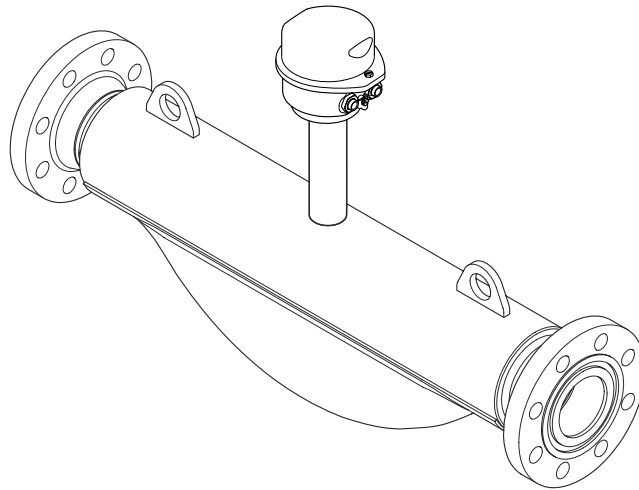


Operating Instructions

Proline Promass O 100

Coriolis flowmeter
Modbus RS485



- 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	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
	Series of steps
	Result of a sequence of actions
	Help in the event of a problem
	Visual inspection



1.2.5 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3, ...	Item numbers		Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	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
→  101

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Modbus RS485 register information	Reference for Modbus RS485 register information The document provides Modbus-specific information for each individual parameter in the operating menu.

1.3.2 Supplementary device-dependent documentation

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

1.4 Registered trademarks

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

Microsoft®

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

Applicator®, FieldCare®, Field Xpert™, HistoROM®, Heartbeat Technology™

Registered or registration-pending trademarks of the Endress+Hauser Group

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- ▶ Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- ▶ Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- ▶ Following the instructions in these Operating Instructions

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 in applications where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

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

- ▶ Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- ▶ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- ▶ Use the measuring device only for media against which the process-wetted materials are adequately resistant.
- ▶ If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section →  6.

Incorrect use

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



Danger of breakage of the measuring tube due to corrosive or abrasive fluids.

Housing breakage due to mechanical overload possible!

- ▶ Verify the compatibility of the process fluid with the measuring tube material.
- ▶ Ensure the resistance of all fluid-wetted materials in the process.
- ▶ Observe 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

WARNING

Danger of housing breaking due to measuring tube breakage!

- ▶ In the event of a measuring tube breakage for a device version without rupture disk it is possible for the pressure loading capacity of the sensor housing to be exceeded. This can lead to rupture or failure of the sensor housing.

The external surface temperature of the housing can increase by max. 20 K due to the power consumption of the electronic components. Hot process fluids passing through the measuring device will further increase the surface temperature of the housing. The surface of the sensor, in particular, can reach temperatures which are close to the fluid temperature.

Possible burn hazard due to fluid temperatures!

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

2.3 Workplace safety

For work on and with the device:

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

For welding work on the piping:

- ▶ Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:

- ▶ It is recommended to wear gloves on account of the higher risk of electric shock.

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

2.6 IT security

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

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

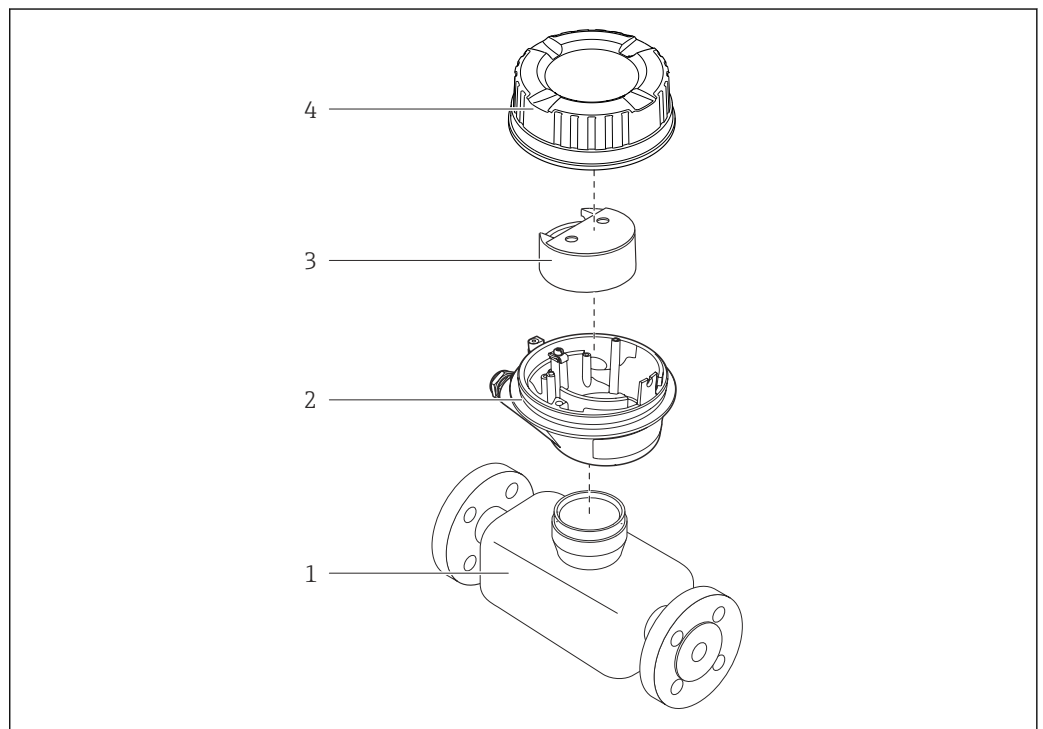
3 Product description

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



A0017609

1 Important components of a measuring device



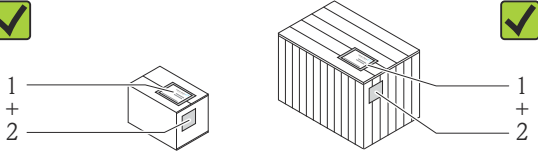
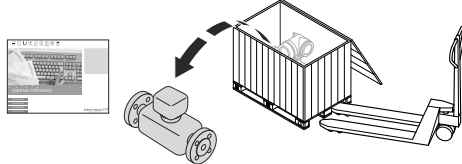





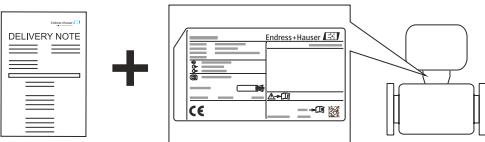


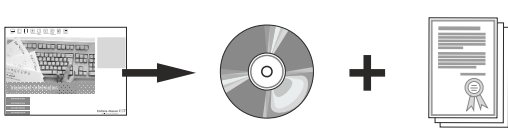
- 1 Sensor
- 2 Transmitter housing
- 3 Main electronics module
- 4 Transmitter housing cover





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

 		<p>Are the order codes on the delivery note (1) and the product sticker (2) identical?</p>
		
 		<p>Are the goods undamaged?</p>
 		<p>Do the nameplate data match the ordering information on the delivery note?</p>
 		<p>Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?</p>



-  ■ 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

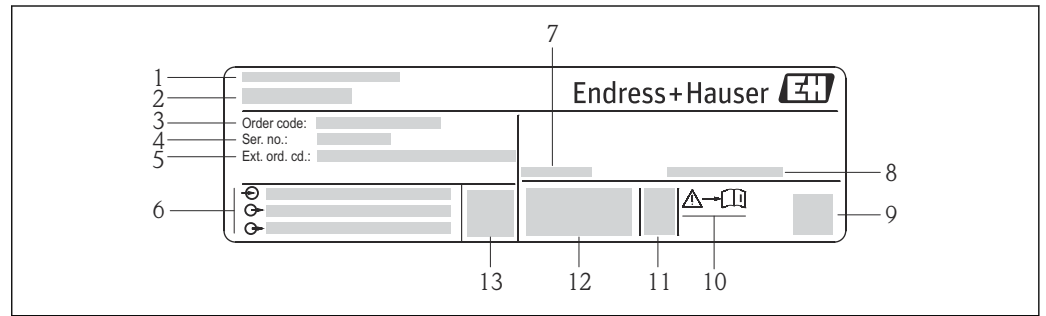
The following options are available for identification of the measuring device:

- 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

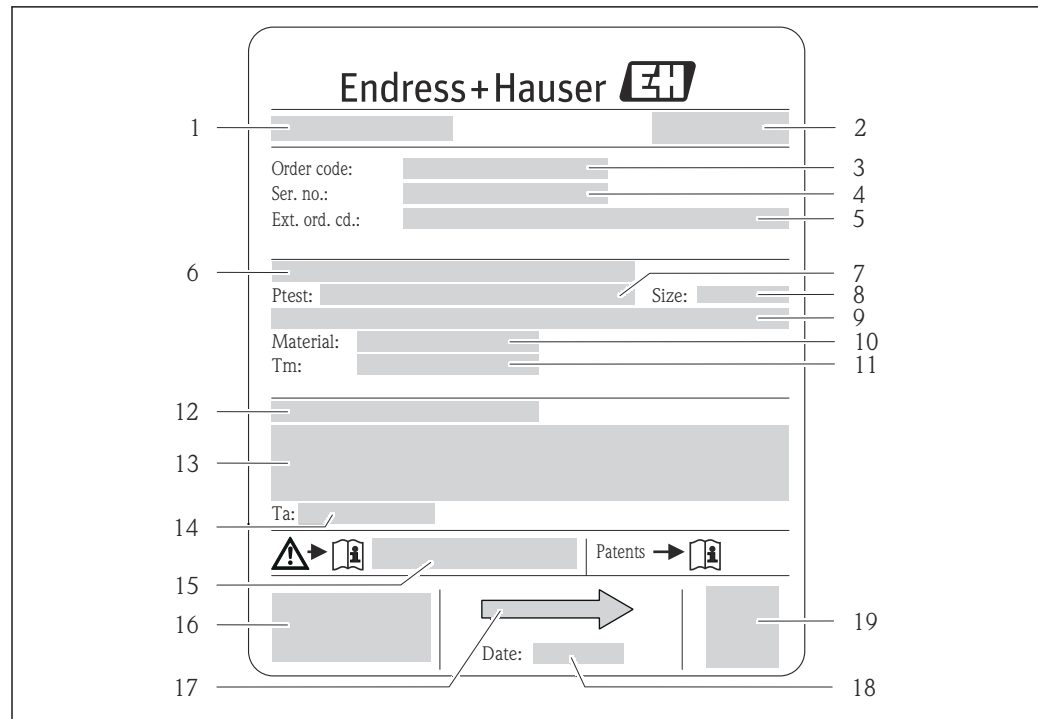


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 2 Example of a transmitter nameplate

- 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 →  101
- 11 Manufacturing date: year-month
- 12 CE mark, C-Tick
- 13 Firmware version (FW)

4.2.2 Sensor nameplate



A0017923

3 Example of a sensor nameplate

- 1 Name of the sensor
- 2 Manufacturing location
- 3 Order code
- 4 Serial number (ser. no.)
- 5 Extended order code (ext. ord. cd.)
- 6 Flange nominal diameter/nominal pressure
- 7 Test pressure of the sensor
- 8 Nominal diameter of sensor
- 9 Sensor-specific data: e.g. pressure range of secondary containment, wide-range density specification (special density calibration)
- 10 Material of measuring tube and manifold
- 11 Medium temperature range
- 12 Degree of protection
- 13 Approval information for explosion protection and Pressure Equipment Directive
- 14 Permitted ambient temperature (T_a)
- 15 Document number of safety-related supplementary documentation → 101
- 16 CE mark, C-Tick
- 17 Flow direction
- 18 Manufacturing date: year-month
- 19 2-D matrix code



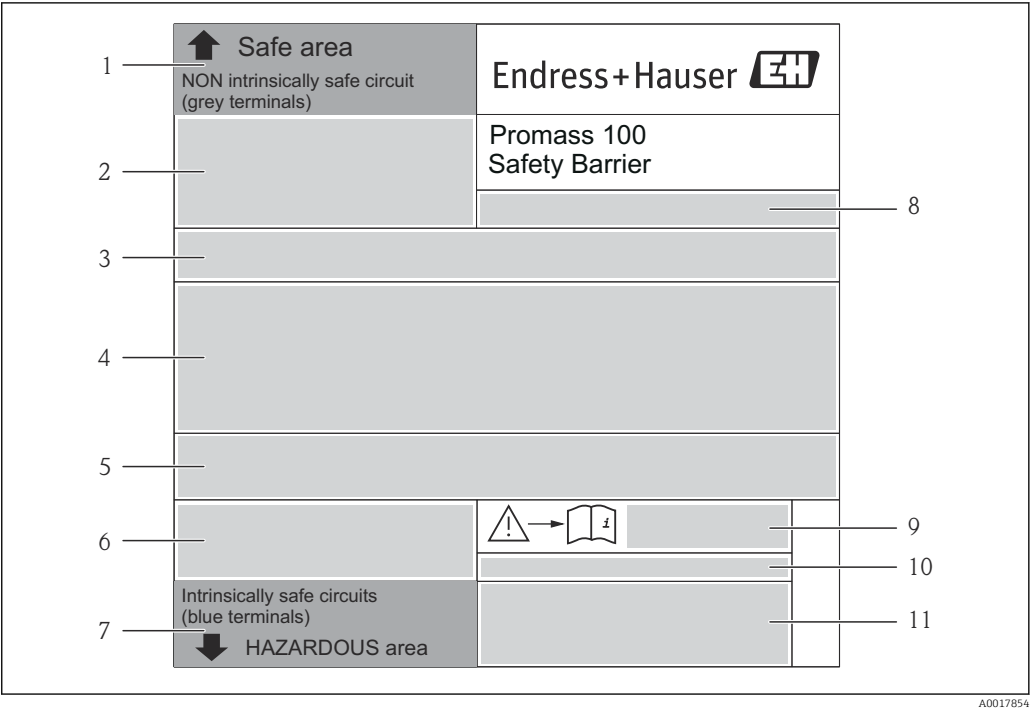
Order code

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



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 → 101
- 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

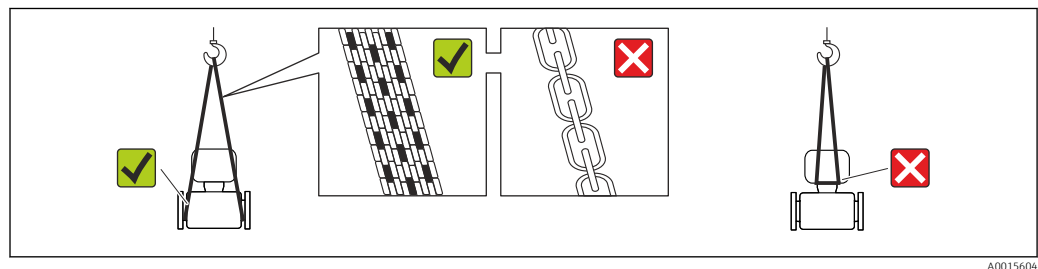
5.1 Storage conditions

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.
- Storage temperature: -40 to $+80$ °C (-40 to $+176$ °F),
Order Code "Test, Certificate", Option JM: -50 to $+60$ °C (-58 to $+140$ °F),
preferably at $+20$ °C ($+68$ °F)
- Store in a dry and dust-free place.
- Do not store outdoors.

5.2 Transporting the product

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



A0015604

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.

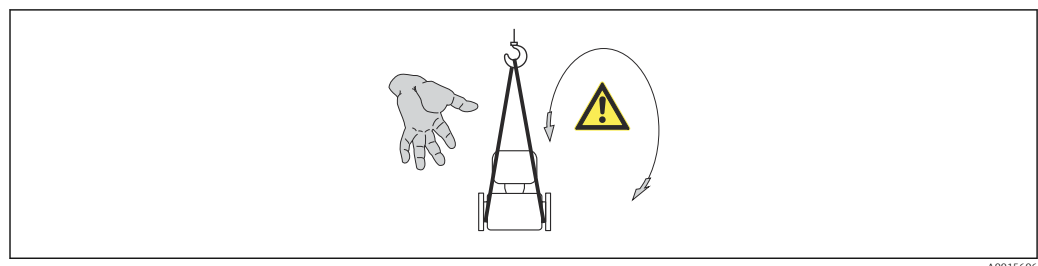
5.2.1 Measuring devices without lifting lugs

⚠ 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).



A0015606

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

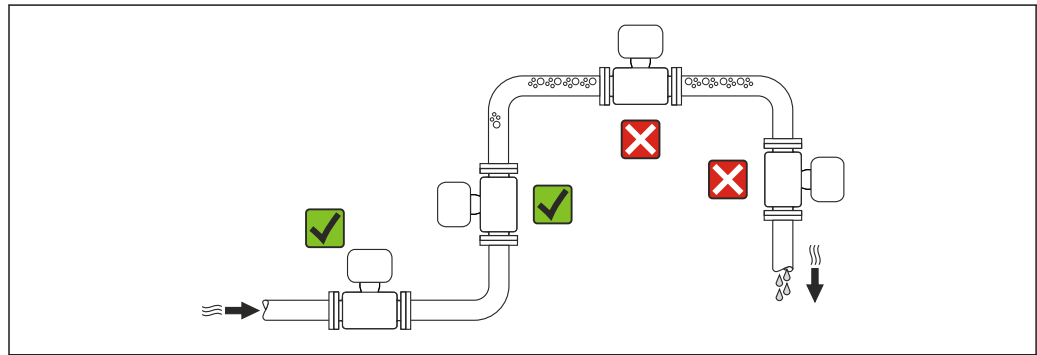
No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

6.1.1 Mounting position

Mounting location

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

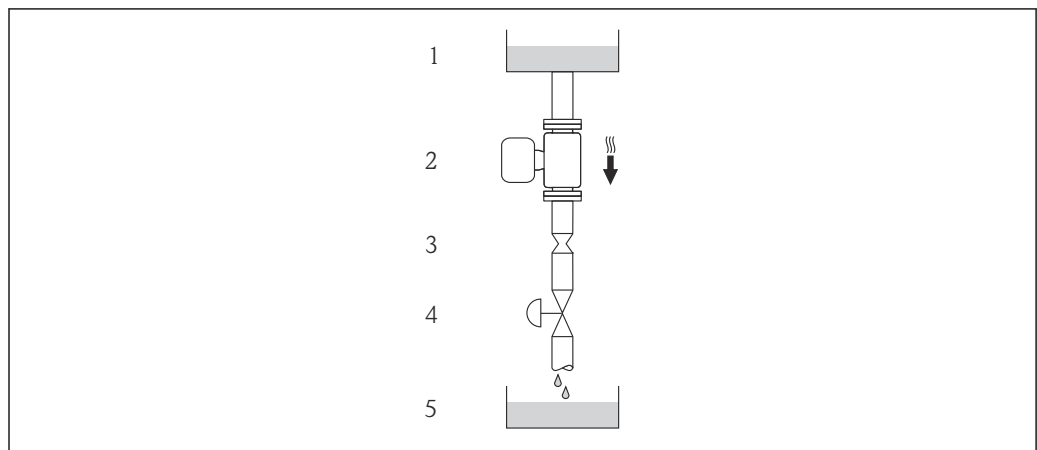
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.



A0023344

Installation in down pipes

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



A0015596

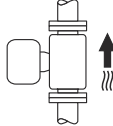
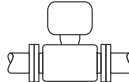
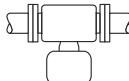

5 Installation in a down pipe (e.g. for batching applications)

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

DN		Ø orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
80	3	50	1.97
100	4	65	2.60
150	6	90	3.54

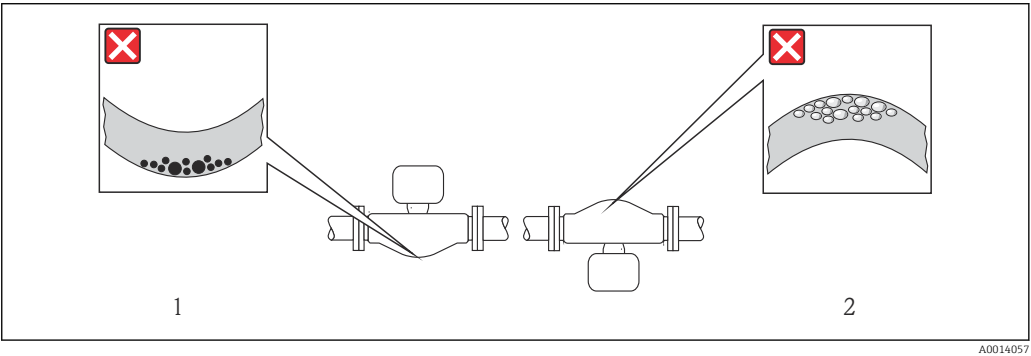
Orientation

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	 <small>A0015591</small>	✓✓
B	Horizontal orientation, transmitter head up	 <small>A0015589</small>	✓✓✓ ¹⁾ Exception: → 6, 19
C	Horizontal orientation, transmitter head down	 <small>A0015590</small>	✓✓✓ ²⁾ Exception: → 6, 19
D	Horizontal orientation, transmitter head at side	 <small>A0015592</small>	✗

- 1) Applications with low process temperatures may reduce 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.

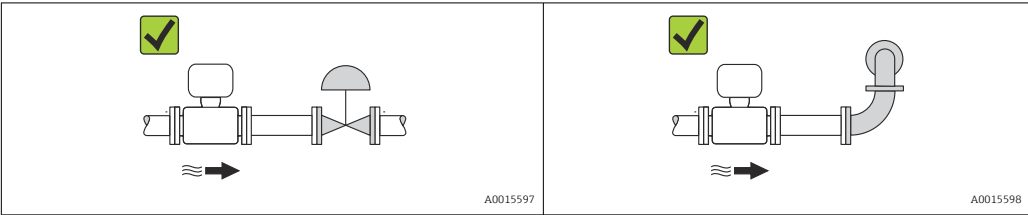


6 Orientation of sensor with curved measuring tube


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

Inlet and outlet runs

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



Installation dimensions

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

6.1.2 Requirements from environment and process

Ambient temperature range

Measuring device	Non-Ex	-40 to +60 °C (-40 to +140 °F)
	Ex na, NI version	-40 to +60 °C (-40 to +140 °F)
	Ex ia, IS version	<ul style="list-style-type: none">■ -40 to +60 °C (-40 to +140 °F)■ -50 to +60 °C (-58 to +140 °F) (Order code for "Test, certificate", option JM)
Local display		-20 to +60 °C (-4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.
Safety Barrier Promass 100		-40 to +60 °C (-40 to +140 °F)

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

System pressure

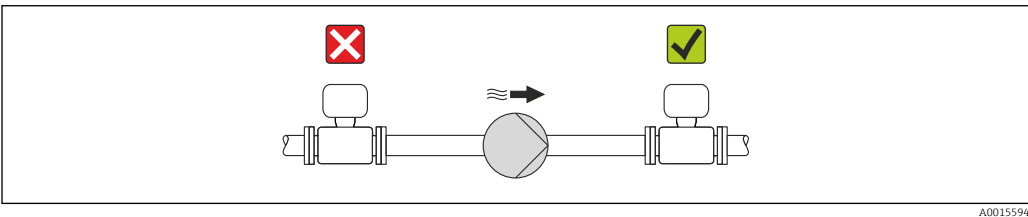
It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas.

Cavitation is caused if the pressure drops below the vapor pressure:

- In liquids that have a low boiling point (e.g. hydrocarbons, solvents, liquefied gases)
- In suction lines
- ▶ Ensure the system pressure is sufficiently high to prevent cavitation and outgassing.

For this reason, the following mounting locations are recommended:

- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of vacuum)



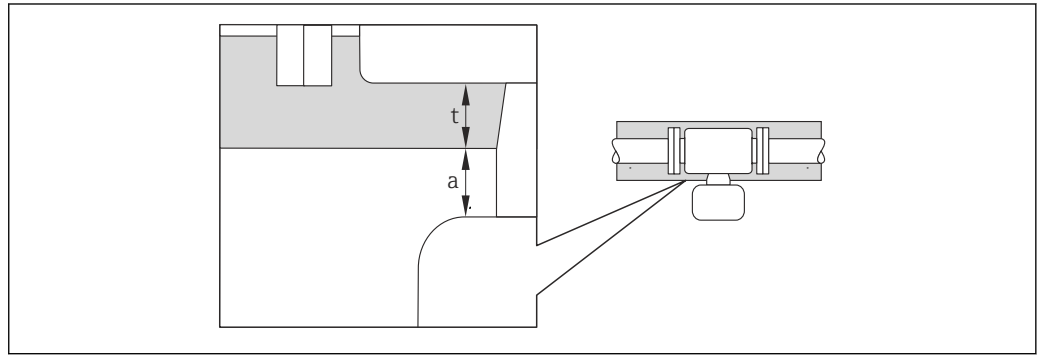
Thermal insulation

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

NOTICE

Electronics overheating on account of thermal insulation!

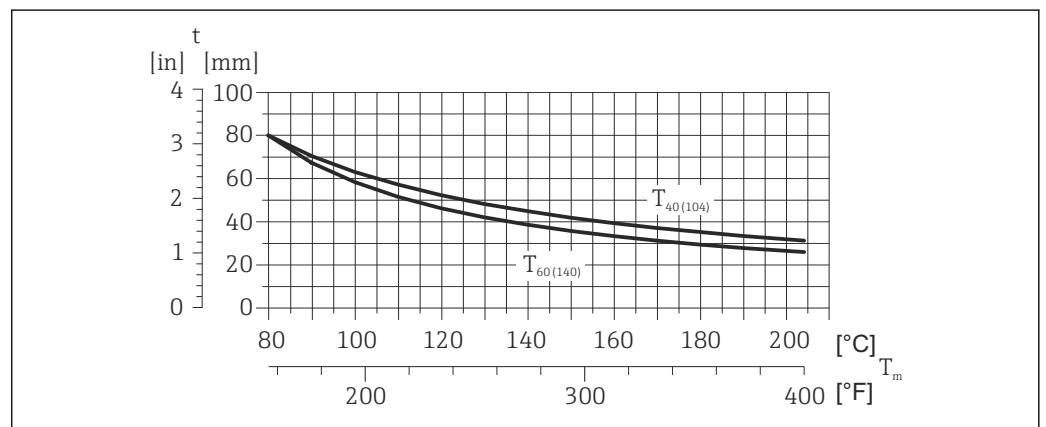
- Observe maximum permitted insulation height of the transmitter neck so that the transmitter head is completely free.



A0019919

- a* Minimum distance to insulation
t maximum Insulation thickness

The minimum distance between the transmitter housing and the insulation is 10 mm (0.39 in) so that the transmitter head remains completely exposed.



A0023177

- 7 Maximum recommended insulation thickness depending on the temperature of the medium and the ambient temperature

- t Insulation thickness
 T_m Medium temperature
 $T_{40(104)}$ Maximum recommended insulation thickness at an ambient temperature of $T_a = 40$ °C (104 °F)
 $T_{60(140)}$ Maximum recommended insulation thickness at an ambient temperature of $T_a = 60$ °C (140 °F)

NOTICE

Danger of overheating with insulation

- Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F)

NOTICE

The insulation can also be thicker than the maximum recommended insulation thickness.

Prerequisite:

- ▶ Ensure that convection takes place on a sufficiently large scale at the transmitter neck.
- ▶ Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

Heating**NOTICE**

Electronics can overheat due to elevated ambient temperature!

- ▶ Observe maximum permitted ambient temperature for the transmitter → 20.
- ▶ Depending on the fluid temperature, take the device orientation requirements into account.

NOTICE

Danger of overheating when heating

- ▶ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F)
- ▶ Ensure that convection takes place on a sufficiently large scale at the transmitter neck.
- ▶ Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

Heating options

If a fluid requires that no heat loss should occur at the sensor, users can avail of the following heating options:

- Electrical heating, e.g. with electric band heaters
- Via pipes carrying hot water or steam
- Via heating jackets

Using an electrical trace heating system

If heating is regulated via phase angle control or pulse packages, magnetic fields can affect the measured values (= for values that are greater than the values approved by the EN standard (sine 30 A/m)).

For this reason, the sensor must be magnetically shielded: the housing can be shielded with tin plates or electric sheets without a privileged direction (e.g. V330-35A).

The sheet must have the following properties:

- Relative magnetic permeability $\mu_r \geq 300$
- Plate thickness $d \geq 0.35 \text{ mm}$ ($d \geq 0.014 \text{ in}$)

Vibrations

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

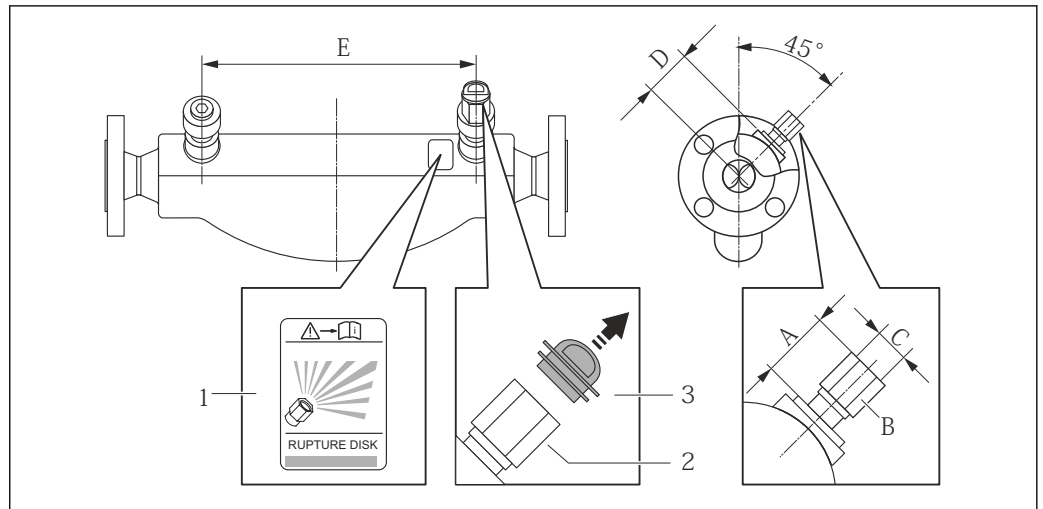
6.1.3 Special mounting instructions

Rupture disk

Make sure that the function and operation of the rupture disk is not impeded through the installation of the device. The position of the rupture disk is indicated on a sticker beside it. For additional information that is relevant to the process.

The existing connecting nozzles are not intended for the purpose of rinsing or pressure monitoring, but instead serve as the mounting location for the rupture disk.

However, by means of the connection available on the rupture disk holder, the escaping fluid (in case of a disk rupture) can be collected by connecting a suitable relief system.



A0008361

- 1 Rupture disk label
- 2 Rupture disk with 1/2" NPT internal thread with 1" width across flat
- 3 Transport protection

DN		A		B	C	D		E	
[mm]	[in]	[mm]	[in]	[in]	[in]	[mm]	[in]	[mm]	[in]
80	3	Approx.42	Approx.1.65	AF 1	½ NPT	101	3.98	560	22.0
100	4	Approx.42	Approx.1.65	AF 1	½ NPT	120	4.72	684	27.0
150	6	Approx.42	Approx.1.65	AF 1	½ NPT	141	5.55	880	34.6

⚠ WARNING

Limited functional reliability of the rupture disk.

Danger to persons from escaping fluids!

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

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 89. 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).

i Zero point adjustment is performed via the **Zero point adjustment control** parameter (→ 59).

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.

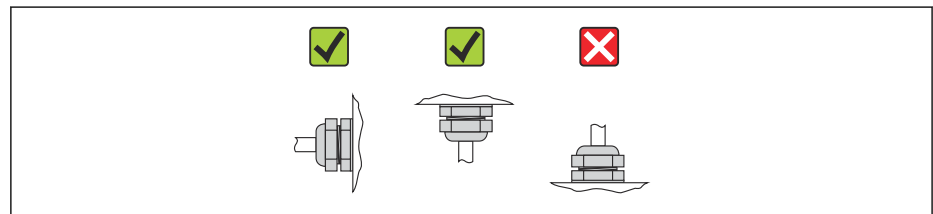
6.2.3 Mounting the measuring device

⚠ 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 → 93 ▪ Process pressure (refer to the chapter on "Pressure-temperature ratings" of the "Technical Information" document) ▪ Ambient temperature → 20 ▪ Measuring range → 85 	<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 → 19?	<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 Electrical safety

In accordance with applicable federal/national regulations.

7.2 Connection conditions

7.2.1 Required tools

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

7.2.2 Requirements for connecting cable

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

Permitted temperature range

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

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

Standard installation cable is sufficient.

Signal cable

Modbus RS485


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

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm ² (22 AWG)
Cable type	Twisted pairs
Loop resistance	$\leq 110 \Omega/\text{km}$
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 →  101.

Wire cross-section		Maximum cable length	
[mm²]	[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)

7.2.3 Terminal assignment


Transmitter

Modbus RS485 connection version

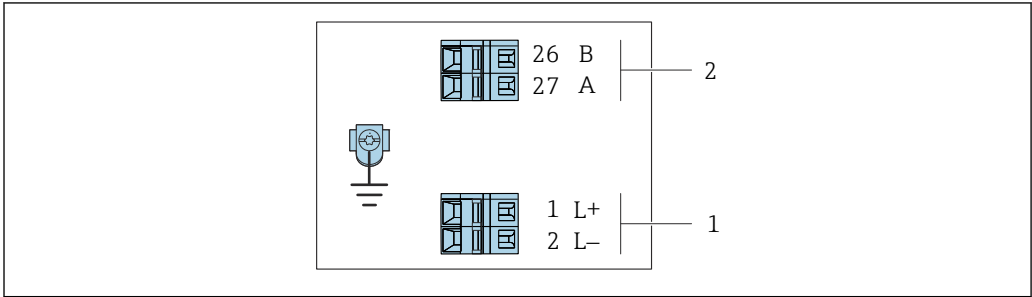
 For use in the non-hazardous area and Zone 2/Div. 2

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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B	Terminals	Terminals	<ul style="list-style-type: none"> ■ Option A: coupling M20x1 ■ Option B: thread M20x1 ■ Option C: thread G ½" ■ Option D: thread NPT ½"
Options A, B	Device plugs →  30	Terminals	<ul style="list-style-type: none"> ■ Option L: plug M12x1 + thread NPT ½" ■ Option N: plug M12x1 + coupling M20 ■ Option P: plug M12x1 + thread G ½" ■ Option U: plug M12x1 + thread M20


Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B, C	Device plugs → 30	Device plugs → 30	Option Q: 2 x plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> Option A: compact, coated aluminum Option B: compact, stainless Option C: ultra-compact, stainless 			



- 8 Modbus RS485 terminal assignment, connection version for use in non-hazardous areas and Zone 2/Div. 2
- 1 Power supply: DC 24 V
- 2 Modbus RS485


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

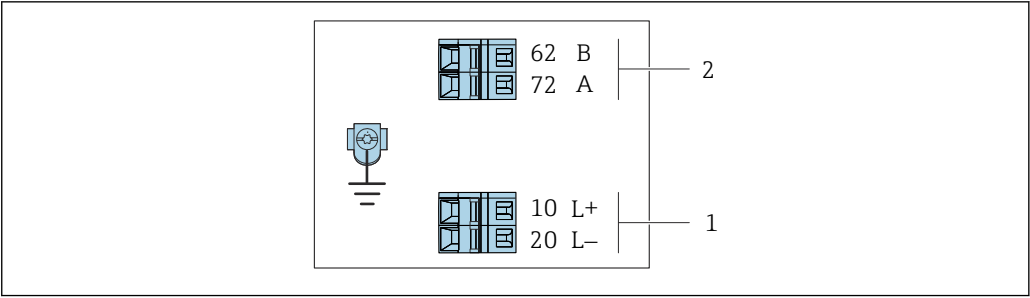
Modbus RS485 connection version

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

Order code for "Output", option M

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B	Terminals	Terminals	<ul style="list-style-type: none">■ Option A: coupling M20x1■ Option B: thread M20x1■ Option C: thread G ½"■ Option D: thread NPT ½"
A, B, C	Device plugs →  30		Option I: plug M12x1
Order code for "Housing": <ul style="list-style-type: none">■ Option A: compact, coated aluminum■ Option B: compact, stainless■ Option C: ultra-compact, stainless			



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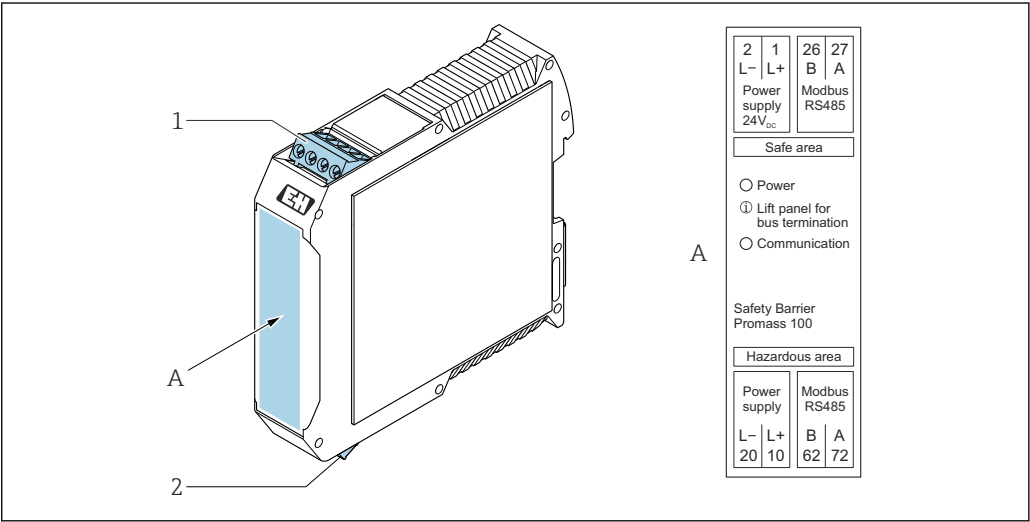
9 Modbus RS485 terminal assignment, connection version for use in intrinsically safe areas (connection via Safety Barrier Promass 100)

- 1 Intrinsically safe power supply
- 2 Modbus RS485

Order code "Output"	10 (L+)	20 (L-)	62 (B)	72 (A)
Option M	Intrinsically safe supply voltage		Modbus RS485 intrinsically safe	

Order code for "Output":
Option M: Modbus RS485, for use in the intrinsically safe area (connection via Safety Barrier Promass 100)

Safety Barrier Promass 100



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10 Safety Barrier Promass 100 with terminals

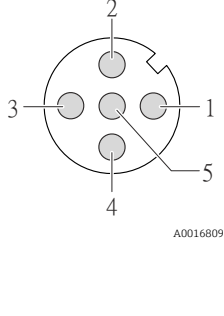
- 1 Non-hazardous area, Zone 2, Class I Division 2
- 2 Intrinsically safe area

7.2.4 Pin assignment, device plug

Supply voltage

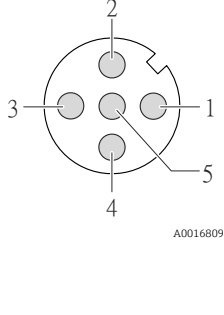
Promass 100

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

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

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

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

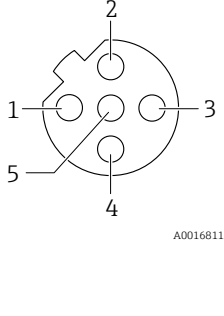
	Pin	Assignment	
	1	L+	DC 24 V
	2		Not assigned
	3		Not assigned
	4	L-	DC 24 V
	5		Grounding/shielding
	Coding		Plug/socket
	A		Plug

Signal transmission

Promass

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

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

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

7.2.5 Shielding and grounding

Shielding and grounding concept

1. Maintain electromagnetic compatibility (EMC).
2. Take explosion protection into consideration.
3. Pay attention to the protection of persons.
4. Comply with national installation regulations and guidelines.
5. Observe cable specifications .
6. Keep the stripped and twisted lengths of cable shield to the ground terminal as short as possible.
7. Shield cables fully.

Grounding of the cable shield

NOTICE

In systems without potential matching, the multiple grounding of the cable shield causes mains frequency equalizing currents!

Damage to the bus cable shield.

- Only ground the bus cable shield to either the local ground or the protective ground at one end.
- Insulate the shield that is not connected.

To comply with EMC requirements:

1. Ensure the cable shield is grounded to the potential matching line at multiple points.
2. Connect every local ground terminal to the potential matching line.


7.2.6 Preparing the measuring device

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

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

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
Observe requirements for connecting cables →  26.

7.3 Connecting the measuring device

NOTICE

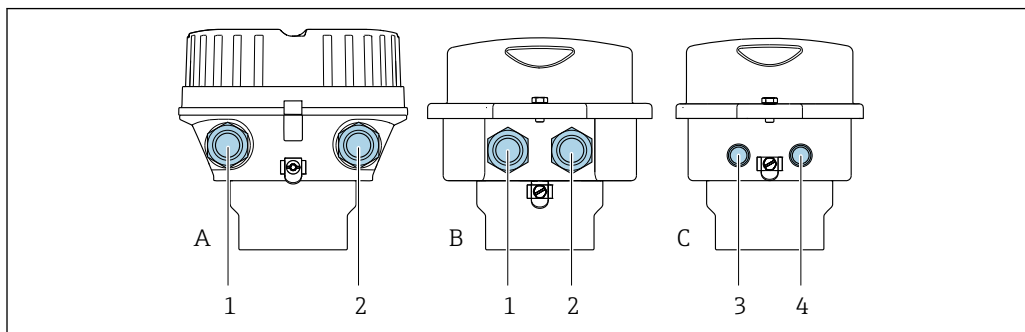
Limitation of electrical safety due to incorrect connection!

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

7.3.1 Connecting the transmitter

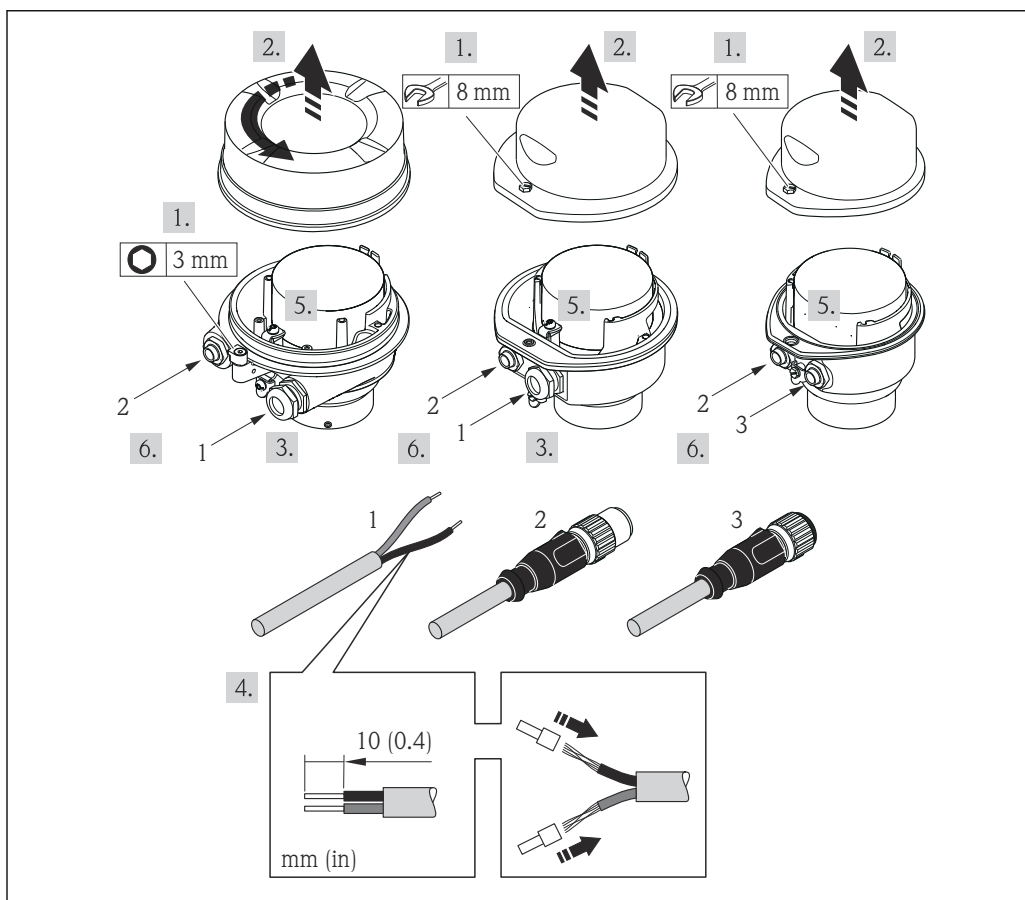
The connection of the transmitter depends on the following order codes:

- Housing version: compact or ultra-compact
- Connection version: device plug or terminals



11 *Housing versions and connection versions*

- | | |
|---|--|
| A | Housing version: compact, coated, aluminum |
| B | Housing version: compact, stainless |
| 1 | Cable entry or device plug for signal transmission |
| 2 | Cable entry or device plug for supply voltage |
| C | Housing version: ultra-compact, stainless |
| 3 | Device plug for signal transmission |
| 4 | Device plug for supply voltage |



12 *Device versions with connection examples*

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

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

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version, unscrew or open the housing cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the cable in accordance with the terminal assignment or the device plug pin assignment .
6. Depending on the device version, tighten the cable glands or plug in the device plug and tighten .
7. Enable the terminating resistor if applicable .
8. **⚠ WARNING**

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

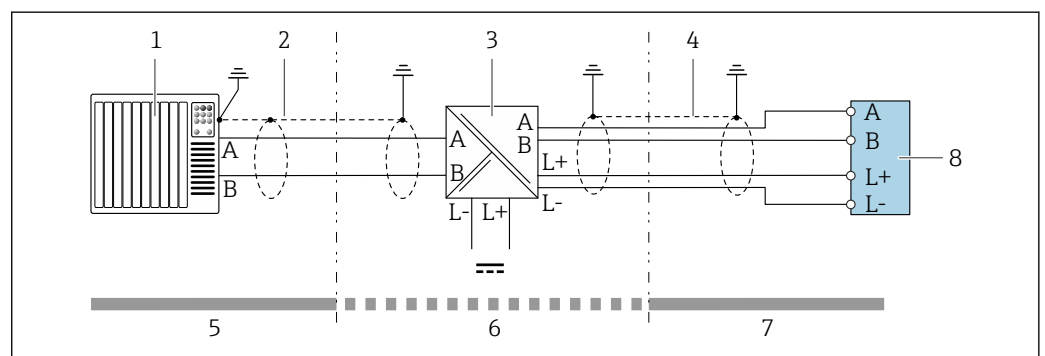
- Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

Reverse the removal procedure to reassemble the transmitter.

7.3.2 Connecting the Safety Barrier Promass 100

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

1. Strip the cable ends. In the case of stranded cables, also fit ferrules.
2. Connect the cable in accordance with the terminal assignment → 27.
3. Where applicable, enable the terminating resistor in the Safety Barrier Promass 100 → 35.



13 Electrical connection between the transmitter and Safety Barrier Promass 100

- 1 Control system (e.g. PLC)
- 2 Observe cable specifications → 26
- 3 Safety Barrier Promass 100: terminal assignment → 29
- 4 Observe cable specifications → 26
- 5 Non-hazardous area
- 6 Non-hazardous area and Zone 2/Div. 2
- 7 Intrinsically safe area
- 8 Transmitter: terminal assignment → 27

7.3.3 Ensuring potential equalization

Requirements

No special measures for potential equalization are required.



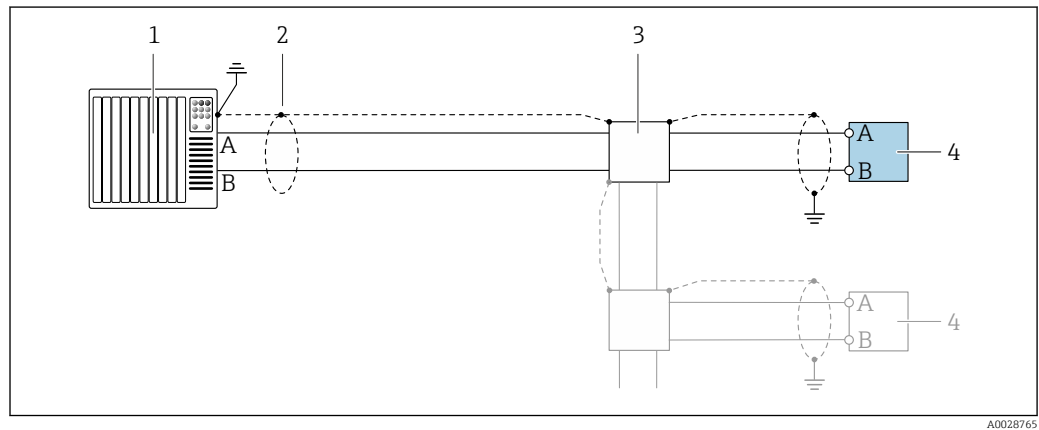
For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

7.4 Special connection instructions

7.4.1 Connection examples

Modbus RS485

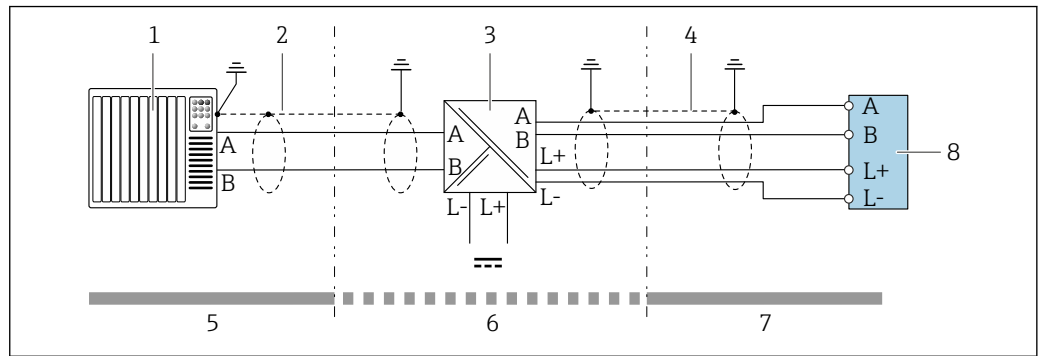
Modbus RS485, non-hazardous area and Zone 2/Div. 2



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14 Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2

- 1 Control system (e.g. PLC)
- 2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 26
- 3 Distribution box
- 4 Transmitter

Modbus RS485 intrinsically safe

A0028766

15 Connection example for Modbus RS485 intrinsically safe

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

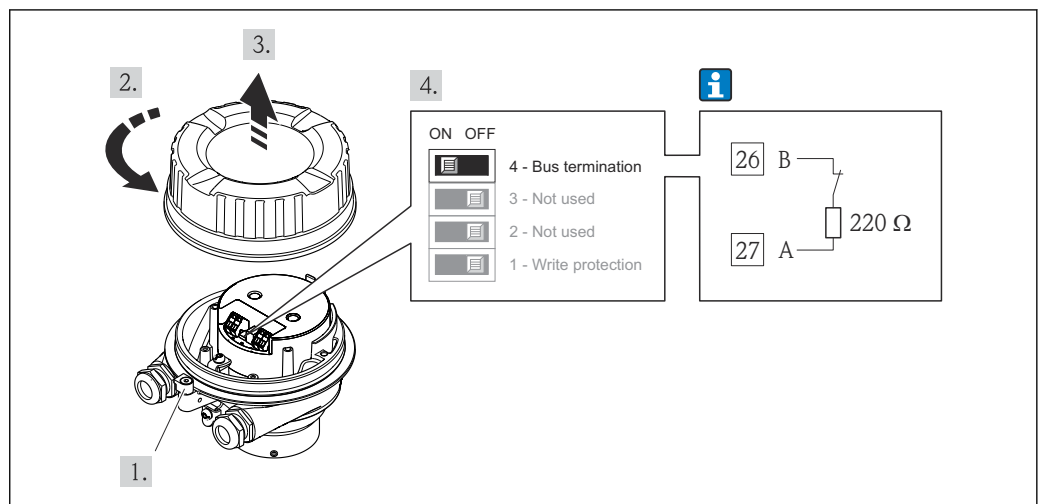
7.5 Hardware settings

7.5.1 Enabling the terminating resistor

Modbus RS485

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

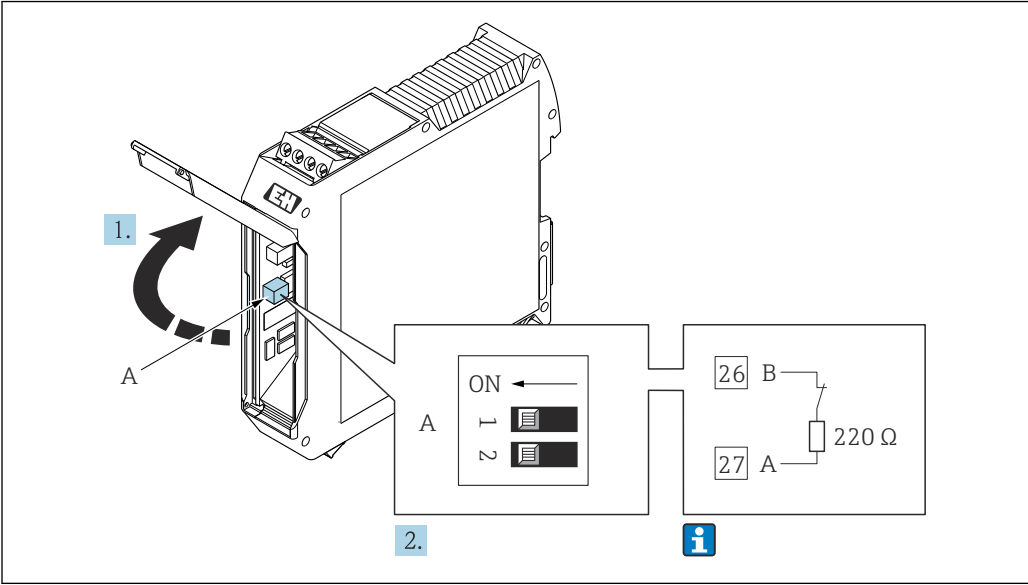
If the transmitter is used in the non-hazardous area or Zone 2/Div. 2



A0017610

16 Terminating resistor can be enabled via DIP switch on the electronics module

If the transmitter is used in the intrinsically safe area



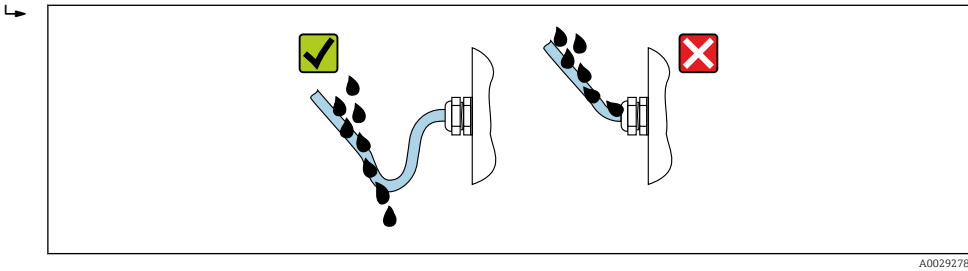
17 Terminating resistor can be enabled via DIP switch in the Safety Barrier Promass 100

7.6 Ensuring the degree of protection

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

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




- 1. Check that the housing seals are clean and fitted correctly.
- 2. Dry, clean or replace the seals if necessary.
- 3. Tighten all housing screws and screw covers.
- 4. Firmly tighten the cable glands.
- 5. To ensure that moisture does not enter the cable entry:
Route the cable so that it loops down before the cable entry ("water trap").



- 6. Insert dummy plugs into unused cable entries.

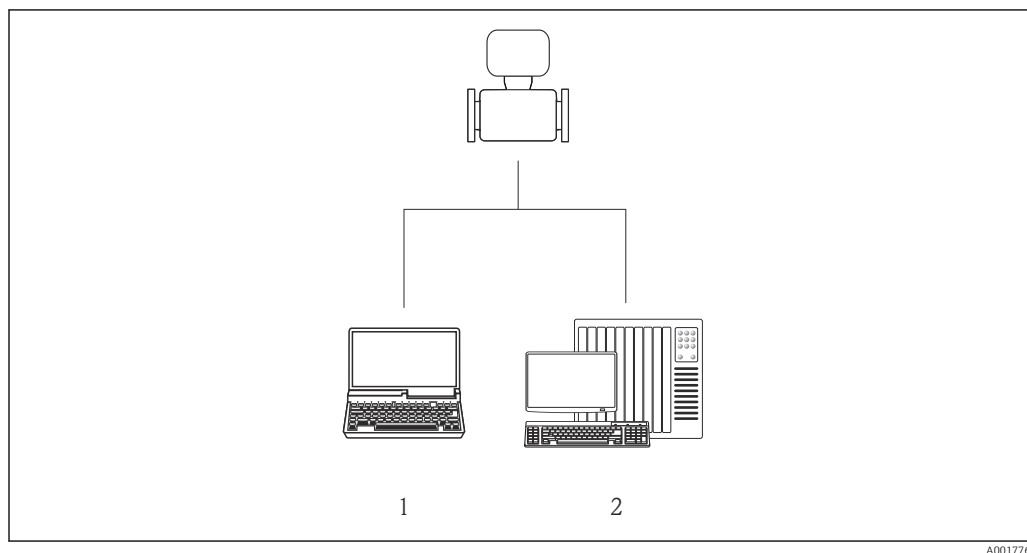
7.7 Post-connection check

Are cables or the device undamaged (visual inspection)?	<input type="checkbox"/>
Do the cables used meet the requirements → 26?	<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" → 36?	<input type="checkbox"/>

Depending on the device version: are all the device plugs firmly tightened →  32?	<input type="checkbox"/>
<ul style="list-style-type: none"> ■ Does the supply voltage match the specifications on the transmitter nameplate ? ■ For device version with Modbus RS485 intrinsically safe: does the supply voltage match the specifications on the nameplate of the Safety Barrier Promass 100 ? 	<input type="checkbox"/>
Is the terminal assignment →  27 or pin assignment of the connector →  30 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 operation options

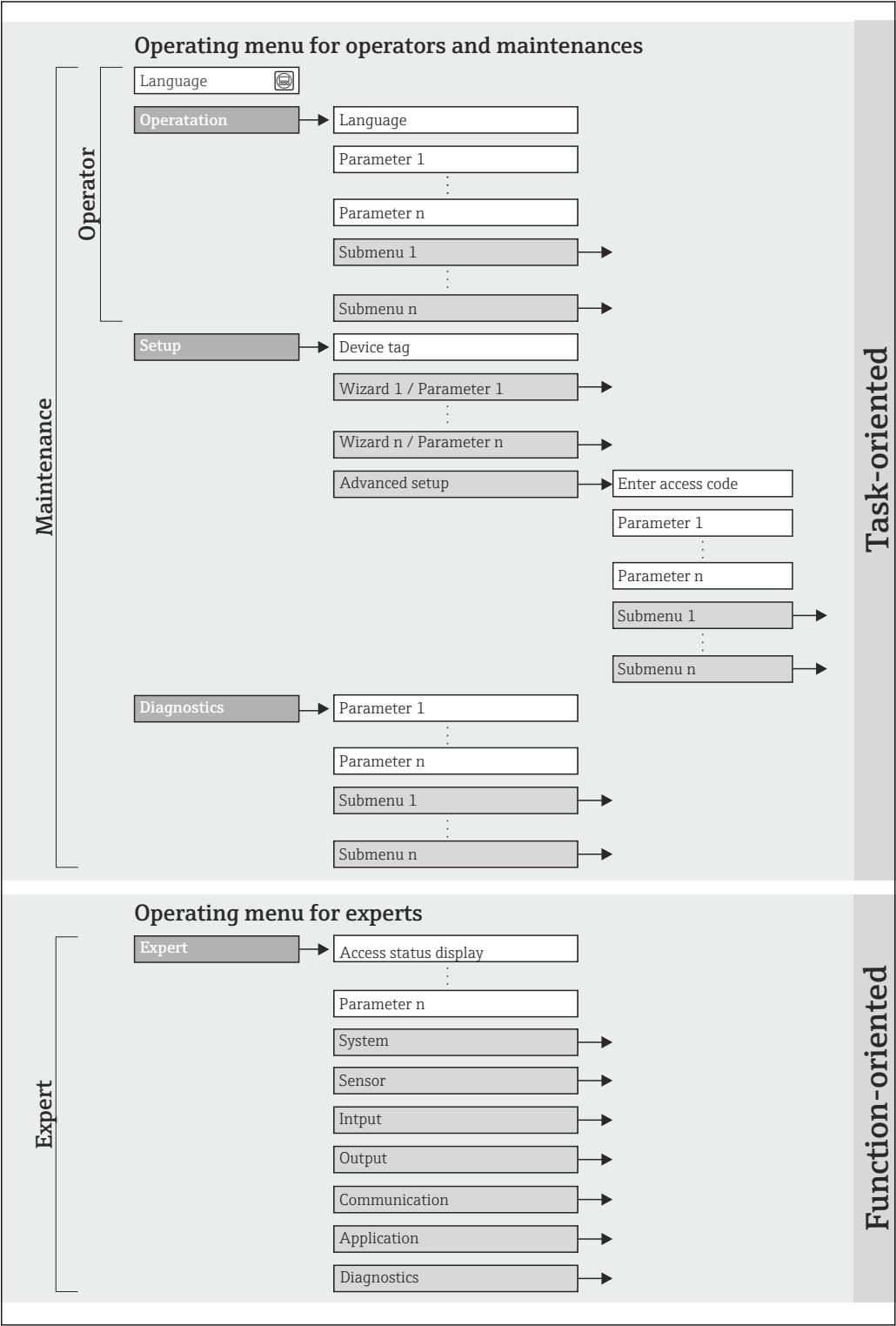



- 1 Computer with Web browser (e.g. Internet Explorer) or with "FieldCare" operating tool via Commubox FXA291 and service interface
- 2 Control system (e.g. PLC)

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

 For an overview of the operating menu with menus and parameters



 18 Schematic structure of the operating menu

A0018237-EN

8.2.2 Operating philosophy

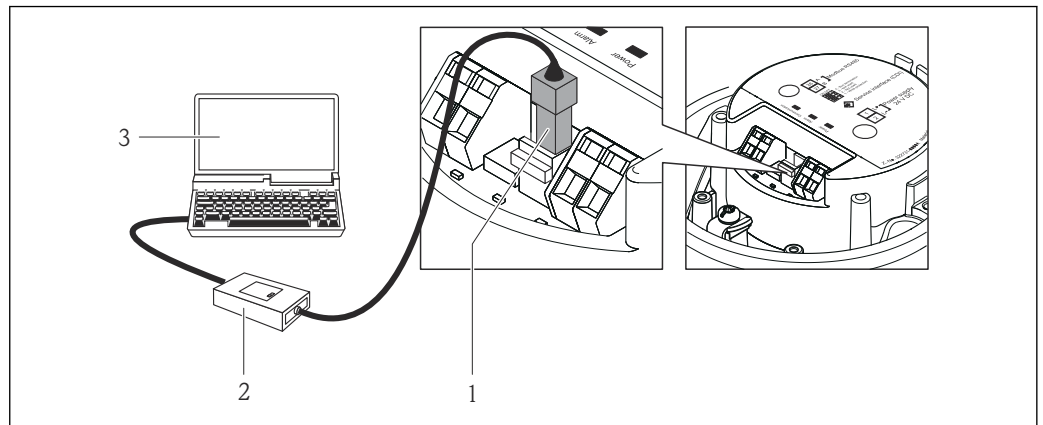
The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

Menu		User role and tasks	Content/meaning
Operation	task-oriented	Role "Operator", "Maintenance" Tasks during operation: Reading measured values	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"> ■ Setting the individual system units ■ Defining the medium ■ Configuration of the digital communication interface ■ Configuring the low flow cut off ■ Configuring partial and empty pipe detection "Advanced setup" submenu: <ul style="list-style-type: none"> ■ For more customized configuration of the measurement (adaptation to special measuring conditions) ■ Configuration of totalizers "Device reset" submenu Resets the device configuration to certain settings
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" submenu Contains up to 5 currently pending diagnostic messages. ■ "Event logbook" submenu Contains 20 event messages that have occurred. ■ "Device information" submenu Contains information for identifying the device. ■ "Measured values" submenu Contains all current measured values. ■ "Simulation" submenu 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" submenu Contains all higher-order device parameters that do not pertain either to measurement or the measured value communication. ■ "Sensor" submenu Configuration of the measurement. ■ "Communication" submenu Configuration of the digital communication interface. ■ "Application" submenu Configuration of the functions that go beyond the actual measurement (e.g. totalizer). ■ "Diagnostics" submenu 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

A0016925

- 1 Service interface (CDI) of the 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 takes place via:
Service interface CDI

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 details, see Operating Instructions BA00027S and BA00059S

Source for device description files

See data → 43

Establishing a connection

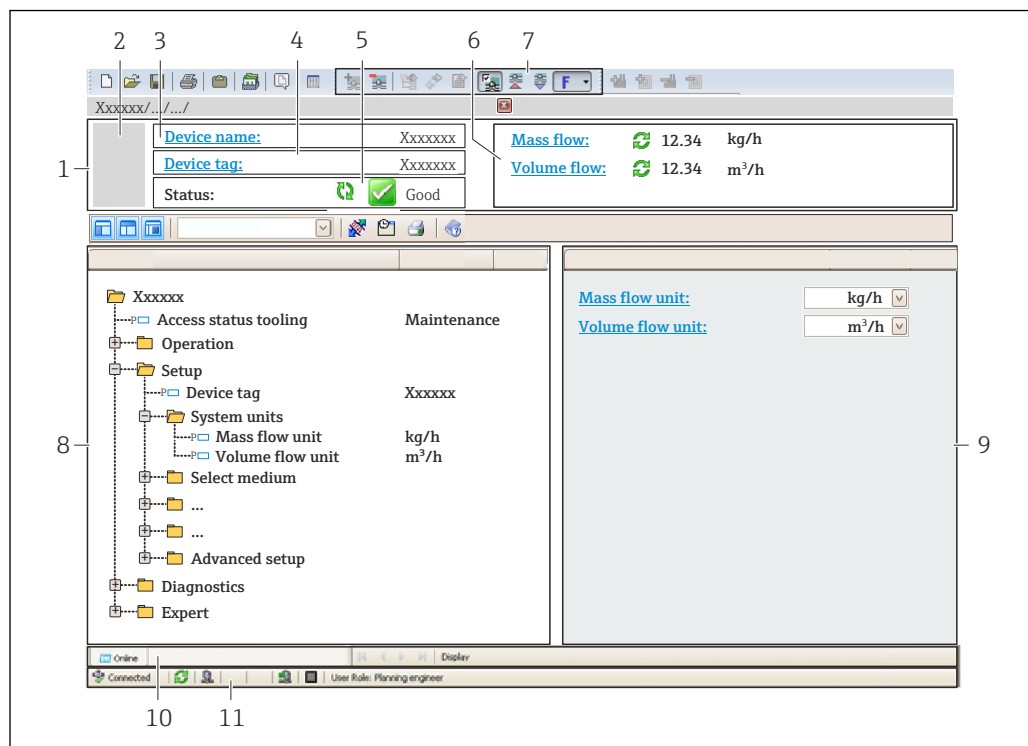
Via service interface (CDI)

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 details, see Operating Instructions BA00027S and BA00059S

User interface




A0021051-EN

- 1 Header
- 2 Picture of device
- 3 Device name
- 4 Device tag
- 5 Status area with status signal → 71
- 6 Display area for current measured values → 62
- 7 Event list with additional functions such as save/load, events list and document creation
- 8 Navigation area with operating menu structure
- 9 Operating range
- 10 Range of action
- 11 Status area

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 transmitter nameplate →  13 Parameter firmware version Diagnostics → Device info → Firmware version
Release date of firmware version	10.2014	---




9.1.2 Operating tools



Operating tool via Service interface (CDI)	Sources for obtaining device descriptions
FieldCare	<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>
06	Write single registers	<p>Master writes a new value to one Modbus register of the measuring device.</p> <p> Use function code 16 to write multiple registers with just 1 telegram.</p>	<p>Write only 1 device parameter</p> <p>Example: reset totalizer</p>

Code	Name	Description	Application
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 →  44	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 on Modbus-specific information of the individual device parameters, please refer to the additional document on Modbus RS485 register information
→  101

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 individual Modbus register address, please refer to the additional document on Modbus RS485 register information
→ 101

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

Carried out using the operating menu of the measuring device:

Expert → Communication → Modbus data map → Scan list register 0 -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 →  24
- "Post-connection check" checklist →  36

10.2 Connecting via FieldCare

- For FieldCare →  40 connection
- For connecting via FieldCare →  41
- For the FieldCare →  42 user interface

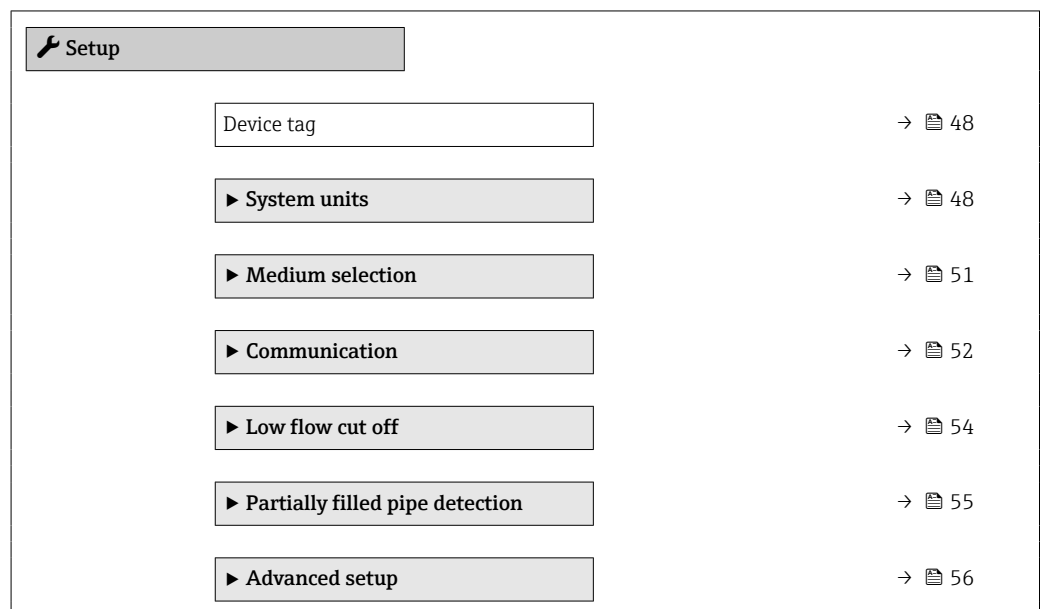
10.3 Setting the operating language

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.

 Enter the tag name in the "FieldCare" operating tool →  42


Navigation
"Setup" menu → Device tag

Parameter overview with brief description

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

10.4.2 Setting the system units


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

 The number of submenus and parameters can vary depending on the device version. Certain submenus and parameters in these submenus are not described in the Operation Instructions. Instead a description is provided in the Special Documentation for the device (→ "Supplementary documentation" section).


Navigation
"Setup" menu → Advanced setup → System units

► System units


Mass flow unit

→  49


Mass unit

→  49


Volume flow unit

→  49


Volume unit

→  49


Corrected volume flow unit

→  49


Corrected volume unit

→  49


Density unit

→  49


Reference density unit

→  49


Temperature unit



→  50

Pressure unit

→  50

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/h lb/min
Mass unit	Select mass unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> kg lb
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/h gal/min (us)
Volume unit	Select volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> l (DN > 150 (6"): m³ option) gal (us)
Corrected volume flow unit	Select corrected volume flow unit. <i>Result</i> The selected unit applies for: Corrected volume flow parameter (→  63)	Unit choose list	Country-specific: <ul style="list-style-type: none"> NI/h 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 lb/ft³
Reference density unit	Select reference density unit.	Unit choose list	Country-dependent <ul style="list-style-type: none"> kg/NI lb/Sft³








Parameter	Description	Selection	Factory setting
Temperature unit	<p>Select temperature unit.</p> <p><i>Result</i></p> <p>The selected unit applies for:</p> <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	<p>Country-specific:</p> <ul style="list-style-type: none"> ▪ °C ▪ °F
Pressure unit	<p>Select process pressure unit.</p> <p><i>Result</i></p> <p>The unit is taken from:</p> <ul style="list-style-type: none"> ▪ Pressure value parameter (→  52) ▪ External pressure parameter (→  52) ▪ Pressure value 	Unit choose list	<p>Country-specific:</p> <ul style="list-style-type: none"> ▪ bar a ▪ psi a

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	→	 52
Select gas type	→	 52
Reference sound velocity	→	 52
Temperature coefficient sound velocity	→	 52
Pressure compensation	→	 52
Pressure value	→	 52
External pressure	→	 52

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 	–
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 NO_x ■ 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 	–
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	–
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 	–
Pressure value	The Fixed value option or the Current input 1...n option is selected in the Pressure compensation parameter.	Enter process pressure to be used for pressure correction.	Positive floating-point number	–
External pressure	The External value option is selected in the Pressure compensation parameter.		Positive floating-point number	–

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		→ 53
Baudrate		→ 53
Data transfer mode		→ 53
Parity		→ 53
Byte order		→ 53
Failure mode		→ 53

Parameter overview with brief description

Parameter	Description	User entry / Selection
Bus address	Enter device address.	1 to 247
Baudrate	Define data transfer speed.	<ul style="list-style-type: none">1200 BAUD2400 BAUD4800 BAUD9600 BAUD19200 BAUD38400 BAUD57600 BAUD115200 BAUD
Data transfer mode	Select data transfer mode.	<ul style="list-style-type: none">ASCIIRTU
Parity	Select parity bits.	Picklist ASCII option: <ul style="list-style-type: none">0 = Even option1 = Odd option Picklist RTU option: <ul style="list-style-type: none">0 = Even option1 = Odd option2 = None / 1 stop bit option3 = None / 2 stop bits option
Byte order	Select byte transmission sequence.	<ul style="list-style-type: none">0-1-2-33-2-1-01-0-3-22-3-0-1
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	<ul style="list-style-type: none">OffAlarm or warningWarningAlarm
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. NaN ¹⁾	<ul style="list-style-type: none">NaN valueLast valid 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

→  54


On value low flow cutoff

→  54




Off value low flow cutoff

→  54

Pressure shock suppression

→  54

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 	–
On value low flow cutoff	A process variable is selected in the Assign process variable parameter (→  54).	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	A process variable is selected in the Assign process variable parameter (→  54).	Enter off value for low flow cut off.	0 to 100.0 %	–
Pressure shock suppression	A process variable is selected in the Assign process variable parameter (→  54).	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 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

→ ⓘ 55

Low value partial filled pipe detection

→ ⓘ 55

High value partial filled pipe detection

→ ⓘ 55

Response time part. filled pipe detect.


→ ⓘ 55

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
Assign process variable	–	Select process variable for partially filled pipe detection.	<div>■ Off</div> <div>■ Density</div> <div>■ Reference density</div>
Low value partial filled pipe detection	A process variable is selected in the Assign process variable parameter (→ ⓘ 55).	Enter lower limit value for deactivating partialy filled pipe detection.	Signed floating-point number
High value partial filled pipe detection	A process variable is selected in the Assign process variable parameter (→ ⓘ 55).	Enter upper limit value for deactivating partialy filled pipe detection.	Signed floating-point number
Response time part. filled pipe detect.	A process variable is selected in the Assign process variable parameter (→ ⓘ 55).	Enter time before diagnostic message is displayed for partially filled pipe detection.	0 to 100 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

→ ⓘ 56

▶ Calculated values

→ ⓘ 56

▶ Sensor adjustment

→ ⓘ 58

▶ Totalizer 1 to n

→ ⓘ 59

▶ Viscosity

▶ Concentration

▶ Heartbeat setup

▶ Administration

→ ⓘ 59

10.5.1 Using the parameter to enter the access code

Navigation

"Setup" menu → Advanced setup

Parameter overview with brief description

Parameter	Description	User entry
Enter access code	Enter access code to disable write protection of parameters.	Max. 16-digit character string comprising numbers, letters and special characters

10.5.2 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	→ 57
External reference density	→ 57
Fixed reference density	→ 57
Reference temperature	→ 57
Linear expansion coefficient	→ 58
Square expansion coefficient	→ 58

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 	–
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	The Calculated reference density option is selected in the Corrected volume flow calculation parameter.	Enter reference temperature for calculating the reference density.	–273.15 to 99 999 °C	Country-specific: <ul style="list-style-type: none"> ■ +20 °C ■ +68 °F

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Linear expansion coefficient	The Calculated reference density option is selected in the Corrected volume flow calculation parameter parameter.	Enter linear, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	–
Square expansion coefficient	The Calculated reference density option is selected in the Corrected volume flow calculation parameter parameter.	For media with a non-linear expansion pattern: enter the quadratic, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	–

10.5.3 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	→ 58
► Zero point adjustment	→ 58

Parameter overview with brief description

Parameter	Description	Selection
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

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 89. 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

► Zero point adjustment	
Zero point adjustment control	→ 59
Progress	→ 59

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 	–
Progress	Shows the progress of the process.	0 to 100 %	–

10.5.4 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

► Totalizer 1 to n	
Assign process variable	→ 59
Unit totalizer	→ 59
Totalizer operation mode	→ 59
Failure mode	→ 59

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 ■ Target mass flow * ■ Carrier mass flow * 	–
Unit totalizer	A process variable is selected in the Assign process variable parameter (→ 59) of the Totalizer 1 to n submenu.	Select process variable totalizer unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ kg ■ lb
Totalizer operation mode	A process variable is selected in the Assign process variable parameter (→ 59) of the Totalizer 1 to n submenu.	Select totalizer calculation mode.	<ul style="list-style-type: none"> ■ Net flow total ■ Forward flow total ■ Reverse flow total 	–
Failure mode	A process variable is selected in the Assign process variable parameter (→ 59) of the Totalizer 1 to n submenu.	Define totalizer behavior in alarm condition.	<ul style="list-style-type: none"> ■ Stop ■ Actual value ■ Last valid value 	–

* Visibility depends on order options or device settings

10.5.5 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

► Administration

Device reset → 60

Parameter overview with brief description

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

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

► Simulation

Assign simulation process variable → 60

Value process variable → 60

Simulation device alarm → 60


Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
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■ Concentration *■ Target mass flow *■ Carrier mass flow *
Value process variable	A process variable is selected in the Assign simulation process variable parameter (→ 60).	Enter the simulation value for the selected process variable.	Depends on the process variable selected
Simulation device alarm	–	Switch the device alarm on and off.	<ul style="list-style-type: none">■ Off■ On

* Visibility depends on order options or device settings

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 →  61

10.7.1 Write protection via write protection switch

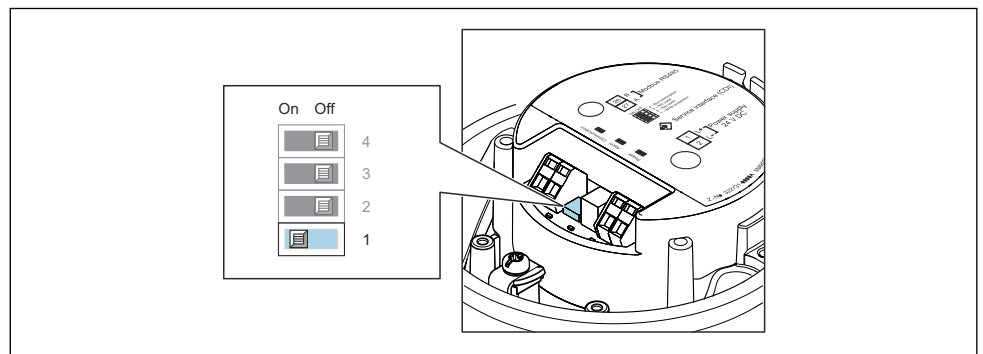
The write protection switch makes it possible to block write access to the entire operating menu with the exception of the following parameters:

- 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 →  62; if disabled, the **Locking status** parameter does not display any option →  62.

4. Reverse the removal procedure to reassemble the transmitter.

11 Operation

11.1 Reading device locking status

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


Navigation



"Operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Hardware locked	The locking switch (DIPswitch) for locking the hardware is activated on the main electronic module. This prevents write access to the parameters .
Temporarily locked	Due to internal processing in the device (e.g. up-/downloading of data, reset), write access to the parameters is blocked for a short time. Once the internal processing has been completed, the parameters can be changed once again.

11.2 Adjusting the operating language

Information →  47

 For information on the operating languages supported by the measuring device
→  98

11.3 Configuring the display

- Basic settings for local display
- Advanced settings for local display

11.4 Reading measured values

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

Diagnostics → Measured values

11.4.1 Process variables

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

Navigation

"Diagnostics" menu → Measured values → Process variables

Process variables

Mass flow

Volume flow

Corrected volume flow

Density

Reference density

	Temperature
	Pressure value

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Mass flow	Displays the mass flow currently measured.	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	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	Signed floating-point number	–
Density	Displays the density currently measured. <i>Dependency</i> The unit is taken from the Density unit parameter	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	Signed floating-point number	–
Temperature	Shows the medium temperature currently measured. <i>Dependency</i> The unit is taken from the Temperature unit parameter	Signed floating-point number	
Pressure value	Displays either a fixed or external pressure value.	Signed floating-point number	

11.4.2 Totalizer

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

Navigation

"Diagnostics" menu → Measured values → Totalizer

Navigation

"Expert" menu → Sensor → Measured values → Totalizer

<div>► Totalizer</div> <div>Totalizer value 1 to n</div> <div>Totalizer overflow 1 to n</div>

Parameter overview with brief description

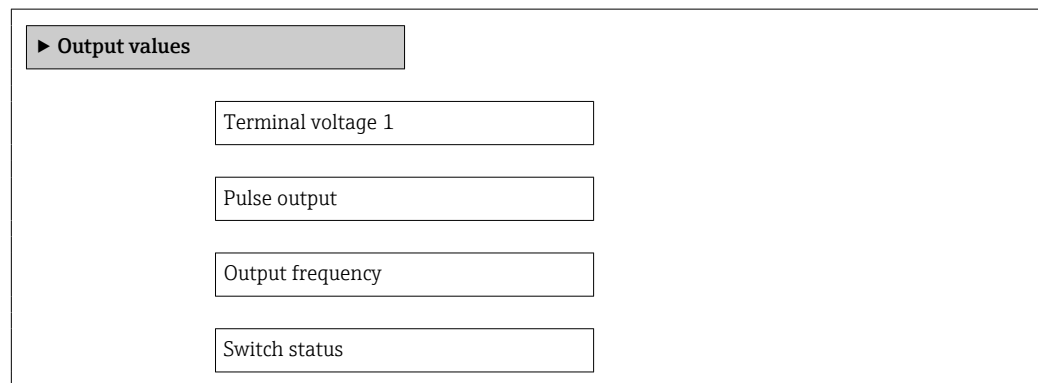
Parameter	Prerequisite	Description	User interface
Totalizer value 1 to n	In the Assign process variable parameter in the Totalizer 1 to n submenu, one of the following options is selected: <ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Corrected volume flow 	Displays the current totalizer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

11.4.3 Output values

The "**Output values**" submenu contains all the parameters needed to display the current measured values for every output.

Navigation

"Diagnostics" menu → Measured values → Output values



Parameter overview with brief description

Parameter	Description	User interface
Pulse output	Displays the value currently measured for the pulse output.	Positive floating-point number
Output frequency	Displays the value currently measured for the frequency output.	0.0 to 1 250.0 Hz
Switch status	Displays the current switch output status.	<ul style="list-style-type: none"> ■ Open ■ Closed

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu
- Advanced settings using the **Advanced setup** submenu

11.6 Performing a totalizer reset

In the **Operation** submenu the totalizers are reset:

- Control Totalizer
- Reset all totalizers

Function scope of "Control Totalizer" parameter

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

Function scope of "Reset all totalizers" parameter

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

Navigation

"Operation" menu → Operation

▶ Totalizer handling

Control Totalizer 1 to n

Preset value 1 to n

Reset all totalizers

Parameter overview with brief description

Parameter	Description	Selection / User entry
Control Totalizer 1 to n	Control totalizer value.	<ul style="list-style-type: none"> ■ Totalize ■ Reset + hold ■ Preset + hold ■ Reset + totalize ■ Preset + totalize
Preset value 1 to n	Specify start value for totalizer.	Signed floating-point number
Reset all totalizers	Reset all totalizers to 0 and start.	<ul style="list-style-type: none"> ■ Cancel ■ Reset + totalize

12 Diagnostics and troubleshooting

12.1 General troubleshooting


For local display

Problem	Possible causes	Remedial action
Local display dark and no output signals	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage → 32.
Local display dark and no output signals	Supply voltage has incorrect polarity.	Reverse polarity of supply voltage.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
Local display dark and no output signals	Terminals are not plugged into the I/O electronics module correctly.	Check terminals.
Local display dark and no output signals	I/O electronics module is defective.	Order spare part → 82.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	<ul style="list-style-type: none"> Set the display brighter by simultaneously pressing + . Set the display darker by simultaneously pressing + .
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 82.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures → 73
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	<ul style="list-style-type: none"> Check the cable and the connector between the main electronics module and display module. Order spare part → 82.

For output signals

Problem	Possible causes	Remedial action
Green power LED on the main electronics module of the transmitter is dark	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage → 32.
Green power LED on the main electronics module of the transmitter is dark	Power supply cable connected incorrectly	Check the terminal assignment .
Green power LED on Safety Barrier Promass 100 is dark	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage → 32.
Green power LED on Safety Barrier Promass 100 is dark	Power supply cable connected incorrectly	Check the terminal assignment .
Device measures incorrectly.	Configuration error or device is operated outside the application.	<ol style="list-style-type: none"> Check and correct parameter configuration. Observe limit values specified in the "Technical Data".

For access

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

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

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

LED	Color	Meaning
Power	Off	Supply voltage is off or too low
	Green	Supply voltage is ok
Alarm	Off	Device status is ok
	Flashing red	A device error of diagnostic behavior "Warning" has occurred
	Red	<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

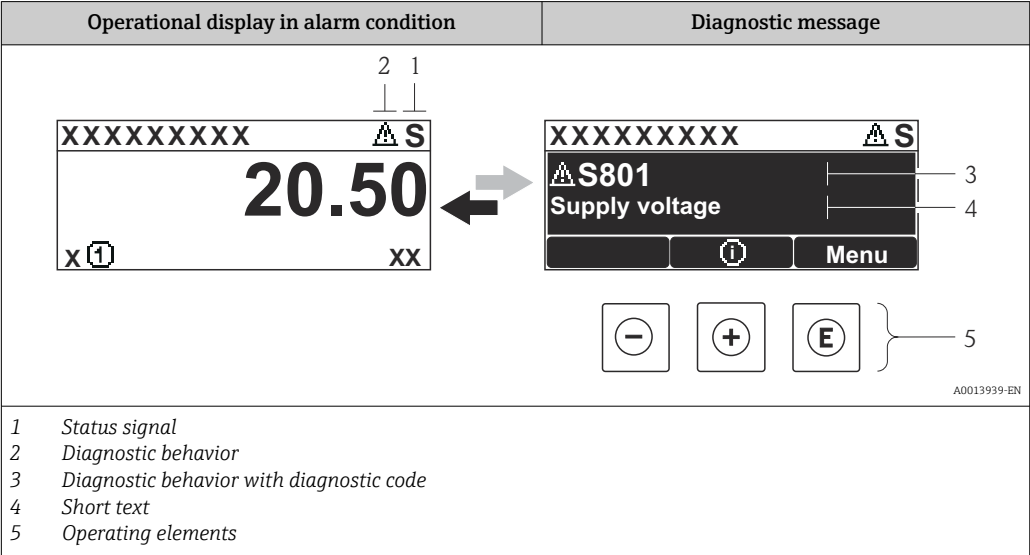
Various light emitting diodes (LEDs) on the Safety Barrier Promass 100 provide status information.

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 on local display

12.3.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.




If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

-  Other diagnostic events that have occurred can be called up in the **Diagnostics** menu:
- Via parameters →  75
 - Via submenus →  76



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).

-  The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

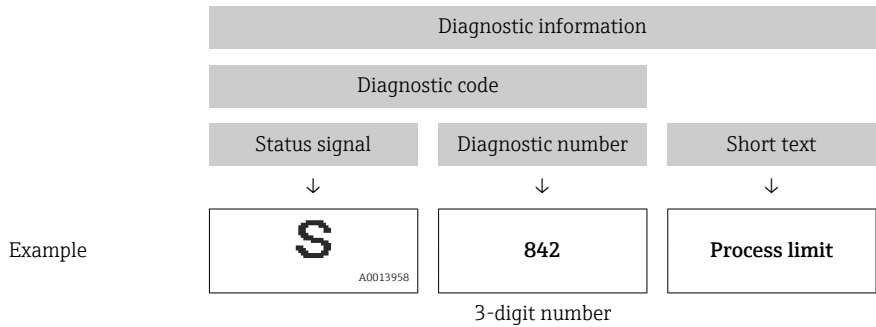
Symbol	Meaning
<div>F</div> <div>A0013956</div>	Failure A device error has occurred. The measured value is no longer valid.
<div>C</div> <div>A0013959</div>	Function check The device is in service mode (e.g. during a simulation).
<div>S</div> <div>A0013958</div>	Out of specification The device is operated: Outside its technical specification limits (e.g. outside the process temperature range)
<div>M</div> <div>A0013957</div>	Maintenance required Maintenance is required. The measured value remains valid.

Diagnostic behavior



Symbol	Meaning
 A0013961	Alarm <ul style="list-style-type: none">■ Measurement is interrupted.■ Signal outputs and totalizers assume the defined alarm condition.■ A diagnostic message is generated.
 A0013962	Warning Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

Diagnostic information

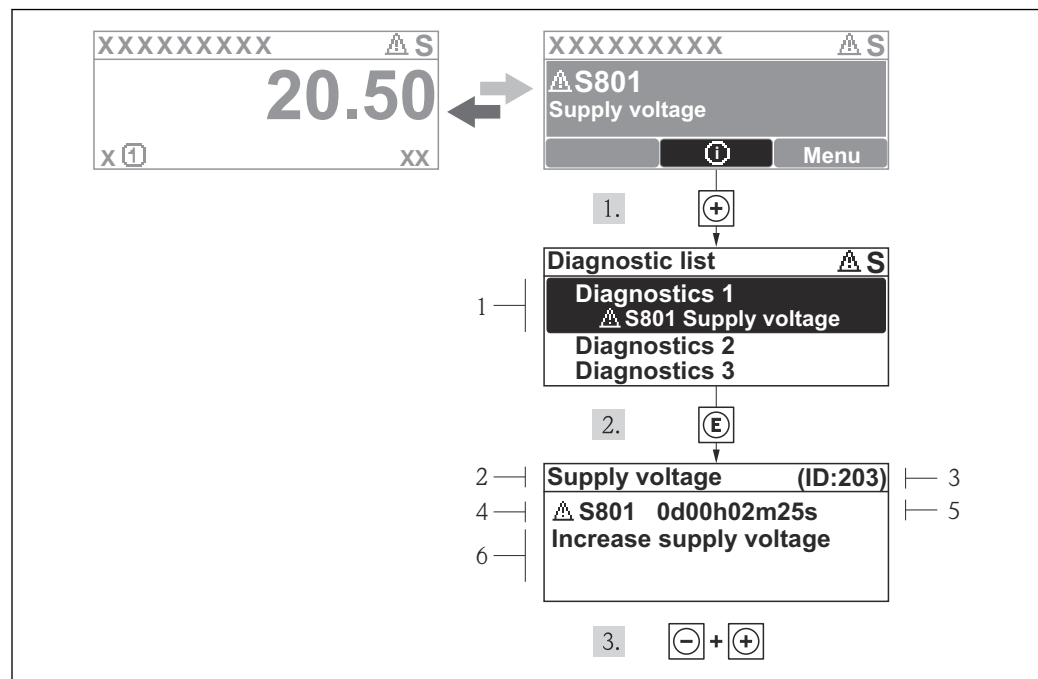
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault.



Operating elements

Key	Meaning
 A0013970	Plus key <i>In a menu, submenu</i> Opens the message about the remedial measures.
 A0013952	Enter key <i>In a menu, submenu</i> Opens the operating menu.

12.3.2 Calling up remedial measures



A0013940-EN

19 Message for remedial measures

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

The user is in the diagnostic message.

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

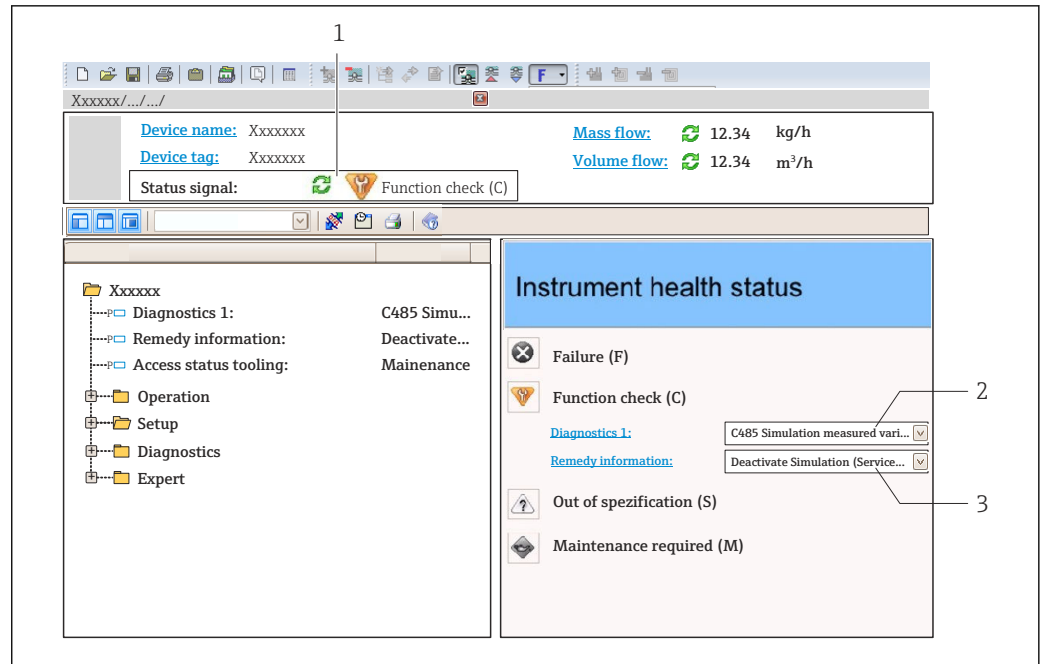
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or the **Previous diagnostics** parameter.

1. Press **E**.
↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press **-** + **+** simultaneously.
↳ The message for the remedial measures closes.

12.4 Diagnostic information in FieldCare

12.4.1 Diagnostic options

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







- 1 Status area with status signal → 68
- 2 Diagnostic information → 69
- 3 Remedial measures with Service ID

i Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:

- Via parameters → 75
- Via submenu → 76

Status signals

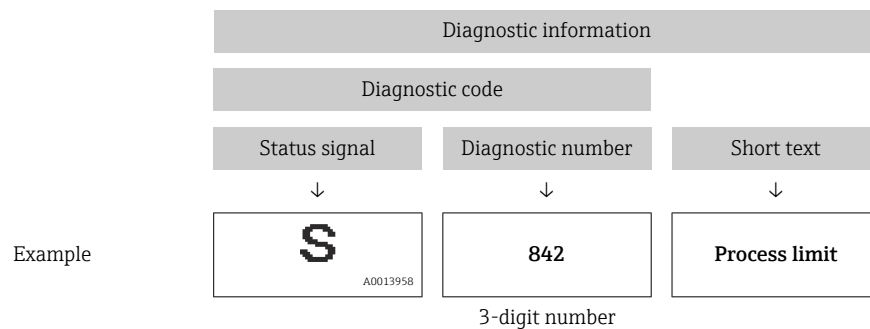
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

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

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.



12.4.2 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.

12.5 Diagnostic information via communication interface

12.5.1 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
→  73



12.5.2 Configuring error response mode

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

Navigation path

"Setup" menu → Communication

Parameter overview with brief description

Parameter	Description	Options	Factory setting
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	<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.  This parameter operates in accordance with the option selected in the Assign diagnostic behavior parameter.	<ul style="list-style-type: none"> NaN value Last valid value  NaN ≡ not a number	NaN value

12.6 Adapting the diagnostic information

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

12.7 Overview of diagnostic information

 The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.

 In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Adapt the diagnostic information →  73

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

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
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
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

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
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
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.

12.8 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 → 72

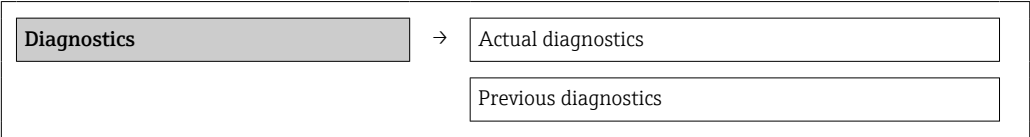


Other pending diagnostic events can be displayed in the **Diagnostic list** submenu


→ 76

Navigation
"Diagnostics" menu

Structure of the submenu





Parameter overview with brief description

Parameter	Prerequisite	Description	User interface	Factory setting
Actual diagnostics	1 diagnostic event has occurred.	Displays the current diagnostic event along with the 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	2 diagnostic events have already occurred.	Displays the diagnostic event that occurred prior to the current diagnostic event along with the diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.	–

12.9 Diagnostic list

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

Navigation path
Diagnostics menu → **Diagnostic list** submenu


 To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool →  72

12.10 Event logbook



12.10.1 Event history

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




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



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


This event history includes entries for:

- Diagnostic events →  73
- Information events →  77

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

- Diagnostic event
 - : Event has occurred
 - : Event has ended
- Information event
 - : Event has occurred

 To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool →  72

 For filtering the displayed event messages →  77

12.10.2 Filtering the event logbook

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

Navigation path

"Diagnostics" menu → Event logbook → Filter options

Filter categories

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

12.10.3 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
I1451	Monitoring on

Info number	Info name
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.

12.11 Resetting the measuring device

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

Navigation

"Setup" menu → Advanced setup → Administration → Device reset

▶ Administration

▶ Define access code

Define access code

Confirm access code

Device reset

Parameter overview with brief description

Parameter	Description	Selection
Device reset	Restart or reset device manually.	<ul style="list-style-type: none">■ Cancel■ To fieldbus defaults *■ To delivery settings■ Restart device

* Visibility depends on communication

12.11.1 Function scope of "Device reset" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
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.
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.
History reset	Every parameter is reset to its factory setting.

12.12 Device information

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

Navigation

"Diagnostics" menu → Device information

► Device information

Device tag

Serial number

Firmware version

Extended order code

Extended order code 1

Extended order code 2


Device type


Device Revision

12.13 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
06.2012	01.01.00	–	Original firmware	Operating Instructions	–
04.2013	01.02.zz	Option 74	Update	Operating Instructions	BA01180D/06/EN/01.13
10.2014	01.03.zz	Option 72	<ul style="list-style-type: none"> ■ New unit "Beer Barrel (BBL)" ■ Use of an external pressure value for "liquid" medium type ■ New parameter and diagnostic information for "oscillation damping" upper limit value 	Operating Instructions	BA01180D/06/EN/02.14

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

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

 The manufacturer's information is available:

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

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

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

13.2 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.



For a list of some of the measuring and test equipment, refer to the "Accessories" chapter of the "Technical Information" document for the device.

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 Repair

14.1 General notes

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 correspondingly trained customers.
- Certified devices can be converted into other certified devices by Endress+Hauser Service or at the factory only.

Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:


- Use only original Endress+Hauser spare parts.
- Carry out the repair according to the Installation Instructions.
- Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

W@M Device Viewer (www.endress.com/deviceviewer):

All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

 Measuring device serial number:

- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter in the **Device information** submenu →  79.

14.3 Endress+Hauser services

 Contact your Endress+Hauser Sales Center for information on services and spare parts.

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.

2. ⚠ WARNING**Danger to persons from process conditions.**

- Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

Carry out the mounting and connection steps from the chapters "Mounting the measuring device" and "Connecting the measuring device" in the logically reverse sequence. 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"> ■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ■ Graphic illustration of the calculation results <p>Administration, documentation and access to all project-related data and parameters throughout the entire life cycle of a project.</p> <p>Applicator is available:</p> <ul style="list-style-type: none"> ■ Via the Internet: https://wapps.endress.com/applicator ■ On CD-ROM for local PC installation.
W@M	<p>Life cycle management for your plant</p> <p>W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle.</p> <p>The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.</p> <p>W@M is available:</p> <ul style="list-style-type: none"> ■ Via the Internet: www.endress.com/lifecyclemanagement ■ On CD-ROM for local PC installation.
FieldCare	<p>FDT-based plant asset management tool from Endress+Hauser.</p> <p>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>
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>

15.2 System components

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

16.2 Function and system design

Measuring principle	Mass flow measurement based on the Coriolis measuring principle
Measuring system	<p>The device consists of a transmitter and a sensor. If a device with Modbus RS485 intrinsically safe is ordered, the Safety Barrier Promass 100 is part of the scope of supply and must be implemented to operate the device.</p> <p>One device version is available: compact version, transmitter and sensor form a mechanical unit.</p> <p>For information on the structure of the device →  11</p>

16.3 Input

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured variables

- Volume flow
- Corrected volume flow
- Reference density

Measuring range

Measuring ranges for liquids

DN		Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
80	3	0 to 180 000	0 to 6 600
100	4	0 to 350 000	0 to 12 860
150	6	0 to 800 000	0 to 29 400

Measuring ranges for gases

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

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

$\dot{m}_{\max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{\max(F)}$	Maximum full scale value for liquid [kg/h]
$\dot{m}_{\max(G)} < \dot{m}_{\max(F)}$	$\dot{m}_{\max(G)}$ can never be greater than $\dot{m}_{\max(F)}$
ρ_G	Gas density in [kg/m ³] at operating conditions

[mm]	DN	x [kg/m ³]
	[in]	
80	3	155
100	4	130
150	6	200

Calculation example for gas

- Sensor: Promass O, DN 80
- Gas: Air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range (liquid): 180 000 kg/h
- x = 130 kg/m³ (for Promass O, DN 80)

Maximum possible full scale value:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_G : x = 180\,000 \text{ kg/h} \cdot 60.3 \text{ kg/m}^3 : 130 \text{ kg/m}^3 = 83\,500 \text{ kg/h}$$

Recommended measuring range

"Flow limit" section → 94

Operable flow range	Over 1000 : 1. Flow rates above the preset full scale value are not overridden by the electronics unit, with the result that the totalizer values are registered correctly.
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Input signal	Fieldbuses To increase the accuracy of certain measured variables or to calculate the corrected volume flow for gases, the automation system can continuously write different measured values to the measuring device via Modbus RS485, EtherNet/IP or HART input: <ul style="list-style-type: none"> ■ Process pressure or medium temperature to increase accuracy (e.g. external values from Cerabar M, Cerabar S or iTEMP) ■ Reference density for calculating the corrected volume flow
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16.4 Output

Output signal	Modbus RS485 <table> <tr> <td>Physical interface</td><td>In accordance with EIA/TIA-485-A standard</td></tr> <tr> <td>Terminating resistor</td><td> <ul style="list-style-type: none"> ■ For device version used in non-hazardous areas or Zone 2/Div. 2: integrated and can be activated via DIP switches on the transmitter electronics module ■ For device version used in intrinsically safe areas: integrated and can be activated via DIP switches on the Safety Barrier Promass 100 </td></tr> </table>	Physical interface	In accordance with EIA/TIA-485-A standard	Terminating resistor	<ul style="list-style-type: none"> ■ For device version used in non-hazardous areas or Zone 2/Div. 2: integrated and can be activated via DIP switches on the transmitter electronics module ■ For device version used in intrinsically safe areas: integrated and can be activated via DIP switches on the Safety Barrier Promass 100
Physical interface	In accordance with EIA/TIA-485-A standard				
Terminating resistor	<ul style="list-style-type: none"> ■ For device version used in non-hazardous areas or Zone 2/Div. 2: integrated and can be activated via DIP switches on the transmitter electronics module ■ For device version used in intrinsically safe areas: integrated and can be activated via DIP switches on the Safety Barrier Promass 100 				

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

Modbus RS485

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

Operating tool

Plain text display	With information on cause and remedial measures
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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
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Ex connection data

These values only apply for the following device version:
Order code for "Output", option **M**: Modbus RS485, for use in intrinsically safe areas

Transmitter*Intrinsically safe values*

Order code for "Approvals"	Terminal numbers			
	Supply voltage		Signal transmission	
	20 (L-)	10 (L+)	62 (A)	72 (B)
<ul style="list-style-type: none">■ Option BM: ATEX II2G + IECEx Z1 Ex ia, II2D Ex tb■ Option BO: ATEX II1/2G + IECEx Z0/Z1 Ex ia, II2D■ Option BQ: ATEX II1/2G + IECEx Z0/Z1 Ex ia■ Option BU: ATEX II2G + IECEx Z1 Ex ia■ Option C2: CSA C/US IS Cl. I, II, III Div. 1■ Option 85: ATEX II2G + IECEx Z1 Ex ia + CSA C/US IS Cl. I, II, III Div. 1	<div>U_i =16.24 V</div> <div>I_i =623 mA</div> <div>P_i =2.45 W</div> <div>L_i = 0 μH</div> <div>C_i =6 nF</div>			
<div>* The gas group depends on the sensor and nominal diameter.</div> <div> For an overview and for information on the interdependencies between the gas group - sensor - nominal diameter, see the "Safety Instructions" (XA) document for the measuring device</div>				

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**Modbus RS485**

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 register04: Read input register06: Write single registers08: Diagnostics16: Write multiple registers23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: <ul style="list-style-type: none">06: Write single registers16: Write multiple registers23: Read/write multiple registers
Supported baud rate	<ul style="list-style-type: none">1 200 BAUD2 400 BAUD4 800 BAUD9 600 BAUD19 200 BAUD38 400 BAUD57 600 BAUD115 200 BAUD
Data transfer mode	<ul style="list-style-type: none">ASCIIRTU
Data access	Each device parameter can be accessed via Modbus RS485.  For Modbus register information →  101

16.5 Power supply

Terminal assignment	(Verweisziel existiert nicht, aber @y.link.required='true')
Pin assignment, device plug	
Supply voltage	<p>Transmitter</p> <ul style="list-style-type: none">For device version with all communication types except Modbus RS485 intrinsically safe: DC20 to 30 VFor device version with Modbus RS485 100 intrinsically safe: power supply via Safety Barrier Promass 100 <p>The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).</p> <p>Safety Barrier Promass 100</p> <p>DC20 to 30 V</p>

Power consumption	<p><i>Transmitter</i></p> <table><tr><th>Order code for "Output"</th><th>Maximum Power consumption</th></tr><tr><td>Option M: Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2</td><td>3.5 W</td></tr><tr><td>Option M: Modbus RS485, for use in intrinsically safe areas</td><td>2.45 W</td></tr></table> <p><i>Safety Barrier Promass 100</i></p> <table><tr><th>Order code for "Output"</th><th>Maximum Power consumption</th></tr><tr><td>Option M: Modbus RS485, for use in intrinsically safe areas</td><td>4.8 W</td></tr></table>	Order code for "Output"	Maximum Power consumption	Option M : Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2	3.5 W	Option M : Modbus RS485, for use in intrinsically safe areas	2.45 W	Order code for "Output"	Maximum Power consumption	Option M : Modbus RS485, for use in intrinsically safe areas	4.8 W
Order code for "Output"	Maximum Power consumption										
Option M : Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2	3.5 W										
Option M : Modbus RS485, for use in intrinsically safe areas	2.45 W										
Order code for "Output"	Maximum Power consumption										
Option M : Modbus RS485, for use in intrinsically safe areas	4.8 W										

Current consumption

Transmitter

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

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.
- Depending on the device version, the configuration is retained in the device memory or in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Potential equalization

No special measures for potential equalization are required.

Terminals

Transmitter

Spring 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

Transmitter

- 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

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 → 100

Maximum measured error

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

Base accuracy

Mass flow and volume flow (liquids)
±0.05 % o.r. (PremiumCal, for mass flow)
±0.10 %

Mass flow (gases)
±0.35 % o.r.

 Design fundamentals →  92

Density (liquids)

- Reference conditions:±0.0005 g/cm³
- Standard density calibration:±0.01 g/cm³
(valid over the entire temperature range and density range)
- Wide-range density specification (order code for "Application package", option EF "Special density and concentration ") : ±0.001 g/cm³ (valid range for special density calibration: 0 to 2 g/cm³, +5 to +80 °C (+41 to +176 °F))

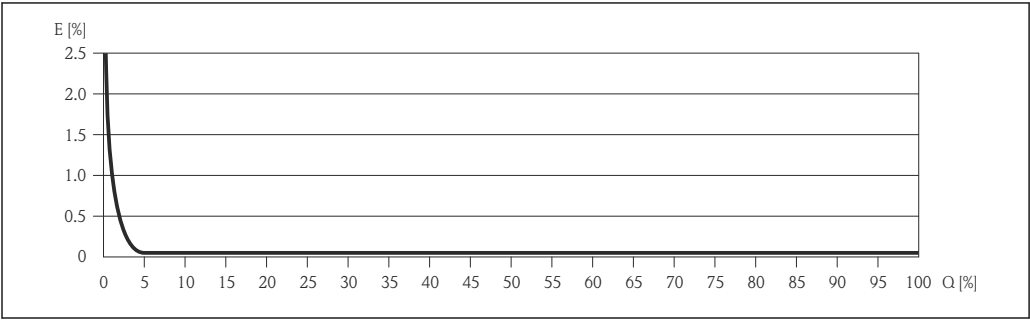
Temperature

±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]
80	3	9.0	0.330
100	4	14.0	0.514
150	6	32.0	1.17

Example for max. measured error



A0016708

E Error: Maximum measured error as % o.r. (example using PremiumCal)
Q Flow rate as %

 Design fundamentals →  92

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]
80	180 000	18 000	9 000	3 600	1 800	360
100	350 000	35 000	17 500	7 000	3 500	700
150	800 000	80 000	40 000	16 000	8 000	1 600

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	6 600	660	330	132	66	13.2
4	12 860	1 286	643	257.2	128.6	25.7
6	29 400	2 940	1 470	588	294	58.8

Repeatability

o.r. = of reading; $1 \text{ g/cm}^3 = 1 \text{ kg/l}$; T = medium temperature

Mass flow and volume flow (liquids)

$\pm 0.025 \%$ o.r. (PremiumCal, for mass flow)

$\pm 0.05 \%$ o.r.

Mass flow (gases)

$\pm 0.25 \%$ o.r.



Design fundamentals → 92

Density (liquids)

$\pm 0.00025 \text{ g/cm}^3$

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 (only mass flow): after 100 ms 95 % of the full scale value

Influence of medium temperature

Mass flow and volume flow

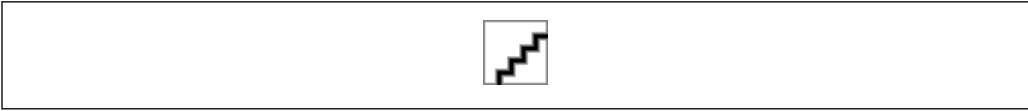
When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is $\pm 0.0002 \%$ of the full scale value/ $^\circ\text{C}$ ($\pm 0.0001 \%$ of the full scale value/ $^\circ\text{F}$).

Density

When there is a difference between the density calibration temperature and the process temperature, the typical measured error of the sensor is $\pm 0.00005 \text{ g/cm}^3 \text{ }^\circ\text{C}$ ($\pm 0.000025 \text{ g/cm}^3 \text{ }^\circ\text{F}$). Field density calibration is possible.

Wide-range density specification (special density calibration)

If the process temperature is outside the valid range → 90 the measured error is $\pm 0.00005 \text{ g/cm}^3 \text{ }^\circ\text{C}$ ($\pm 0.000025 \text{ g/cm}^3 \text{ }^\circ\text{F}$)



A0016612

- 1 Field density calibration, for example at +20 °C (+68 °F)
- 2 Special density calibration

Temperature
 $\pm 0.005 \cdot T \text{ }^{\circ}\text{C} (\pm 0.005 \cdot (T - 32) \text{ }^{\circ}\text{F})$

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]		
80	3	-0.0055	-0.0004
100	4	-0.0035	-0.0002
150	6	-0.002	-0.0001


Design fundamentals	o.r. = of reading, o.f.s. = of full scale value Dependent on the flow: <ul style="list-style-type: none">Flow in % o.f.s. \geq (zero point stability : base accuracy in % o.r.) $\cdot 100$<ul style="list-style-type: none">Maximum measured error in % o.r.: \pmbase accuracy in % o.r.Repeatability in % o.r.: $\pm \frac{1}{2} \cdot$ base accuracy in % o.r.Flow in % o.f.s. $<$ (zero point stability : base accuracy in % o.r.) $\cdot 100$<ul style="list-style-type: none">Maximum measured error in % o.r.: \pm (zero point stability : measured value) $\cdot 100$Repeatability in % o.r.: $\pm \frac{1}{2} \cdot$ (zero point stability : measured value) $\cdot 100$		
Base accuracy for		[% o.r.]	
Mass flow, liquids, PremiumCal		0.05	
Mass flow, liquids		0.1	
Volume flow, liquids		0.1	
Mass flow, gases		0.35	

16.7 Installation



"Mounting requirements" \rightarrow 18

16.8 Environment


Ambient temperature range	\rightarrow 20
Storage temperature	-40 to +80 °C (-40 to +176 °F), preferably at +20 °C (+68 °F)
Climate class	DIN EN 60068-2-38 (test Z/AD)

Degree of protection	Transmitter and sensor <ul style="list-style-type: none"> ■ As standard: IP66/67, type 4X enclosure ■ With the order code for "Sensor options", option CM: IP69K can also be ordered ■ When housing is open: IP20, type 1 enclosure Safety Barrier Promass 100 IP20
Shock resistance	As per IEC/EN 60068-2-31
Vibration resistance	Acceleration up to 1 g, 10 to 150 Hz, based on IEC/EN 60068-2-6
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)  Details are provided in the Declaration of Conformity.

16.9 Process

Medium temperature range	Sensor <ul style="list-style-type: none"> ■ -50 to +150 °C (-58 to +302 °F) ■ -40 to +200 °C (-40 to +392 °F) with extended temperature (order code for "Measuring tube mat.", option TK) Seals No internal seals
Medium density	0 to 5 000 kg/m ³ (0 to 312 lb/cf)
Pressure-temperature ratings	 An overview of the material load diagrams (pressure/temperature diagrams) for the process connections is provided in the "Technical Information" document.
Sensor housing	<p>The sensor housing is filled with dry nitrogen gas and protects the electronics and mechanics inside.</p> <p> If a measuring tube fails (e.g. due to process characteristics like corrosive or abrasive fluids), the fluid will initially be contained by the sensor housing.</p> <p>In the event of a tube failure, the pressure level inside the sensor housing will rise according to the operating process pressure. If the user judges that the sensor housing burst pressure does not provide an adequate safety margin, the device can be fitted with a rupture disk. This prevents excessively high pressure from forming inside the sensor housing. Therefore, the use of a rupture disk is strongly recommended in applications involving high gas pressures, and particularly in applications in which the process pressure is greater than 2/3 of the sensor housing burst pressure.</p> <p>If there is a need to drain the leaking medium into a discharge device, the sensor should be fitted with a rupture disk. Connect the discharge to the additional threaded connection .</p>

If the sensor is to be purged with gas (gas detection), it should be equipped with purge connections.

 Do not open the purge connections unless the containment can be filled immediately with a dry, inert gas. Use only low pressure to purge.

Maximum pressure:

- DN 80 to 150 (3 to 6"): 5 bar (72.5 psi)
- DN 250 (10"): 3 bar (43.5 psi)

Burst pressure of the sensor housing


The following sensor housing burst pressures are only valid for standard devices and/or devices equipped with closed purge connections (not opened/as delivered).

If a device fitted with purge connections (order code for "Sensor option", option CH "Purge connection") is connected to the purge system, the maximum pressure is determined by the purge system itself or by the device, depending on which component has the lower pressure classification.

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

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



DN		Sensor housing burst pressure	
[mm]	[in]	[bar]	[psi]
80	3	120	1 740
100	4	95	1 370
150	6	75	1 080
250	10	50	720


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

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


 For information on the dimensions of the rupture disk: see the "Mechanical construction" section of the "Technical Information" document

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

 For an overview of the measuring range full scale values, see the "Measuring range" section →  85

- 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
- Select a lower full scale value for abrasive substances (such as liquids with entrained solids): flow velocity <1 m/s (<3 ft/s).
- For gas measurement the following rules apply:
 - The flow velocity in the measuring tubes should not exceed half the sonic velocity (0.5 Mach).
 - The maximum mass flow depends on the density of the gas: formula →  85

Pressure loss

To calculate the pressure loss, use the *Applicator* sizing tool →  100

16.10 Mechanical construction

Design, dimensions



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

Weight

All values (weight exclusive of packaging material) refer to devices with ASME B16.5 Class 900 flanges. Weight specifications including transmitter: order code for "Housing", option A "Compact, aluminum coated".

Weight in SI units

DN [mm]	Weight [kg]
80	75
100	141
150	246
250	572

Weight in US units

DN [in]	Weight [lbs]
3	165
4	311
6	542
10	1261

Safety Barrier Promass 100

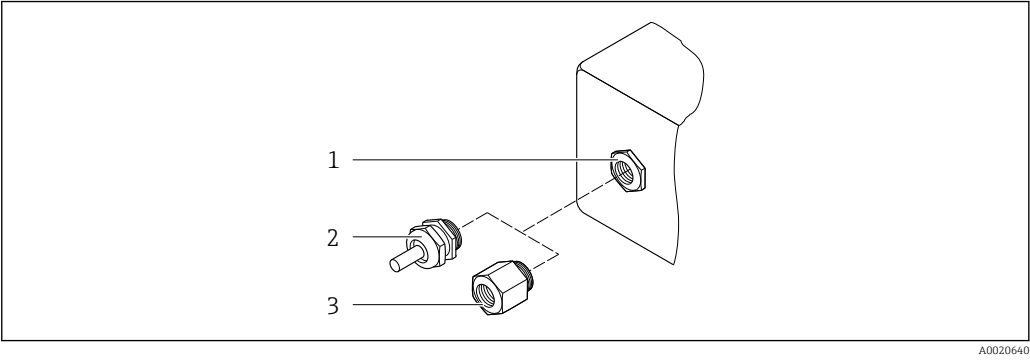
49 g (1.73 ounce)

Materials

Transmitter housing

- Order code for "Housing", option **A** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **B** "Compact, stainless":
Stainless steel 1.4404 (316L)
- Order code for "Housing", option **C** "Ultra-compact, stainless":
Stainless steel 1.4404 (316L)

Cable entries/cable glands



20 Possible cable entries/cable glands

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

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

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

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

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

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

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

Device plug

Electrical connection	Material
Plug M12x1	<ul style="list-style-type: none">Socket: Stainless steel, 1.4404 (316L)Contact housing: PolyamideContacts: Gold-plated brass

Sensor housing

- Acid and alkali-resistant outer surface
- Stainless steel, 1.4404 (316L)

Measuring tubes

Stainless steel, 1.4410/UNS S32750 25Cr Duplex (Super Duplex)

Process connections

Stainless steel, 1.4410/F53 25Cr Duplex (Super Duplex)

Accessories

Protective cover


Stainless steel, 1.4404 (316L)

Safety Barrier Promass 100

Housing: Polyamide

Process connections

- Fixed flange connections:
- EN 1092-1 (DIN 2512N) flange
 - ASME B16.5 flange
 - JIS B2220 flange

 Process connection materials

Surface roughness

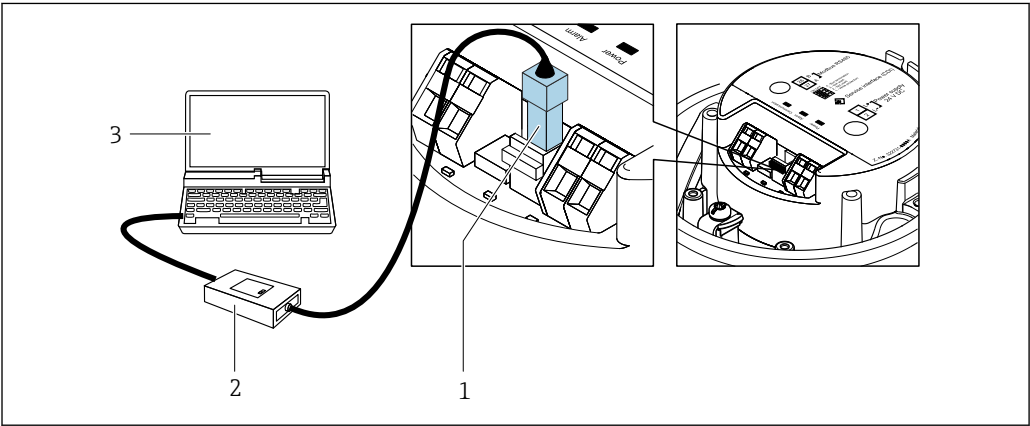
All data relate to parts in contact with fluid. The following surface roughness quality can be ordered.
Not polished

16.11 Human interface

Service interface

Via service interface (CDI)

Modbus RS485



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

Languages

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

16.12 Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC 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 and is certified by the "MODBUS/TCP Conformance Test Laboratory" of the University of Michigan.
Pressure Equipment Directive	<ul style="list-style-type: none"> ■ With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC. ■ Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.
Other standards and guidelines	<ul style="list-style-type: none"> ■ EN 60529 Degrees of protection provided by enclosures (IP code) ■ IEC/EN 60068-2-6 Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal). ■ IEC/EN 60068-2-31 Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices. ■ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use ■ IEC/EN 61326 Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements) ■ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment ■ NAMUR NE 32 Data retention in the event of a power failure in field and control instruments with microprocessors ■ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal. ■ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics ■ NAMUR NE 80 The application of the pressure equipment directive to process control devices ■ NAMUR NE 105 Specifications for integrating fieldbus devices in engineering tools for field devices ■ NAMUR NE 107 Self-monitoring and diagnosis of field devices ■ NAMUR NE 131 Requirements for field devices for standard applications

- NAMUR NE 132
Coriolis mass meter
- NACE MR 103
Materials resistant to sulfide stress cracking in corrosive petroleum refining environments.
- NACE MR 0175/ISO 15156-1
Materials for use in H₂S-containing Environments in Oil and Gas Production.

16.13 Application packages

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

The application packages can be ordered from Endress+Hauser either directly with the device or subsequently. 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.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	<p>Heartbeat Monitoring: Continuously supplies monitoring data, which are characteristic of the measuring principle, for an external condition monitoring system. This makes it possible to:</p> <ul style="list-style-type: none"> ■ Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time. ■ Schedule servicing in time. ■ Monitor the product quality, e.g. gas pockets. <p>Heartbeat Verification: Makes it possible to check the device functionality on demand when the device is installed, without having to interrupt the process.</p> <ul style="list-style-type: none"> ■ Access via onsite operation or other interfaces (requires no on-site presence). ■ Ideal solution for recurring device checks (SIL). ■ End-to-end, traceable documentation of the verification results and verification report. ■ Extension of calibration intervals.

Concentration

Package	Description
Concentration measurement and special density	<p>Calculation and outputting of fluid concentrations Many applications use density as a key measured value for monitoring quality or controlling processes. The device measures the density of the fluid as standard and makes this value available to the control system. The "Special Density" application package offers high-precision density measurement over a wide density and temperature range particularly for applications subject to varying process conditions.</p> <p>With the help of the "Concentration Measurement" application package, the measured density is used to calculate other process parameters:</p> <ul style="list-style-type: none"> ■ Temperature-compensated density (reference density). ■ Percentage mass of the individual substances in a two-phase fluid. (Concentration in %). ■ Fluid concentration is output with special units (°Brix, °Baumé, °API, etc.) for standard applications. <p>The measured values are output via the digital and analog outputs of the device.</p>

16.14 Accessories



Overview of accessories available for order → 84

16.15 Documentation



The following document types are available:

- On the CD-ROM supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Standard documentation

Communication	Document type	Documentation code
----	Brief Operating Instructions	KA01147D
----	Technical Information	TI01107D

Supplementary device-dependent documentation

Document type	Contents	Documentation code
Safety Instructions	ATEX/IECEX Ex i	XA00159D
	ATEX/IECEX Ex nA	XA01029D
	cCSAus IS	XA00160D
Special documentation	Information on the Pressure Equipment Directive	SD00142D
Special documentation	Modbus RS485 Register Information	SD00154D
Special documentation	Concentration Measurement	SD01152D
Special documentation	Viscosity Measurement	SD01151D
Special documentation	Heartbeat Technology	SD01153D
Installation Instructions		Specified for each individual accessory → 84 Overview of accessories available for order → 84









17 Appendix

17.1 Overview of the operating menu

The following graphic provides an overview of the entire operating menu structure with its menus, submenus and parameters. The page reference indicates where a description of the parameter can be found in the manual.



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

For the Order Code "Application Package", the associated parameters are described in the Special Documentation.

 Operation	→  102
 Setup	→  102
 Diagnostics	→  107
 Expert	→  110

17.1.1 "Operation" menu

Navigation  Operation

 Operation	→  62
Access status tooling	
Locking status	
▶ Totalizer handling	
Control Totalizer 1 to n	
Preset value 1 to n	
Reset all totalizers	

17.1.2 "Setup" menu

Navigation  Setup

 Setup	→  47
Device tag	→  48

► System units	→ 48
Mass flow unit	→ 49
Mass unit	→ 49
Volume flow unit	→ 49
Volume unit	→ 49
Corrected volume flow unit	→ 49
Corrected volume unit	→ 49
Density unit	→ 49
Reference density unit	→ 49
Temperature unit	→ 50
Pressure unit	→ 50
► Medium selection	→ 51
Select medium	→ 52
Select gas type	→ 52
Reference sound velocity	→ 52
Temperature coefficient sound velocity	→ 52
Pressure compensation	→ 52
Pressure value	→ 52
External pressure	→ 52
► Communication	→ 52
Bus address	→ 53
Baudrate	→ 53
Data transfer mode	→ 53
Parity	→ 53
Byte order	→ 53






Assign diagnostic behavior	→ 53
Failure mode	→ 53
► Low flow cut off	→ 54
Assign process variable	→ 54
On value low flow cutoff	→ 54
Off value low flow cutoff	→ 54
Pressure shock suppression	→ 54
► Partially filled pipe detection	→ 55
Assign process variable	→ 55
Low value partial filled pipe detection	→ 55
High value partial filled pipe detection	→ 55
Response time part. filled pipe detect.	→ 55
► Advanced setup	→ 56
Enter access code	→ 56
► Calculated values	→ 56
► Corrected volume flow calculation	
Corrected volume flow calculation	
External reference density	
Fixed reference density	
Reference temperature	
Linear expansion coefficient	
Square expansion coefficient	

► Sensor adjustment	→ 58
Installation direction	→ 58
► Zero point adjustment	→ 58
Zero point adjustment control	→ 59
Progress	→ 59
► Totalizer 1 to n	→ 59
Assign process variable	→ 59
Mass unit	
Volume unit	
Corrected volume unit	
Totalizer operation mode	→ 59
Failure mode	→ 59
► Viscosity	
► Temperature compensation	
Calculation model	
Reference temperature	
Compensation coefficient X 1	
Compensation coefficient X 2	
► Dynamic viscosity	
Dynamic viscosity unit	
User dynamic viscosity text	
User dynamic viscosity factor	
User dynamic viscosity offset	
► Kinematic viscosity	
Kinematic viscosity unit	

	User kinematic viscosity text	
	User kinematic viscosity factor	
	User kinematic viscosity offset	
► Concentration		
	Concentration unit	
	User concentration text	
	User concentration factor	
	User concentration offset	
	A 0	
	A 1	
	A 2	
	A 3	
	A 4	
	B 1	
	B 2	
	B 3	
► Heartbeat setup		
	► Heartbeat Monitoring	
	Activate monitoring	
► Administration		→ 59
	Device reset	→ 60

17.1.3 "Diagnostics" menu

Navigation  Diagnostics

 Diagnostics	→  75
Actual diagnostics	→  76
Timestamp	
Previous diagnostics	→  76
Timestamp	
Operating time from restart	
Operating time	
► Diagnostic list	
Diagnostics 1	
Timestamp	
Diagnostics 2	
Timestamp	
Diagnostics 3	
Timestamp	
Diagnostics 4	
Timestamp	
Diagnostics 5	
Timestamp	
► Event logbook	
Filter options	
► Device information	→  79
Device tag	
Serial number	

Firmware version	
Device name	
Order code	
Extended order code 1	
Extended order code 2	
Extended order code 3	
ENP version	
► Measured values	
► Process variables	→ ⓘ 62
Mass flow	→ ⓘ 63
Volume flow	→ ⓘ 63
Corrected volume flow	→ ⓘ 63
Density	→ ⓘ 63
Reference density	→ ⓘ 63
Temperature	→ ⓘ 63
Pressure value	→ ⓘ 63
Dynamic viscosity	
Kinematic viscosity	
Temp. compensated dynamic viscosity	
Temp. compensated kinematic viscosity	
Concentration	

Target mass flow	
Carrier mass flow	
► Totalizer	→ 59
Totalizer value 1 to n	→ 64
Totalizer overflow 1 to n	→ 64
► Heartbeat	
► Performing verification	
Year	
Month	
Day	
Hour	
AM/PM	
Minute	
Start verification	
Progress	
Status	
Overall result	
► Verification results	
Date/time	
Verification ID	
Operating time	
Overall result	
Sensor	

	Sensor integrity	
	Sensor electronic module	
	► Monitoring results	
	Sensor integrity	
► Simulation		→ 60
	Assign simulation process variable	→ 60
	Value process variable	→ 60
	Simulation device alarm	→ 60

17.1.4 "Expert" menu

The following tables provide an overview of the **Expert** menu with its submenus and parameters. The direct access code to the parameter is given in brackets. The page reference indicates where a description of the parameter can be found in the manual.

Navigation  Expert

 Expert
--

"System" submenu

Navigation   Expert → System



















► System
► Diagnostic handling
Alarm delay
► Diagnostic behavior
Assign behavior of diagnostic no. 140
Assign behavior of diagnostic no. 046
Assign behavior of diagnostic no. 144
Assign behavior of diagnostic no. 832
Assign behavior of diagnostic no. 833

Assign behavior of diagnostic no. 834	
Assign behavior of diagnostic no. 835	
Assign behavior of diagnostic no. 912	
Assign behavior of diagnostic no. 913	
Assign behavior of diagnostic no. 944	
Assign behavior of diagnostic no. 192	
Assign behavior of diagnostic no. 274	
Assign behavior of diagnostic no. 392	
Assign behavior of diagnostic no. 592	
Assign behavior of diagnostic no. 992	
► Administration	→ 59
Device reset	→ 60
Activate SW option	
Software option overview	
Permanent storage	
Device tag	

"Sensor" submenu

Navigation  Expert → Sensor

► Sensor	
► Measured values	
► Process variables	→ 62
Mass flow	→ 63
Volume flow	→ 63
Corrected volume flow	→ 63

	Density	→  63
	Reference density	→  63
	Temperature	→  63
	Pressure value	→  63
	Dynamic viscosity	
	Kinematic viscosity	
	Temp. compensated dynamic viscosity	
	Temp. compensated kinematic viscosity	
	Concentration	
	Target mass flow	
	Carrier mass flow	
	► Totalizer	→  63
	Totalizer value 1 to n	→  64
	Totalizer overflow 1 to n	→  64
	► System units	→  48
	Mass flow unit	→  49
	Mass unit	→  49
	Volume flow unit	→  49
	Volume unit	→  49
	Corrected volume flow unit	→  49
	Corrected volume unit	→  49
	Density unit	→  49
	Reference density unit	→  49
	Temperature unit	→  50
	Pressure unit	→  50

Date/time format		
► User-specific units		
User mass text		
User mass factor		
User volume text		
User volume factor		
User corrected volume text		
User corrected volume factor		
User density text		
User density offset		
User density factor		
User pressure text		
User pressure offset		
User pressure factor		
► Process parameters		
Flow damping		
Density damping		
Temperature damping		
Flow override		
► Low flow cut off		
Assign process variable		→ 54
On value low flow cutoff		→ 54

Off value low flow cutoff	→ 54
Pressure shock suppression	→ 54
► Partially filled pipe detection	→ 55
Assign process variable	→ 55
Low value partial filled pipe detection	→ 55
High value partial filled pipe detection	→ 55
Response time part. filled pipe detect.	→ 55
Maximum damping partial filled pipe det.	
► Measurement mode	
Select medium	
Select gas type	
Reference sound velocity	
Temperature coefficient sound velocity	
► External compensation	
Pressure compensation	
Pressure value	
External pressure	
Temperature mode	
External temperature	
► Calculated values	→ 56
► Corrected volume flow calculation	
Corrected volume flow calculation	
External reference density	
Fixed reference density	

	Reference temperature	
	Linear expansion coefficient	
	Square expansion coefficient	
► Sensor adjustment		→ 58
	Installation direction	→ 58
► Zero point adjustment		→ 58
	Zero point adjustment control	→ 59
	Progress	→ 59
► Process variable adjustment		
	Mass flow offset	
	Mass flow factor	
	Volume flow offset	
	Volume flow factor	
	Density offset	
	Density factor	
	Corrected volume flow offset	
	Corrected volume flow factor	
	Reference density offset	
	Reference density factor	
	Temperature offset	
	Temperature factor	
► Calibration		
	Calibration factor	
	Zero point	

Nominal diameter

C0 to 5

► Testpoints

Oscillation frequency 0 to 1

Frequency fluctuation 0 to 1

Oscillation amplitude 0 to 1

Oscillation damping 0 to 1

Tube damping fluctuation 0 to 1

Signal asymmetry

Electronic temperature

Carrier pipe temperature

Exciter current 0 to 1

RawMassFlow

► Supervision

Limit value measuring tube damping

"Current input" submenu

Navigation  Expert → Input → Current input

► Input

► Status input

Assign status input

Value status input

Active level

Response time status input

► Output

► Pulse/frequency/switch output
1 to n

Operating mode

Channel 2

Assign pulse output

Value per pulse

Pulse width

Measuring mode

Failure mode

Pulse output

Assign frequency output

Minimum frequency value

Maximum frequency value

Measuring value at maximum
frequency

Measuring mode

Damping output

Failure mode

Failure frequency

Output frequency

Switch output function

Assign diagnostic behavior

Assign limit

Switch-on value

Switch-off value

Assign flow direction check

Assign status

Failure mode

Switch status

Invert output signal

► Communication

► Modbus configuration

Bus address

Baudrate

Data transfer mode

Parity

Byte order

Telegram delay

Assign diagnostic behavior

Failure mode

Interpreter mode

► Modbus information

Device ID

Device revision

► Modbus data map

Scan list register 0 to 15

► Application	
Reset all totalizers	
► Totalizer 1 to n	→ 59
Assign process variable	→ 59
Mass unit	
Volume unit	
Corrected volume unit	
Totalizer operation mode	→ 59
Control Totalizer 1 to n	
Preset value 1 to n	
Failure mode	→ 59
► Viscosity	
Viscosity damping	
► Temperature compensation	
Calculation model	
Reference temperature	
Compensation coefficient X 1	
Compensation coefficient X 2	
► Dynamic viscosity	
Dynamic viscosity unit	
User dynamic viscosity text	

User dynamic viscosity factor

User dynamic viscosity offset

► Kinematic viscosity

Kinematic viscosity unit

User kinematic viscosity text

User kinematic viscosity factor

User kinematic viscosity offset

► Concentration

Concentration damping

Concentration unit

User concentration text

User concentration factor

User concentration offset

A 0

A 1

A 2

A 3

A 4

B 1

B 2

B 3

► Diagnostics

Actual diagnostics

Timestamp

Previous diagnostics

Timestamp

Operating time from restart

Operating time

► Diagnostic list

Diagnostics 1

Timestamp

Diagnostics 2

Timestamp

Diagnostics 3

Timestamp

Diagnostics 4

Timestamp

Diagnostics 5

Timestamp

► Event logbook

Filter options

► Device information

Device tag

Serial number

Firmware version

Device name

Order code

Extended order code 1

Extended order code 2

Extended order code 3

ENP version

Configuration counter

▶ Min/max values

Reset min/max values

▶ Electronic temperature

Minimum value

Maximum value

▶ Medium temperature

Minimum value

Maximum value

▶ Carrier pipe temperature

Minimum value

Maximum value

▶ Oscillation frequency

Minimum value

Maximum value

▶ Torsion oscillation frequency

Minimum value

Maximum value

▶ Oscillation amplitude

Minimum value

Maximum value

► Torsion oscillation amplitude

Minimum value

Maximum value

► Oscillation damping

Minimum value

Maximum value

► Torsion oscillation damping

Minimum value

Maximum value

► Signal asymmetry

Minimum value

Maximum value

► Heartbeat

► Performing verification

Year

Month

Day

Hour

AM/PM

Minute

Start verification

Progress

Status

Overall result

► Verification results

Date/time

Verification ID

Operating time

Overall result

Sensor

Sensor integrity

Sensor electronic module

I/O module

► Heartbeat Monitoring

Activate monitoring

► Monitoring results

Sensor integrity

► Simulation

Assign simulation process variable

Value process variable

Simulation device alarm

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