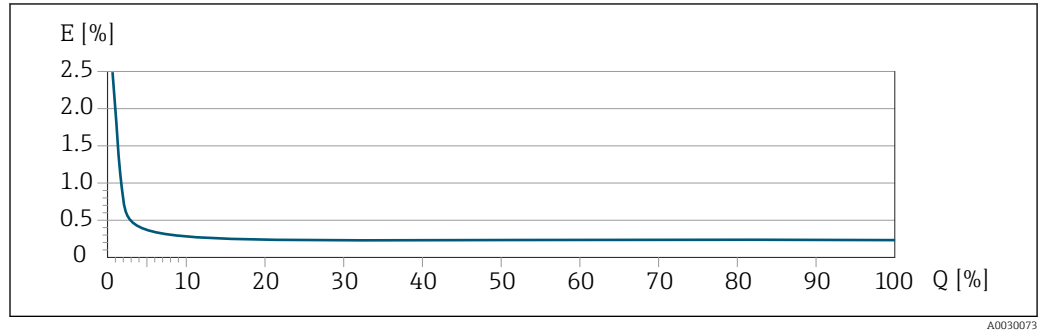
Calculation of the maximum measured error as a function of the flow rate

Flow rate	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021332</small>	$\pm \text{BaseAccu}$ <small>A0021339</small>
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021333</small>	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021334</small>

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

Flow rate	Maximum repeatability in % o.r.
$\geq \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021335</small>	$\pm \text{BaseRepeat}$ <small>A0021340</small>
$< \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021336</small>	$\pm 1/2 \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021337</small>

Example for max. measured error



E Error: maximum measured error in % o.r.
Q Flow rate as %

16.7 Installation

"Mounting requirements" → 18

16.8 Environment

Ambient temperature range → 19

Temperature tables

i 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 +60 °C (-40 to +140 °F)






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

Degree of protection **Transmitter and sensor**
 ■ As standard: IP66/67, type 4X enclosure
 ■ When housing is open: IP20, type 1 enclosure
 ■ Display module: IP20, type 1 enclosure


Safety Barrier Promass 100
IP20

Vibration resistance	<ul style="list-style-type: none"> ■ Vibration, sinusoidal according to IEC 60068-2-6 <ul style="list-style-type: none"> - 2 to 8.4 Hz, 3.5 mm peak - 8.4 to 2 000 Hz, 1 g peak ■ Vibration broad-band random, according to IEC 60068-2-64 <ul style="list-style-type: none"> - 10 to 200 Hz, 0.003 g²/Hz - 200 to 2 000 Hz, 0.001 g²/Hz - Total: 1.54 g rms
Shock resistance	Shock, half-sine according to IEC 60068-2-27 6 ms 30 g
Shock resistance	Rough handling shocks according to IEC 60068-2-31
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none"> ■ As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) ■ Complies with emission limits for industry as per EN 55011 (Class A) <p> For details, refer to the Declaration of Conformity.</p>

16.9 Process

Medium temperature range	<p>Sensor -50 to +125 °C (-58 to +257 °F)</p> <p>Seals No internal seals</p>
Density	0 to 5 000 kg/m ³ (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
Flow limit	<p>Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.</p> <p> For an overview of the full scale values for the measuring range, see the "Measuring range" section →  74</p> <ul style="list-style-type: none"> ■ 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).
Pressure loss	 To calculate the pressure loss, use the <i>Applicator</i> sizing tool →  84

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) refer to devices with EN/DIN PN 40 flanges.

Weight in SI units

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

Weight in US units

DN [in]	Weight [lbs]
$\frac{3}{8}$	10
$\frac{1}{2}$	11
1	14
1 $\frac{1}{2}$	23
2	34

Safety Barrier Promass 100

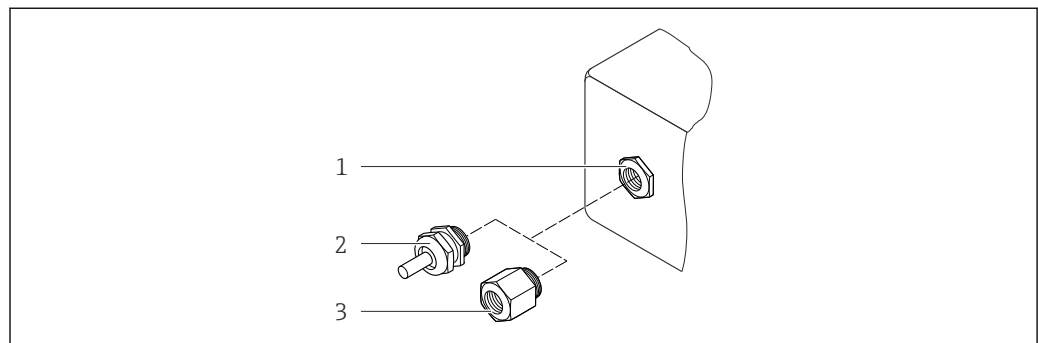
49 g (1.73 ounce)

Materials

Transmitter housing

Order code for "Housing", option **A** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated

Cable entries/cable glands



14 Possible cable entries/cable glands

- 1 Cable entry with M20 × 1.5 internal thread
- 2 Cable gland M20 × 1.5
- 3 Adapter for cable entry with internal thread G 1/2" or NPT 1/2"

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

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 internal thread G ½"	
Adapter for cable entry with internal thread NPT ½"	

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 (316/316L)

Process connections

For all process connections:
Stainless steel, 1.4404 (316/316L)

 List of all available process connections →  83

Seals



Welded process connections without internal seals

Safety Barrier Promass 100

Housing: Polyamide

Process connections

- Fixed flange connections:
 - EN 1092-1 (DIN 2501) flange
 - EN 1092-1 (DIN 2512N) flange
 - ASME B16.5 flange
- Internal thread
Cylindrical internal thread BSPP (G) in accordance with ISO 228-1 with sealing surfaces in accordance with DIN 3852-2/ISO 1179-1

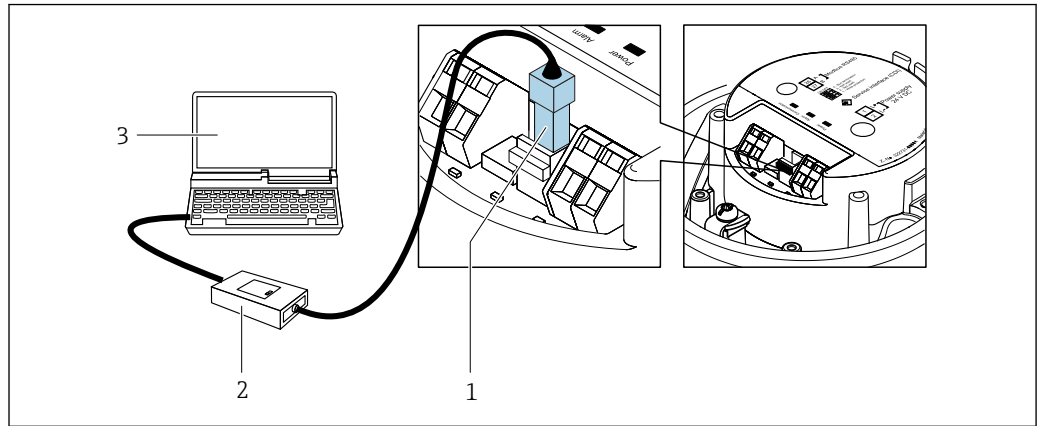
 For information on the different materials used in the process connections →  83

16.11 Operability

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 COM DTM "CDI Communication FXA291"

A0030216

Languages Can be operated in the following languages:
Via "FieldCare" operating tool: English, German

16.12 Certificates and approvals

CE mark The measuring system is in conformity with the statutory 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.



C-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.


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.

Measuring instrument approval The measuring device is (optionally) approved as a gas meter (MI-002) or component in measuring systems (MI-005) in service subject to legal metrological control in accordance with the European Measuring Instruments Directive 2014/32/EU (MID).
The measuring device is qualified to OIML R117 and has an OIML Certificate of Conformity (optional).

16.13 Accessories

 Overview of accessories available for order →  73

16.14 Supplementary documentation

 For an overview of the scope of the associated Technical Documentation, refer to the following:

- 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.

Standard documentation

Brief Operating Instructions

Measuring device	Documentation code
LPGmass	KA01242

Technical Information

Measuring device	Documentation code
LPGmass	TI01169D

Description of device parameters

Measuring device	Documentation code
LPGmass	GP01093D

Supplementary device-dependent documentation



Safety Instructions

Contents	Documentation code
ATEX/IECEX Ex i	XA01323
cCSAus IS	XA01411

Special documentation

Contents	Documentation code
Information on Custody Transfer Measurement	SD01758D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	 Overview of accessories available for order →  73

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