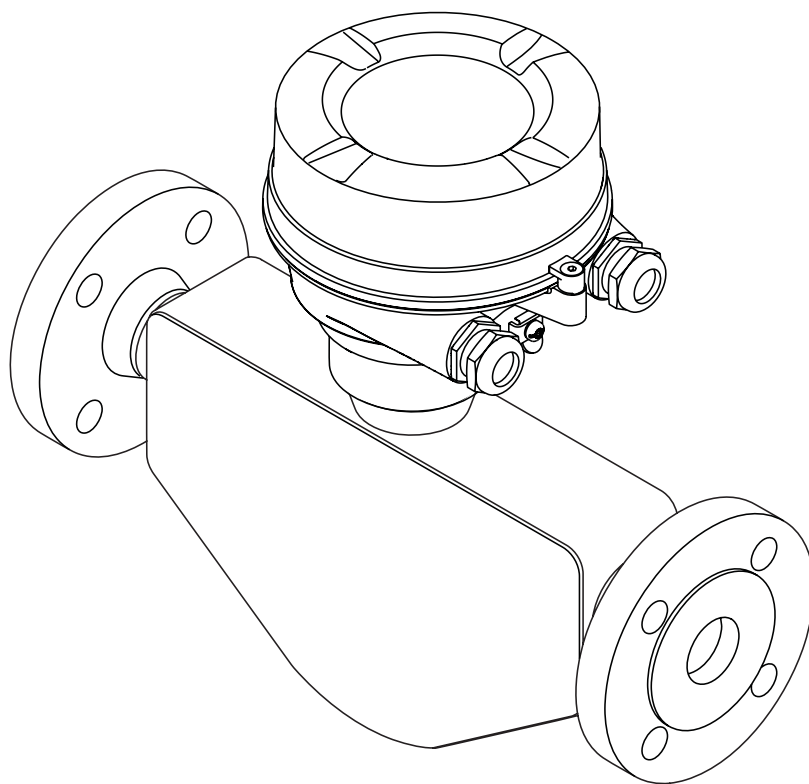


Proline Promass E 100 Modbus RS485 Coriolis Flowmeter

Operating Instructions Manual

BA01658O/06/EN/01.16

Valid as of version 01.02 zz (Device firmware)



- 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.

Important

All information and technical specifications in this documentation have been carefully checked and compiled by the author. However, we cannot completely exclude the possibility of errors. TechnipFMC is always grateful to be informed of any errors. Contact us on the website.

Smith Meter® is a registered trademark of TechnipFMC.

Technical Support

Contact Information:

Field Service Response Center

24/7 Technical Support/Schedule a Technician: 1-844-798-3819

System Installation Supervision, Start-Up, and Commissioning Services Available

Customer Support

Contact Information:

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TechnipFMC.com

Literature Library:

<http://fmctechnologies.com/en/MeasurementSolutions/OnlineServices.aspx>

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











1.2.2 Electrical symbols

| Symbol | Meaning |
|---|--|
|  A0011197 | Direct current A terminal to which DC voltage is applied or through which direct current flows. |
|  A0011198 | Alternating current A terminal to which alternating voltage is applied or through which alternating current flows. |
|  A0017381 | Direct current and alternating current <ul style="list-style-type: none"> ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows. |
|  A0011200 | Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |
|  A0011199 | Protective ground connection A terminal which must be connected to ground prior to establishing any other connections. |
|  A0011201 | Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice. |



1.2.3 Tool symbols



| Symbol | Meaning |
|---|-------------------|
|  A0011221 | Allen key |
|  A0011222 | Open-ended wrench |

1.2.4 Symbols for certain types of information




| Symbol | Meaning |
|---|--|
|  A0011182 | Allowed Indicates procedures, processes or actions that are allowed. |
|  A0011183 | Preferred Indicates procedures, processes or actions that are preferred. |
|  A0011184 | Forbidden Indicates procedures, processes or actions that are forbidden. |
|  A0011193 | Tip Indicates additional information. |
|  A0011194 | Reference to documentation Refers to the corresponding device documentation. |
|  A0011195 | Reference to page Refers to the corresponding page number. |
|  A0011196 | Reference to graphic Refers to the corresponding graphic number and page number. |
|  | Series of steps |
|  | Result of a sequence of actions |
|  A0013562 | Help in the event of a problem |

1.2.5 Symbols in graphics

| Symbol | Meaning |
|---|-----------------|
| 1, 2, 3,... | Item numbers |
|  | Series of steps |
| A, B, C, ... | Views |
| A-A, B-B, C-C, ... | Sections |
|  A0013441 | Flow direction |

| Symbol | Meaning |
|---|--|
|  A0011187 | Hazardous area Indicates a hazardous area. |
|  A0011188 | Safe area (non-hazardous area) Indicates a non-hazardous area. |

1.3 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
-  For a detailed list of the individual documents along with the documentation code →  96

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.

TRI-CLAMP®

Registered trademark of Ladish & Co., Inc., Kenosha, 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 device documentation provided (on the CD-ROM) is absolutely essential.

Incorrect use

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

WARNING

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.

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

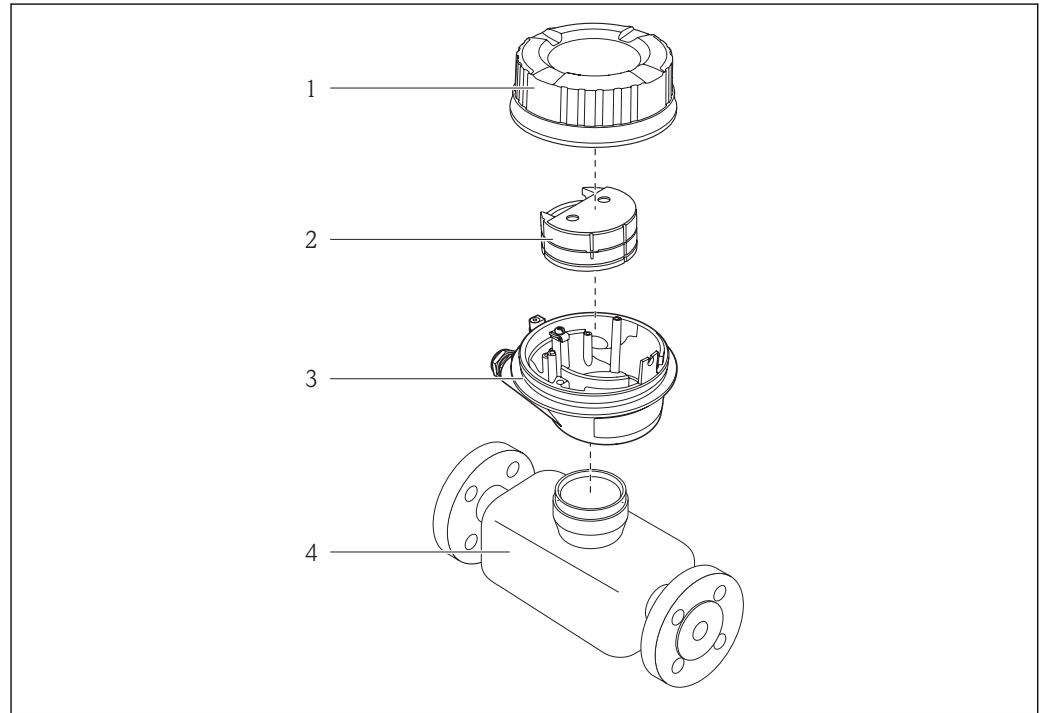
This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which they are safe to operate.

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.

3 Product description

3.1 Product design

3.1.1 Device version with Modbus RS485 communication type



A0017609

1 Important components of a measuring device

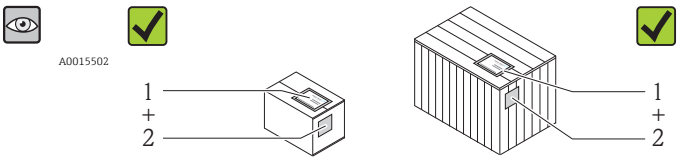
- 1 Transmitter housing cover
- 2 Main electronics module for Modbus RS485
- 3 Transmitter housing
- 4 Sensor



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

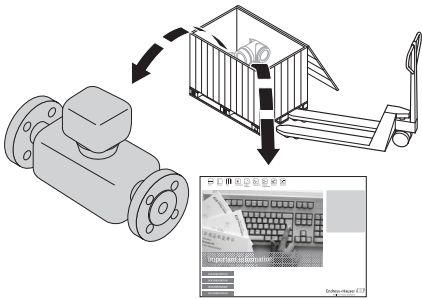
4 Incoming acceptance and product identification

4.1 Incoming acceptance

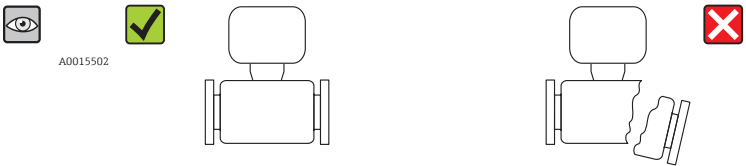


A0013843

Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?

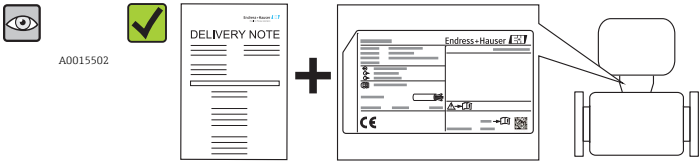


A0013695



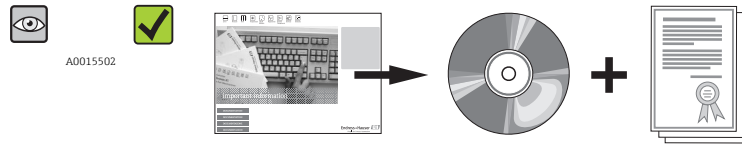
A0013698

Are the goods undamaged?



A0013699

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



A0013697

Is the CD-ROM with the Technical Documentation and documents present?



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

4.2 Product identification

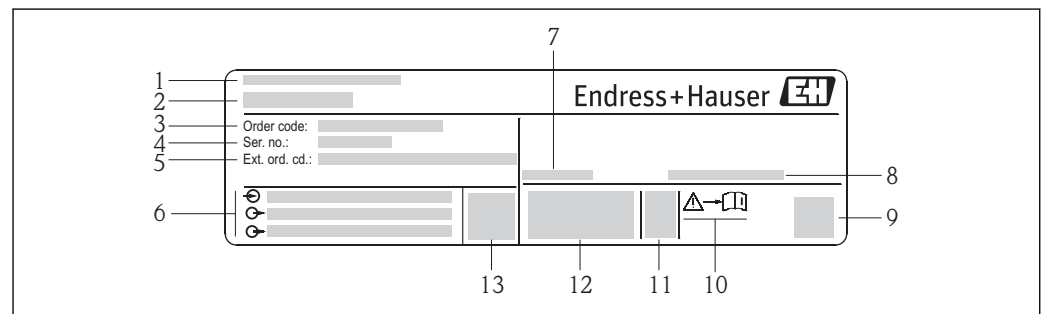
The following options are available for identification of the measuring device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All information about the measuring device is displayed.

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

- The "Additional standard documentation on the device" → 7 and "Supplementary device-dependent documentation" → 7 sections
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)

4.2.1 Transmitter nameplate

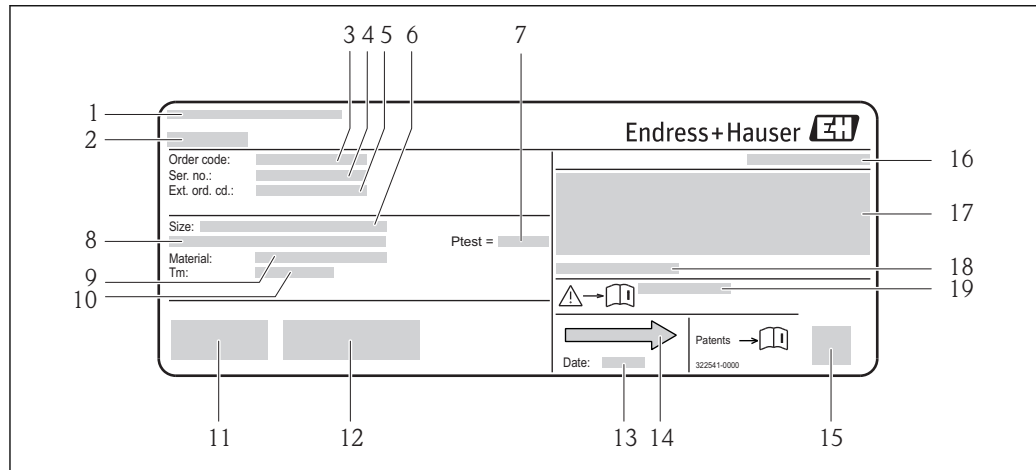


A0017520


2 Example of a transmitter nameplate


- 1 Manufacturing location
- 2 Name of the transmitter
- 3 Order code
- 4 Serial number
- 5 Extended order code
- 6 Electrical connection data, e.g. available inputs and outputs, supply voltage
- 7 Permitted ambient temperature range (T_a)
- 8 Degree of protection
- 9 2-D matrix code
- 10 Document number of safety-related supplementary documentation → 96
- 11 Manufacturing date: year-month
- 12 CE mark, C-Tick
- 13 Firmware version (FW)

4.2.2 Sensor nameplate



A0013907

 3 Example of a sensor nameplate

- 1 Manufacturing location
- 2 Name of the sensor
- 3 Order code
- 4 Serial number (Ser. no.)
- 5 Extended order code (Ext. ord. cd.)
- 6 Nominal diameter of the sensor
- 7 Test pressure of the sensor
- 8 Flange nominal diameter/nominal pressure
- 9 Material of measuring tube and manifold
- 10 Medium temperature range
- 11 CE mark, C-Tick
- 12 Additional information on version: certificates, approvals
- 13 Manufacturing date: year-month
- 14 Flow direction
- 15 2-D matrix code
- 16 Degree of protection
- 17 Approval information for explosion protection and Pressure Equipment Directive
- 18 Permitted ambient temperature (T_a)
- 19 Document number of safety-related supplementary documentation →  96



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 +).

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 fouling in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Storage temperature: -40 to $+80$ °C (-40 to $+176$ °F), preferable for $+20$ °C ($+68$ °F)
- Store in a dry and dust-free place.
- Do not store outdoors.

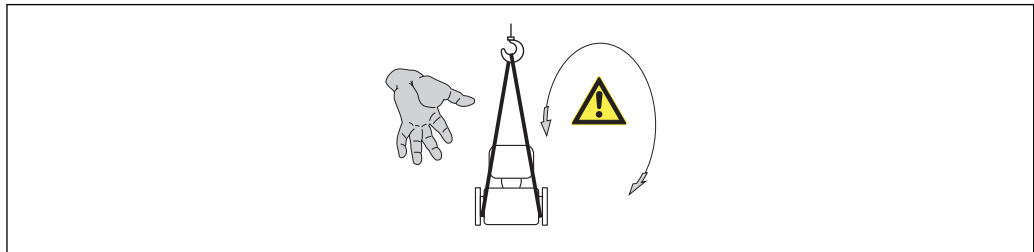
5.2 Transporting the product

⚠ 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 from rotating or slipping.
- ▶ Observe the weight specified on the packaging (stick-on label).
- ▶ Observe the transport instructions on the stick-on label on the electronics compartment cover.



A0015606

Observe the following notes during transport:

- Transport the measuring device to the measuring point in the original packaging.
- Lifting gear
 - Webbing slings: Do not use chains, as they could damage the housing.
 - For wood crates, the floor structure enables these to be loaded lengthwise or broadside using a forklift.
- For measuring device > DN 40 (1½ in): lift the measuring device using the webbing slings at the process connections; do not lift at the transmitter housing.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and fouling in the measuring tube.

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

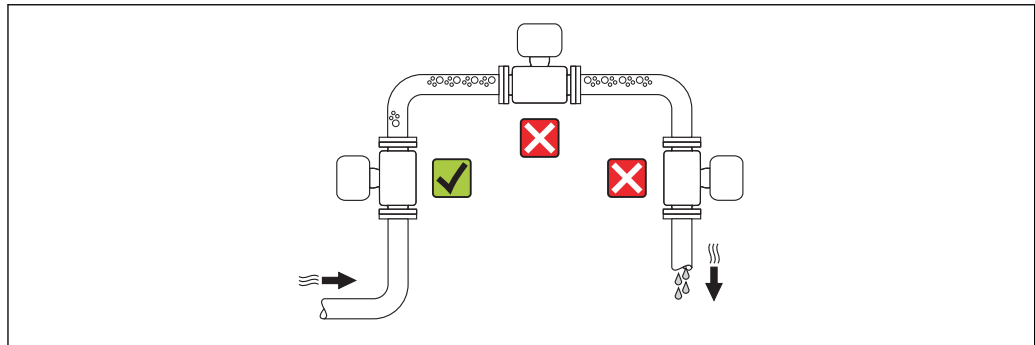
No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

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:

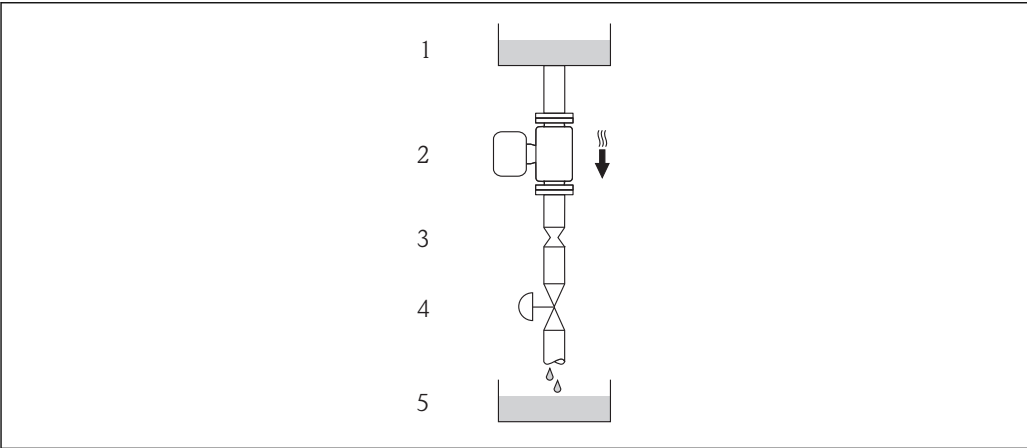
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.



A0015595

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

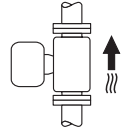
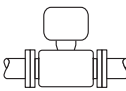
5 Installation in a down pipe (e.g. for batching applications)

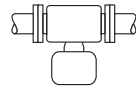

- 1 Supply tank
- 2 Sensor
- 3 Orifice plate, pipe restriction
- 4 Valve
- 5 Batching tank

| DN | | Ø orifice plate, pipe restriction | |
|------|----------------|-----------------------------------|------|
| [mm] | [in] | [mm] | [in] |
| 8 | $\frac{3}{8}$ | 6 | 0.24 |
| 15 | $\frac{1}{2}$ | 10 | 0.40 |
| 25 | 1 | 14 | 0.55 |
| 40 | $1\frac{1}{2}$ | 22 | 0.87 |
| 50 | 2 | 28 | 1.10 |
| 80 | 3 | 50 | 1.97 |

Orientation

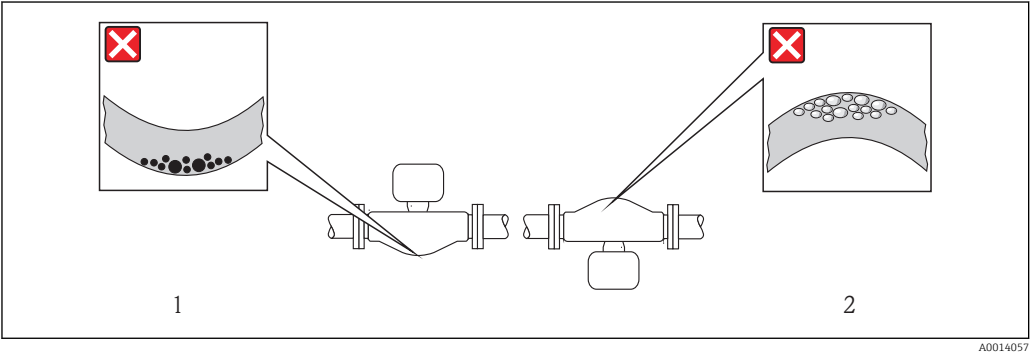
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

| Orientation | | | Recommendation |
|-------------|---|---|--|
| A | Vertical orientation |  A0015591 | ✓✓ |
| B | Horizontal orientation, transmitter head up |  A0015589 | ✓✓✓ ¹⁾ Exception: → 6, 20 |

| Orientation | | | Recommendation |
|-------------|--|--|---|
| C | Horizontal orientation, transmitter head down |  A0015590 | ✓✓ ²⁾ Exception: → 6, 20 |
| D | Horizontal orientation, transmitter head at side |  A0015592 | ✗ |

- 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.

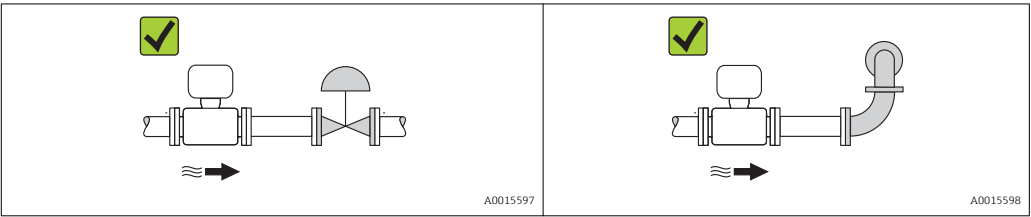
If a sensor is installed horizontally with a curved measuring tube, match the position of the sensor to the fluid properties.



- 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 → 21.



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 | <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) |
| 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

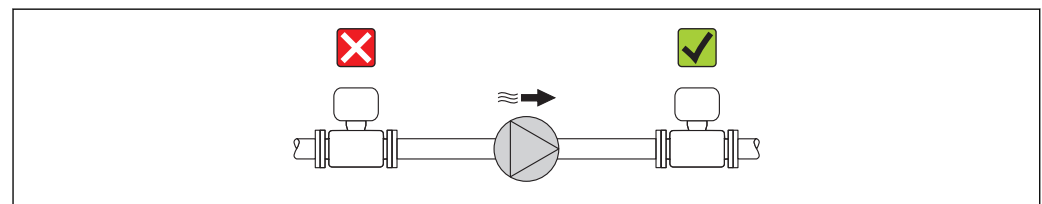
It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas.

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)



A0015594

Heating

NOTICE

Electronics can overheat due to elevated ambient temperature!

- ▶ Observe maximum permitted ambient temperature for the transmitter → 21.
- ▶ Depending on the fluid temperature, take the device orientation requirements into account.

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 $d \geq 0.35 \text{ mm}$ ($d \geq 0.014 \text{ in}$)

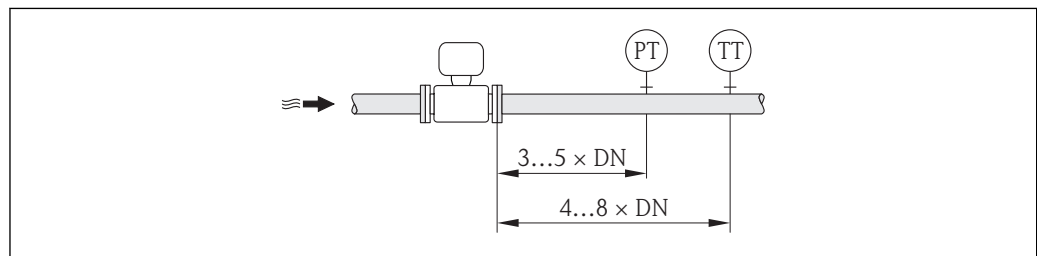
Vibrations

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

Outlet run for peripheral device

If a pressure and temperature measuring device are installed downstream from the measuring device, make sure there is sufficient distance between the two devices.

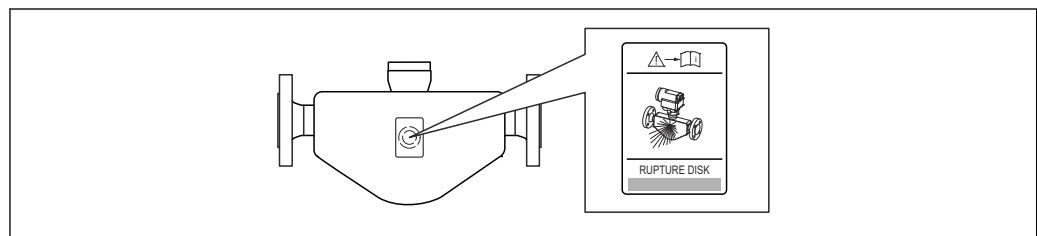


A0016893

PT Pressure transmitter
TT Temperature transmitter

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 applied over it. If the rupture disk is triggered, the sticker is destroyed. The disk can therefore be visually monitored. For additional information that is relevant to the process → 90.



A0007823

7 Rupture disk label


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

⚠ 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. The zero point obtained in this way is printed on the nameplate of the measuring device. Calibration takes place under reference conditions →  85. 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 very low flow rates
- Under extreme process or operating conditions, e.g.:
 - high process temperature ($> 50\text{ °C}$ (122 °F))
 - high viscosity ($> 100\text{ cSt}$)
 - high process pressure ($> 20\text{ bar}$ (290 psi))

6.2 Mounting the measuring device

6.2.1 Required tools

For sensor

For flanges and other process connections: Corresponding mounting tools

6.2.2 Preparing the measuring device

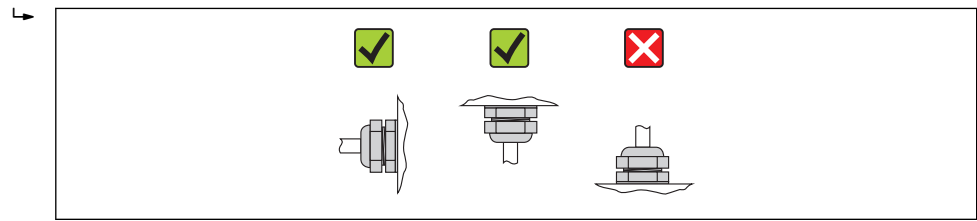
1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.
3. If present, remove transport protection of the rupture disk.
4. Remove stick-on label on the electronics compartment cover.

6.2.3 Mounting the measuring device

⚠ WARNING**Danger due to improper process sealing!**

- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
 - ▶ Ensure that the 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.



A0013964

6.3 Post-installation check

| | |
|---|---|
| Is the device damaged (visual inspection)? | → |
| Does the measuring device conform to the measuring point specifications? For example: <ul style="list-style-type: none"> ■ Process temperature → 89 ■ Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document) ■ Ambient temperature → 21 ■ Measuring range → 80 | → |
| 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) | → |
| Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping → 19? | → |
| Are the measuring point identification and labeling correct (visual inspection)? | → |
| Is the device adequately protected from precipitation and direct sunlight? | → |
| Are the securing screw and securing clamp tightened securely? | → |

7 Electrical connection

7.1 Connection conditions

7.1.1 Required tools

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

7.1.2 Requirements for connecting cable

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

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

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

Power supply cable

Standard installation cable is sufficient.

Signal cable

Modbus RS485


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

| | |
|---------------------------------|--|
| Cable type | A |
| Characteristic impedance | 135 to 165 Ω at a measuring frequency of 3 to 20 MHz |
| Cable capacitance | <30 pF/m |
| Wire cross-section | >0.34 mm ² (22 AWG) |
| Cable type | Twisted pairs |
| Loop resistance | $\leq 110\text{ }\Omega/\text{km}$ |
| Signal damping | Max. 9 dB over the entire length of the cable cross-section |
| Shielding | 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 →  96.

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

Cable diameter

- Cable glands supplied:
M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- With Safety Barrier Promass 100:
Plug-in screw terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

7.1.3 Terminal assignment

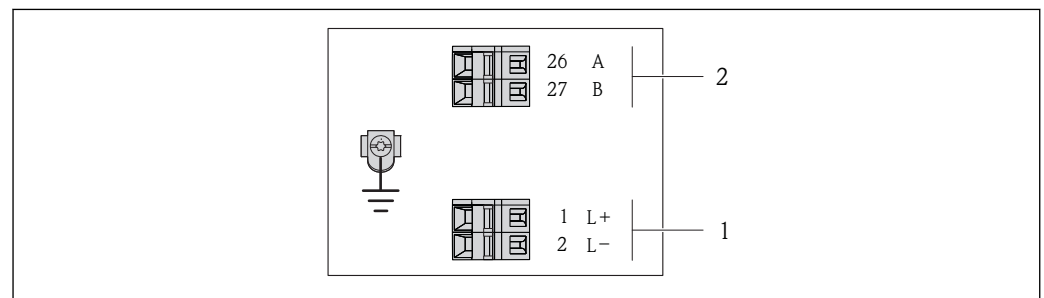
Transmitter

Connection version *Modbus RS485*, for use in non-hazardous areas 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 for "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 plug → 29 | 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 |
| Options A, B, C | Device plug → 29 | Device plug → 29 | Option Q : 2 x plug M12x1 |
| Order code for "Housing": <ul style="list-style-type: none"> Option A: compact, coated alu Option B: compact hygienic, stainless Option C: ultra compact hygienic, stainless, M12 device plug | | | |



A0019528

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 Output: Modbus RS485

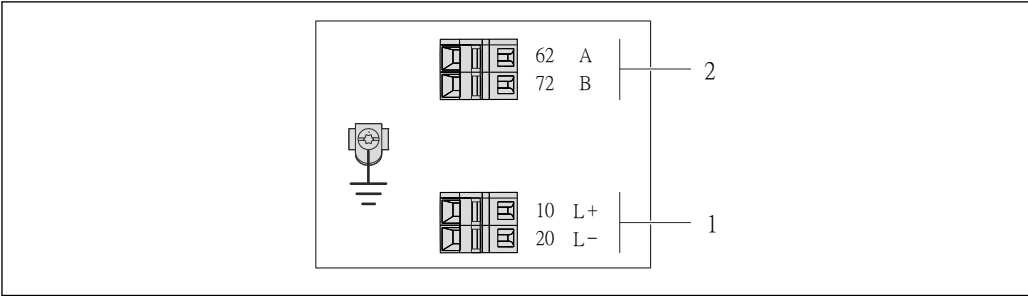
| Order code for "Output" | Terminal number | | | |
|--|-----------------|--------|--------------|--------|
| | Power supply | | Output | |
| | 2 (L-) | 1 (L+) | 27 (B) | 26 (A) |
| Option M | 24 DC V | | Modbus RS485 | |
| Order code for "Output": Option M : Modbus RS485, for use in non-hazardous areas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

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

Order code for "Output", option **M**: Modbus R485, for use in intrinsically safe areas (connection via Safety Barrier Promass 100)

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

| Order code for "Housing" | Connection methods available | | Possible options for order code "Electrical connection" |
|---|---|--------------|---|
| | Output | Power supply | |
| Options A, B | Terminals | Terminals | <div>■ Option A: coupling M20x1</div> <div>■ Option B: thread M20x1</div> <div>■ Option C: thread G ½"</div> <div>■ Option D: thread NPT ½"</div> |
| A, B, C | Device plug →  29 | | Option I: plug M12x1 |
| Order code for "Housing": <div>■ Option A: compact, coated alu</div> <div>■ Option B: compact hygienic, stainless</div> <div>■ Option C: ultra compact hygienic, stainless, M12 device plug</div> | | | |



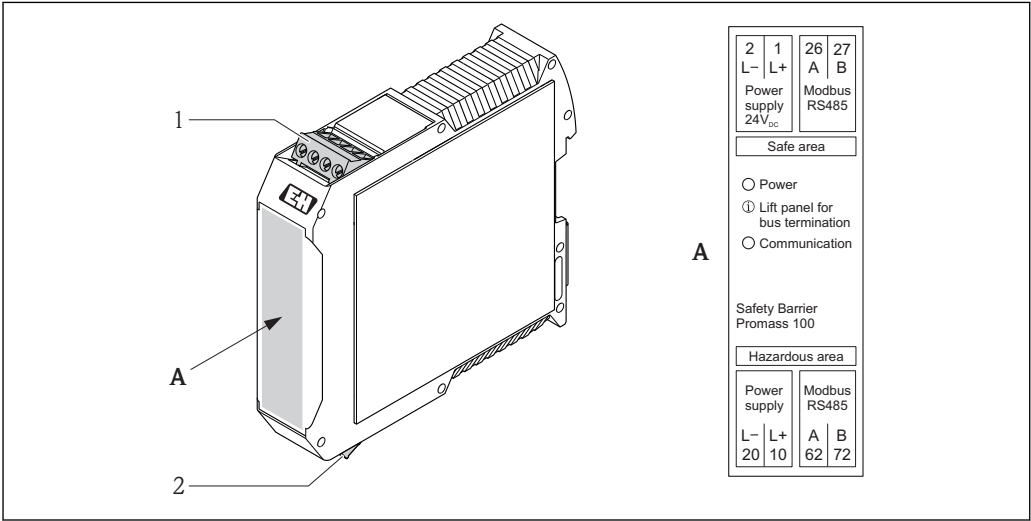
9 Modbus RS485 terminal assignment, connection version for use in intrinsically safe areas (connection via Safety Barrier Promass 100)

1 Intrinsically safe power supply

2 Output: Modbus RS485

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

Safety Barrier Promass 100



10 Safety Barrier Promass 100 with terminals

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

7.1.4 Pin assignment, device plug

Modbus RS485

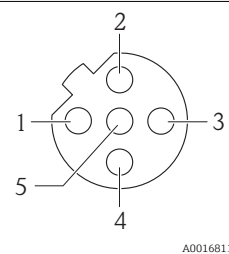
Modbus RS485 intrinsically safe with supply voltage (on the device side)

| | Pin | Assignment | Coding | Plug/socket |
|--|-----|---------------------|--------|-------------|
| | 1 | L+ | A | Plug |
| | 2 | A | | |
| | 3 | B | | |
| | 4 | L- | | |
| | 5 | Grounding/shielding | | |

Supply voltage for Modbus RS485, non-hazardous area and Zone 2/Div. 2 (on the device side)

| | Pin | Assignment | Coding | Plug/socket |
|--|-----|---------------------|--------|-------------|
| | 1 | L+ | A | Plug |
| | 2 | | | |
| | 3 | | | |
| | 4 | L- | | |
| | 5 | Grounding/shielding | | |

Modbus RS485, non-hazardous areas and zone 2/Div. 2 (on the device side)

|  | Pin | Assignment | Coding | Plug/socket |
|---|-----|------------|--------|-------------|
| | 1 | | B | Socket |
| | 2 | A | | |
| | 3 | | | |
| | 4 | B | | |
| | 5 | | | |

7.1.5 Shielding and grounding

The shielding and grounding concept requires compliance with the following:

- Electromagnetic compatibility (EMC)
- Explosion protection
- Personal protection equipment
- National installation regulations and guidelines
- Observe cable specification → 25.
- Keep the stripped and twisted lengths of cable shield to the ground terminal as short as possible.
- Seamless cable shielding.

Grounding of the cable shield

To comply with EMC requirements:

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

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.

7.1.6 Preparing the measuring device

1. Remove dummy plug if present.

2. NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

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

If measuring device is delivered without cable glands:

Provide suitable cable gland for corresponding connecting cable → 25.

3. If measuring device is delivered with cable glands:

Observe cable specification → 25.

7.2 Connecting the measuring device

NOTICE

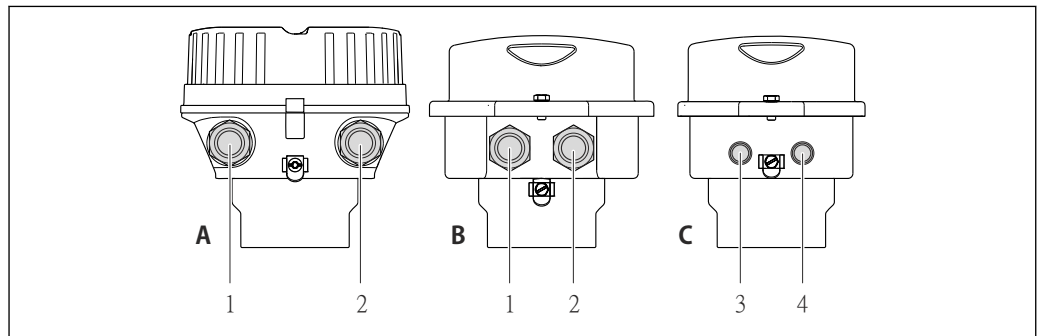
Limitation of electrical safety due to incorrect connection!

- ▶ Have electrical connection work carried out by correspondingly trained specialists only.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.
- ▶ For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

7.2.1 Connecting the transmitter

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

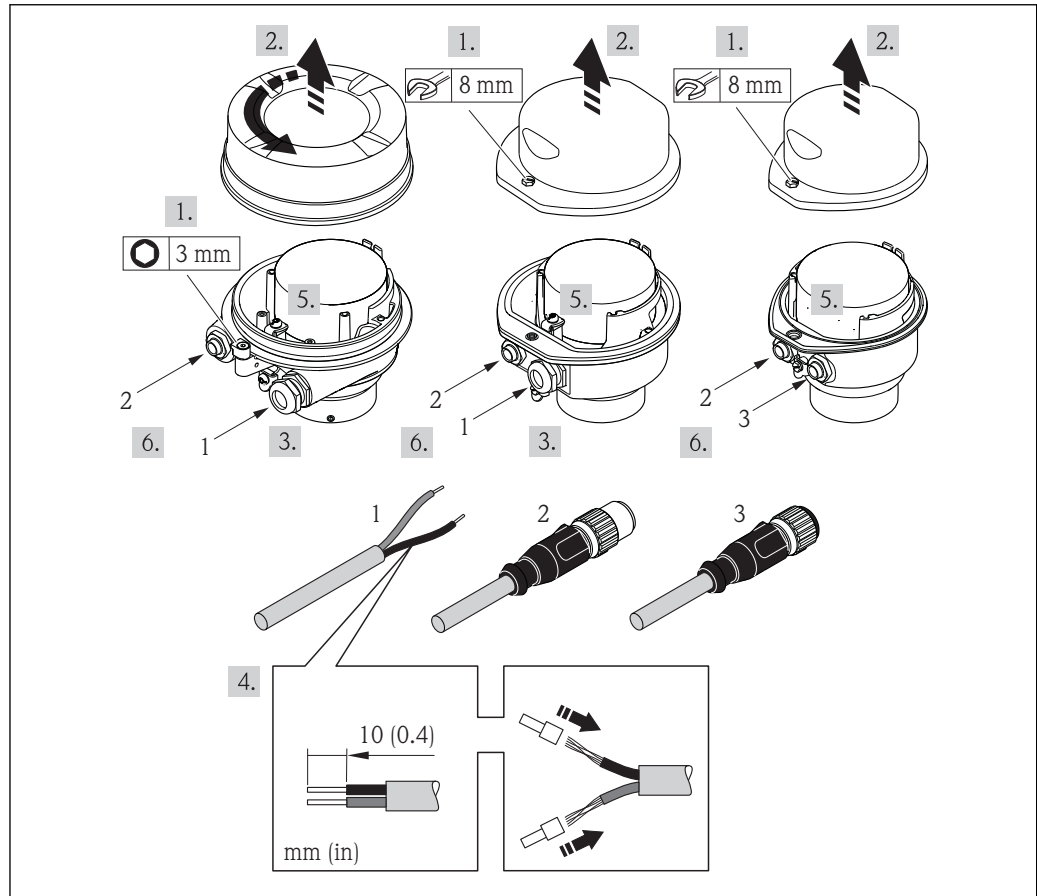
- Housing version: compact or ultracompact
- Connection version: device plug or terminals



A0016924

11 Device versions and connection versions

- A Housing version: compact, aluminum coated
- B Housing version: compact hygienic, stainless
- 1 Cable entry or device plug for signal transmission
- 2 Cable entry or device plug for supply voltage
- C Housing version: ultra-compact hygienic, stainless, device plug M12
- 3 Device plug for signal transmission
- 4 Device plug for supply voltage



A0017844

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: only pay attention to Step 6.

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 → 29.
6. Depending on the device version: tighten the cable glands or plug in the device plug and tighten → 29.
7. Enable the terminating resistor if applicable → 33.
8. **NOTICE**

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

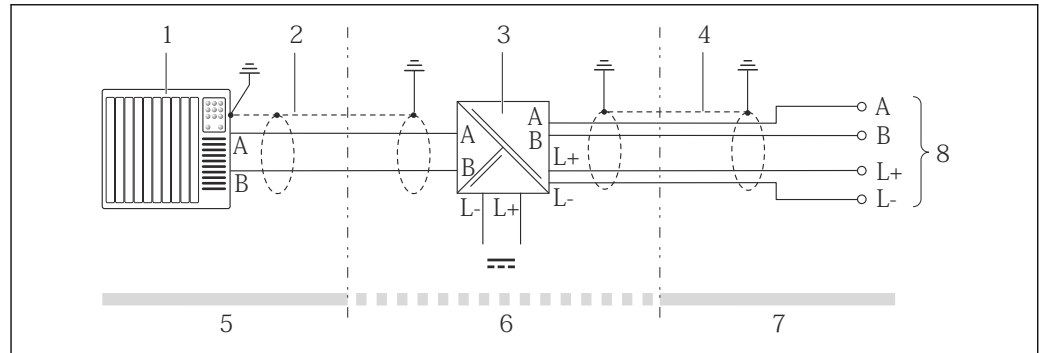
- Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

Reverse the removal procedure to reassemble the transmitter.

7.2.2 Connecting the Safety Barrier Promass 100

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

1. Strip the cable ends. In the case of stranded cables, also fit ferrules.
2. Connect the cable in accordance with the terminal assignment → 29.
3. Where applicable, enable the terminating resistor in the Safety Barrier Promass 100 → 33.



13 Electrical connection between the transmitter and Safety Barrier Promass 100

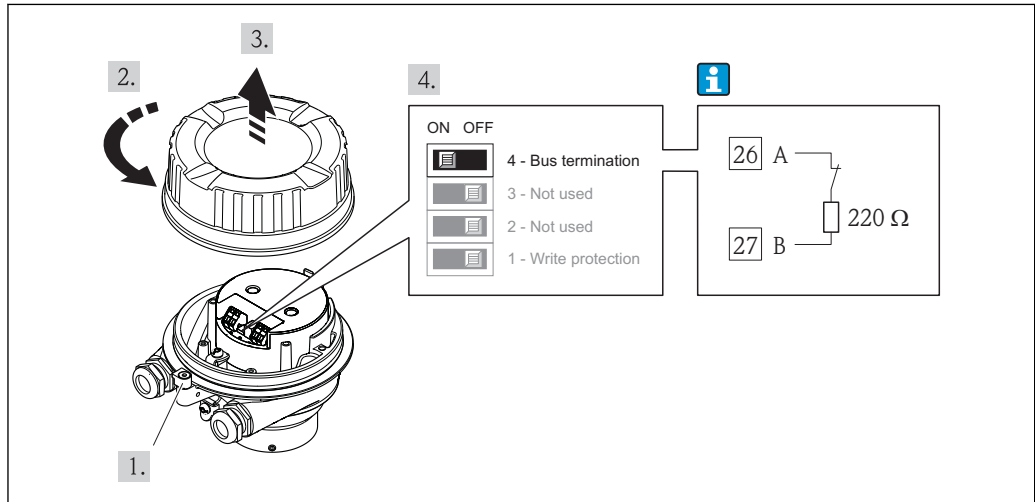
- 1 Control system (e.g. PLC)
- 2 Observe cable specification
- 3 Safety Barrier Promass 100: terminal assignment → 29
- 4 Observe cable specification → 25
- 5 Non-hazardous area
- 6 Non-hazardous area and Zone 2/Div. 2
- 7 Intrinsically safe area
- 8 Transmitter: terminal assignment

7.3 Hardware settings

7.3.1 Enabling the terminating resistor

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

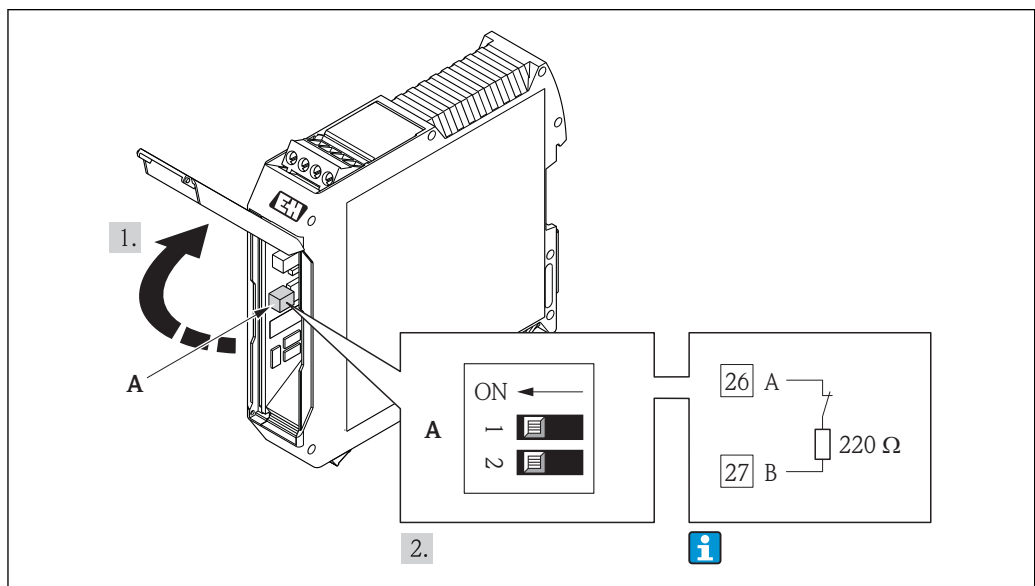
If the transmitter is used in the non-hazardous area or Zone 2/Div. 2



A0017610

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

If the transmitter is used in the intrinsically safe area



A0017791

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

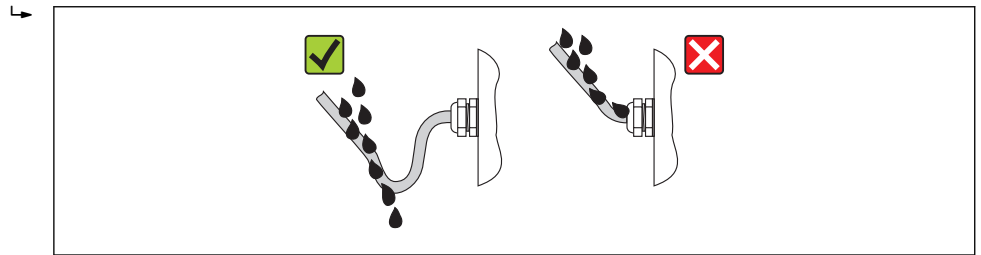
7.4 Ensuring the degree of protection

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

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

1. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
2. Tighten all housing screws and screw covers.

3. Firmly tighten the cable glands.
4. To ensure that moisture does not enter the cable entry, route the cable so that it loops down before the cable entry ("water trap").



A0013960

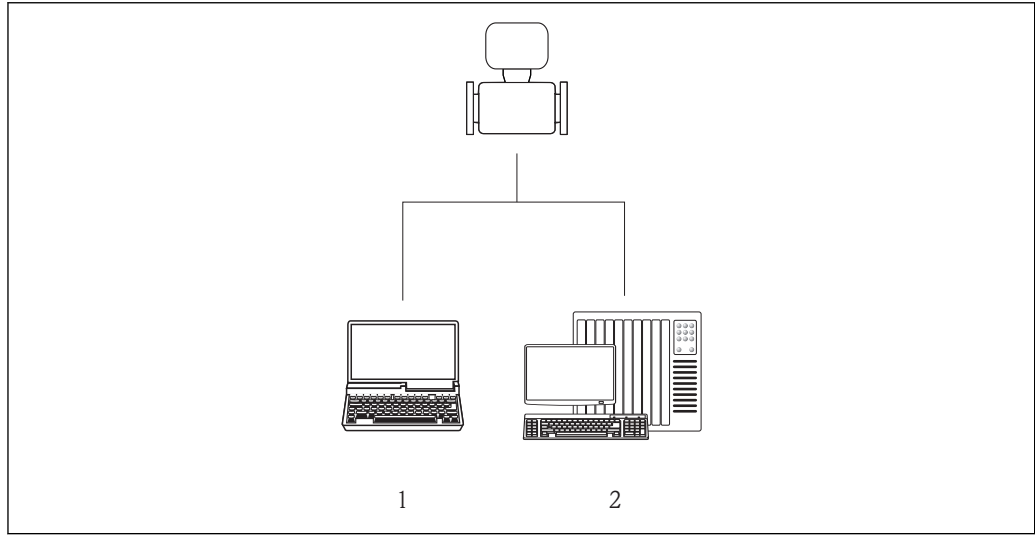
5. Insert dummy plugs into unused cable entries.

7.5 Post-connection check

| | |
|--|--------------------------|
| Are cables or the device undamaged (visual inspection)? | <input type="checkbox"/> |
| Do the cables comply with the requirements → 25? | <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" → 34? | <input type="checkbox"/> |
| Depending on the device version: are all the device plugs firmly tightened → 31? | <input type="checkbox"/> |
| <ul style="list-style-type: none"> ■ Does the supply voltage match the specifications on the transmitter nameplate → 84? ■ For device version with Modbus RS485 intrinsically safe: does the supply voltage match the specifications on the nameplate of the Safety Barrier Promass 100 → 84? | <input type="checkbox"/> |
| Is the terminal assignment or the pin assignment of the device plug → 29 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 → 11? ■ For device version with Modbus RS485 intrinsically safe, if supply voltage is present, is the power LED on the Safety Barrier Promass 100 lit → 11? | <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



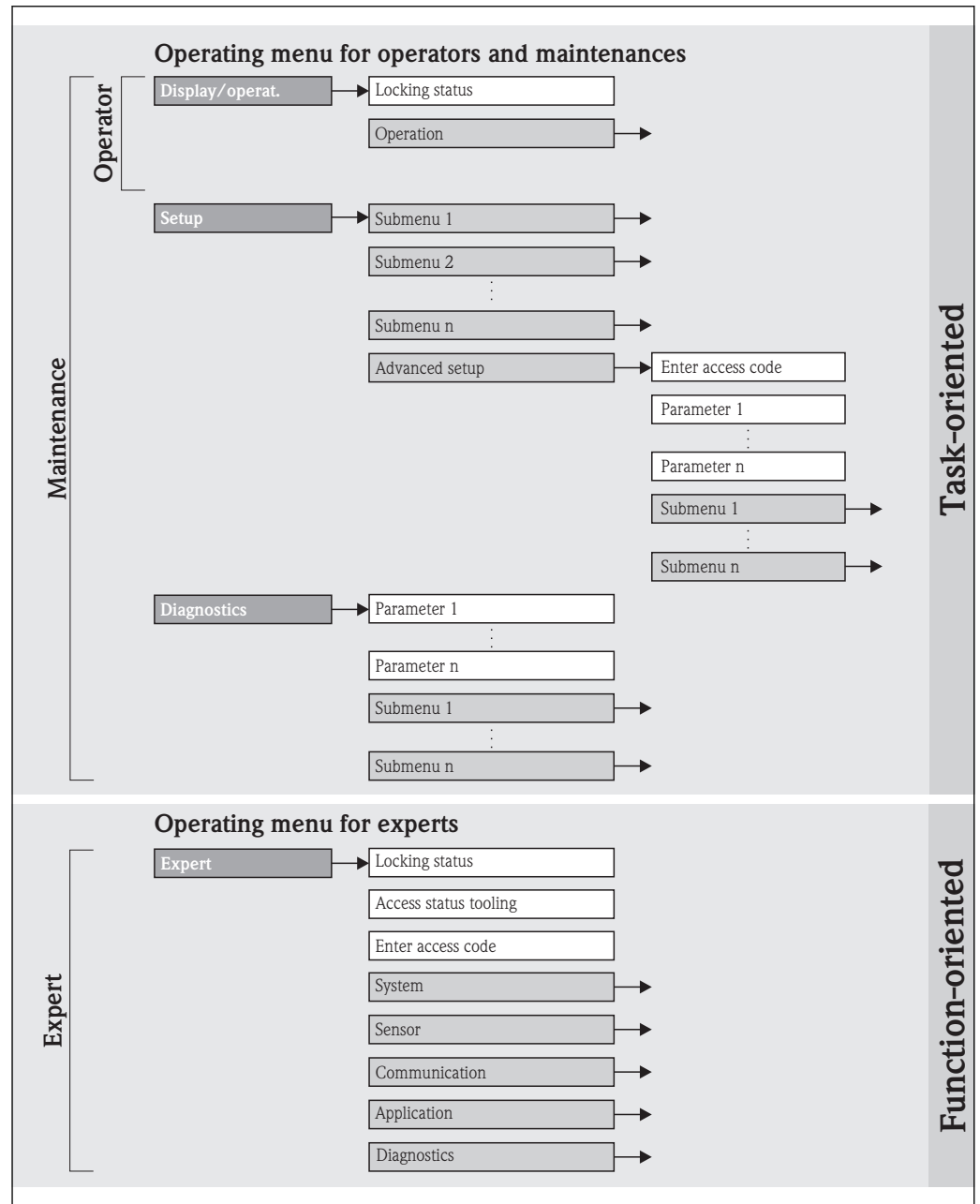
A0017760

- 1 Computer with "FieldCare" operating tool via Commubox FXA291 and service interface (CDI)
- 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 →  97



A0016726-EN

 16 Taking the example of the "FieldCare" operating tool

8.2.2 Operating philosophy

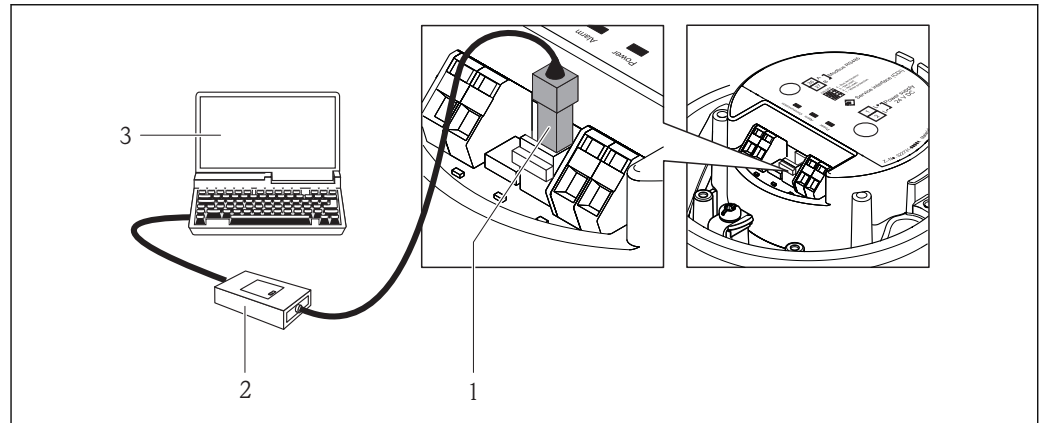
The individual parts of the operating menu are assigned to certain user roles. Each user role corresponds to typical tasks within the device lifecycle.

| Menu | | User role and tasks | Content/meaning |
|-----------------|-------------------|---|---|
| Display/operat. | 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 the monitoring of 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 |
| 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. ■ "Device reset" submenu Resets the device configuration to certain settings |
| 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 Contains all parameters for configuring the measurement. ■ "Communication" submenu Contains all parameters for configuring the digital communication interface. ■ "Application" submenu Contains all parameters for configuring the functions that go beyond the actual measurement (e.g. totalizer). ■ "Diagnostics" submenu Contains all parameters for error detection and analyzing process and device errors and for device simulation. |

8.3 Access to the operating menu via the operating tool

8.3.1 Connecting the operating tool

Via service interface (CDI)



- 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 units 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 → 39

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 → 41

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

1 Header

2 Picture of device

3 Device tag → 59

4 Status area with status signal → 65

5 Display area for current measured values → 59

6 Event list with additional functions such as save/load, events list and document creation

7 Navigation area with operating menu structure

8 Working area

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

| | | |
|----------------------------------|----------|--|
| Firmware version | 01.02.00 | <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 | 04.2013 | --- |

9.1.2 Operating tools



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




| 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> |

| Code | Name | Description | Application |
|------|-------------------------------|---|--|
| 06 | Write single registers | Master writes a new value to one Modbus register of the measuring device.  Use function code 16 to write multiple registers with just 1 telegram. | Write only 1 device parameter Example: reset totalizer |
| 08 | Diagnostics | Master checks the communication connection to the measuring device. The following "Diagnostics codes" are supported: ▪ 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 →  42 | Write multiple device parameters Example: ▪ Mass flow unit ▪ Mass unit |
| 23 | Read/Write multiple registers | Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed before read access. | Write and read multiple device parameters Example: ▪ Read mass flow ▪ Reset totalizer |

 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
→  96

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
→ 96

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

- "Post-mounting check" checklist → 24
- "Post-connection check" checklist → 35

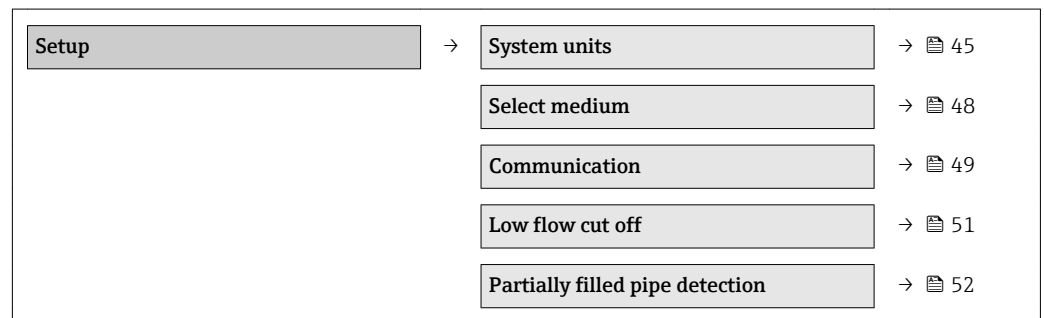
10.2 Establishing a connection via FieldCare

- For FieldCare connection → 39
- For establishing a connection via FieldCare → 39
- For FieldCare user interface → 40

10.3 Configuring the measuring device

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

Structure of the "Setup" menu



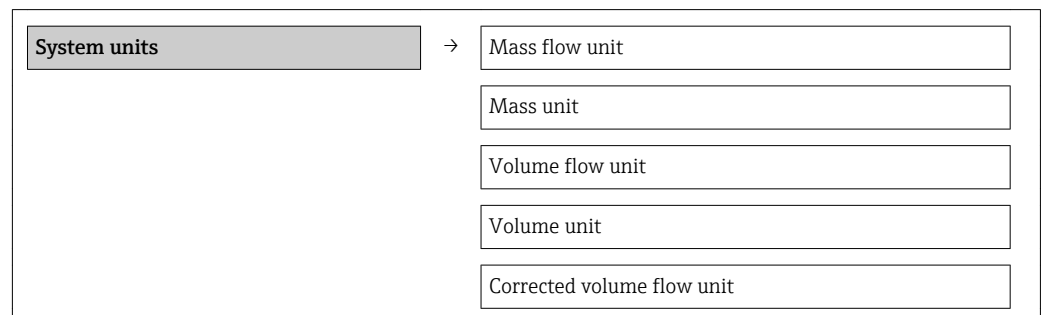
10.3.1 Setting the system units

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

Navigation path

"Setup" menu → Advanced setup → System units

Structure of the submenu



| |
|------------------------|
| Corrected volume unit |
| Density unit |
| Reference density unit |
| Temperature unit |
| Pressure unit |

Parameter overview with brief description

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

| Parameter | Description | Selection/ User entry | Factory setting |
|------------------------|--|--------------------------|---|
| Reference density unit | Select the unit for reference density. <i>Result</i> The selected unit applies for: – Output – Low value partial filled pipe detection – High value partial filled pipe detection – Simulation process variable – Fixed reference density – Density adjustment (in the Expert menu) | Unit choose list | Country-dependent: ■ kg/Nl ■ lb/Scf |
| Temperature unit | Select the unit for temperature. <i>Result</i> The selected unit applies for: – Output – Reference temperature – Simulation process variable | Unit choose list | Country-dependent: ■ °C (Celsius) ■ °F (Fahrenheit) |
| Pressure unit | Select the unit for pipe pressure. | Unit choose list | Country-dependent: ■ bar a ■ psi a |

10.3.2 Selecting and setting the medium

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

Navigation path

"Setup" menu → Medium selection

Structure of the submenu

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

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|--|---|---|--|-----------------|
| Medium selection | – | Select the medium type. | <ul style="list-style-type: none"> ■ Liquid ■ Gas | Liquid |
| Select gas type | The following option is selected in the Medium selection parameter: Gas | Select the gas type for the measurement application. | Gas type choose list | Air |
| Reference sound velocity | The following option is selected in the Select gas type parameter: Others | Enter the sound velocity of the gas at 0°C (32°F). | 0 to 99 999 m/s | 0 m/s |
| Temperature coefficient sound velocity | The following option is selected in the Select gas type parameter: Others | Enter the temperature coefficient of the sound velocity of the gas. | Max. 15-digit, positive floating-point number | 0 (m/s)/K |
| Pressure compensation | The following option is selected in the Medium selection parameter: Gas | Enable the automatic pressure correction. | <ul style="list-style-type: none"> ■ Off ■ Fixed value | Off |

| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|-------------------|---|--|--------------------------|---|
| Pressure value | The following option is selected in the Pressure compensation parameter: Fixed value | Enter a value for the process pressure to be used for pressure correction. | 0 to 99 999 [bar, psi] | Country-dependent: ■ 1.01325 bar ■ 14.7 psi |
| External pressure | The following option is selected in the Pressure compensation parameter: External value | External value | 0 to 99 999 [bar, psi] | Country-dependent: ■ 1.01325 bar ■ 14.7 psi |

10.3.3 Configuring communication interface

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

Navigation path



"Setup" menu → Communication

Structure of the submenu

| | | |
|--------------------------|---|----------------------------|
| <div>Communication</div> | → | Bus address |
| | | Baud rate |
| | | Data transfer mode |
| | | Parity |
| | | Byte order |
| | | Assign diagnostic behavior |
| | | Failure mode |

Parameter overview with brief description

| Parameter | Description | Selection/ User entry | Factory setting |
|--------------------|-----------------------------|--|-----------------|
| Bus address | Enter device address. | 1 to 247 | 247 |
| Baud rate | Define data transfer speed. | Baud rate list box → 83 | 19 200 BAUD |
| Data transfer mode | Select data transfer mode. | <ul style="list-style-type: none"> ■ ASCII Transmission of data in the form of readable ASCII characters. Error protection via LRC. ■ RTU Transmission of data in binary form. Error protection via CRC16. | RTU |

| Parameter | Description | Selection/ User entry | Factory setting |
|----------------------------|---|--|-----------------|
| Parity | Select parity bits. | ASCII picklist <ul style="list-style-type: none"> 0 = even 1 = odd RTU picklist <ul style="list-style-type: none"> 0 = even 1 = odd 2 = no parity bit/1 stop bit 3 = no parity bit/2 stop bits | Even |
| Byte order | Select byte transmission sequence. | <ul style="list-style-type: none"> 0-1-2-3 3-2-1-0 1-0-3-2 2-3-0-1 | 1-0-3-2 |
| Assign diagnostic behavior | Select diagnostic behavior for MODBUS communication. | <ul style="list-style-type: none"> Off Alarm or warning Warning Alarm | Alarm |
| Failure mode | Select measured value output behavior when a diagnostic message occurs via Modbus communication.  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 |

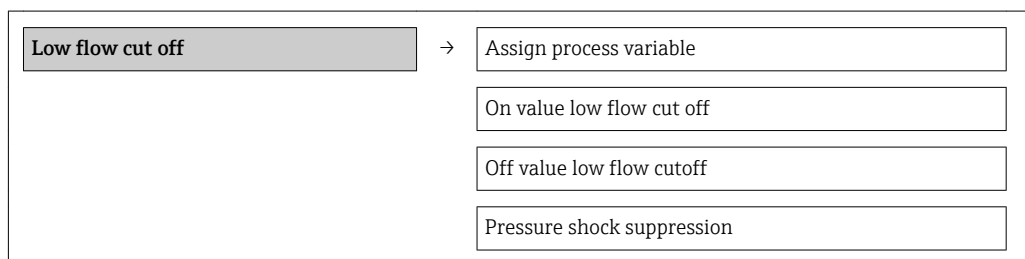
10.3.4 Configuring the low flow cut off

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

Navigation path

"Setup" menu → Low flow cut off

Structure of the submenu



Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|----------------------------|---|---|--|--|
| Assign process variable | – | Select the process variable for low flow cut off. | <ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow | Mass flow |
| On value low flow cut off | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow | Enter the on value for low flow cut off. | Max. 15-digit, positive floating-point number | For liquids: depends on country and nominal diameter |
| Off value low flow cut off | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow | Enter the off value for low flow cut off. | 0 to 100 % | 50 % |
| Pressure shock suppression | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow | Enter the time interval for signal suppression (= active pressure shock suppression). | 0 to 100 s | 0 s |

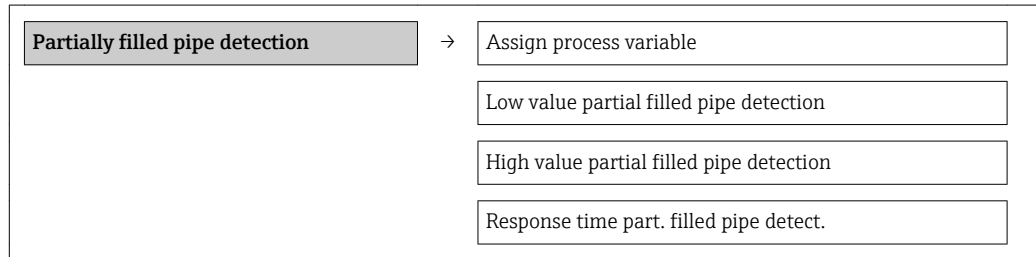
10.3.5 Configuring the partial filled pipe detection

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

Navigation path

"Setup" menu → Partial filled pipe detection

Structure of the submenu



Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|--|--|--|---|---|
| Assign process variable | – | Select a process variable to detect empty or partially filled pipes. | <ul style="list-style-type: none"> Off Density Reference density | Density |
| Low value partial filled pipe detection | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> Density Reference density | Enter a lower limit value to activate detection of an empty or partially filled pipe. | Max. 15-digit, positive floating-point number | Country-dependent: <ul style="list-style-type: none"> 0.2 kg/l 12.5 lb/cf |
| High value partial filled pipe detection | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> Density Reference density | Enter an upper limit value to activate detection of an empty or partially filled pipe. | Max. 15-digit, positive floating-point number | Country-dependent: <ul style="list-style-type: none"> 6 kg/l 374.6 lb/cf |
| Response time part. filled pipe detect. | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> Density Reference density | Enter the time interval until the diagnostic message △S862 Partly filled pipe detection is displayed for an empty or partially filled pipe. | 0 to 100 s | 1 s |

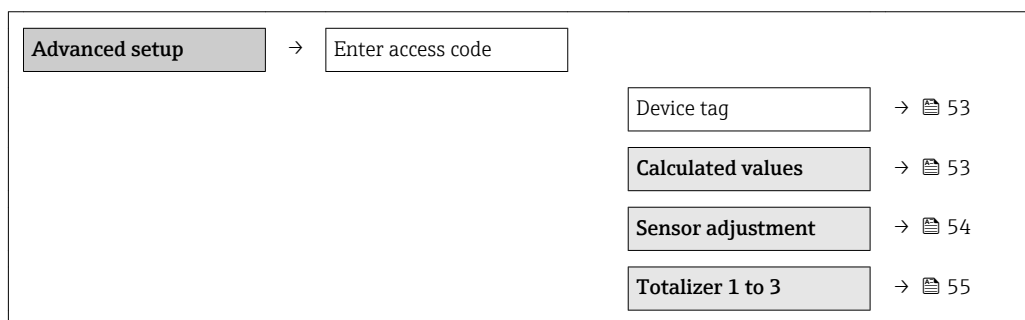
10.4 Advanced settings

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

Navigation path

"Setup" menu → Advanced setup

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



10.4.1 Defining the tag name

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



Navigation path

Setup → Advanced setup → Device tag

Parameter overview with brief description

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

 The number of characters displayed depends on the characters used.

 For information on the tag name in the "FieldCare" operating tool →  40

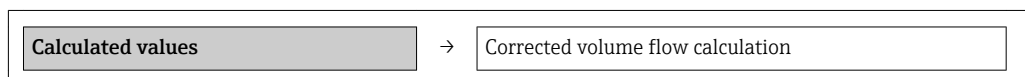
10.4.2 Calculated values

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

Navigation path

"Setup" menu → Advanced setup → Calculated values

Structure of the submenu



| |
|------------------------------|
| External reference density |
| Fixed reference density |
| Reference temperature |
| Linear expansion coefficient |
| Square expansion coefficient |

Parameter overview with brief description

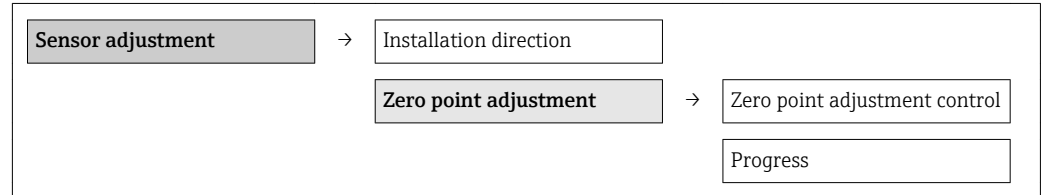
| Parameter | Prerequisites | Description | Selection/input | Factory settings |
|-----------------------------------|---|---|--|--|
| Corrected volume flow calculation | – | Select the reference density for calculating the corrected volume flow. | <ul style="list-style-type: none"> Fixed reference density Calculated reference density Reference density according to API 53 External reference density | Calculated reference density |
| External reference density | – | Shows external reference density. | Floating-point number with sign | Country-dependent: 0 kg/Nl (0 lb/scf) |
| Fixed reference density | The following option is selected in the Corrected volume flow calculation parameter: Fixed reference density | Enter the fixed value for the reference density. | Positive floating-point number with leading sign | Country-dependent: 0.001 kg/Nl (0.062 lb/scf) |
| Reference temperature | The following option is selected in the Corrected volume flow calculation parameter: Calculated reference density | Enter the reference temperature for calculating the reference density. | Floating-point number with sign | Country-dependent: 20 °C (68 °F) |
| Linear expansion coefficient | The following option is selected in the Corrected volume flow calculation parameter: Calculated reference density | Enter the linear, medium-specific expansion coefficient for calculating the reference density. | 0 to 1 | 0.0 |
| Square expansion coefficient | – | For media with a non-linear expansion pattern, use this function to enter a quadratic, medium-specific expansion coefficient for calculating the reference density. | 0 to 1 | 0.0 |

10.4.3 Carrying out a sensor adjustment

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

Navigation path

"Setup" menu → Advanced setup → Sensor adjustment

Structure of the submenu**Parameter overview with brief description**

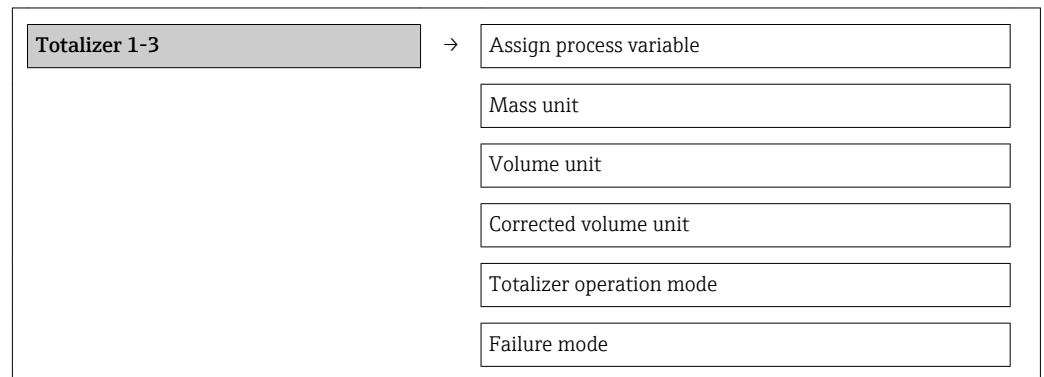
| Parameter | Description | Selection/ User entry | Factory setting |
|-------------------------------|--|---|-------------------------|
| Installation direction | Change the sign of the direction of flow of the fluid. | <ul style="list-style-type: none"> ■ Flow in arrow direction ■ Flow against arrow direction | Flow in arrow direction |
| Zero point adjustment control | Start the zero point adjustment. | <ul style="list-style-type: none"> ■ Cancel ■ Start | Cancel |
| Progress | | 0...100 % | 0 |

10.4.4 Configuring the totalizer


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

Navigation path

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

Structure of the submenu

Parameter overview with brief description

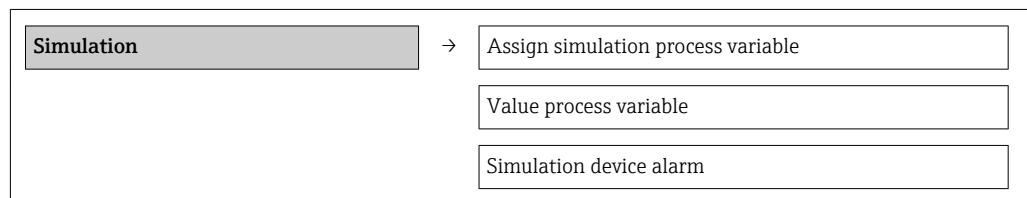
| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|--------------------------|---|---|---|---|
| Assign process variable | - | Select process variable for totalizer. <i>Result</i> The selection determines the choose list of the Unit parameter. | <ul style="list-style-type: none"> Off Mass flow Volume flow Corrected volume flow  The range of options increases if the measuring device has one or more application packages. | Mass flow |
| Mass unit | The following option is selected in the Assign process variable parameter: Mass flow | Select the unit for mass. <i>Result</i> The selected unit is taken from: Mass flow unit | Unit choose list | Country-dependent: <ul style="list-style-type: none"> kg lb |
| Volume unit | The following option is selected in the Assign process variable parameter: Volume flow | Select the unit for volume. <i>Result</i> The selected unit is taken from: Volume flow unit | Unit choose list | Country-dependent <ul style="list-style-type: none"> l gal (us) |
| Corrected volume unit | The following option is selected in the Assign process variable parameter: Corrected volume flow | Select the unit for standard volume. <i>Result</i> The selected unit is taken from: Corrected volume flow unit | Unit choose list | Country-dependent: <ul style="list-style-type: none"> NI Scf |
| Totalizer operation mode | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> Mass flow Volume flow Corrected volume flow | Select totalizer calculation mode. | <ul style="list-style-type: none"> Net flow total Forward flow total Reverse flow total | Net flow total |
| Failure mode | One of the following options is selected in the Assign process variable parameter: <ul style="list-style-type: none"> Mass flow Volume flow Corrected volume flow | Specify the behavior of the totalizer in the event of a device alarm. | <ul style="list-style-type: none"> Stop Actual value Last valid value | Stop |


10.5 Simulation

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

Navigation path

"Diagnostics" menu → Simulation

**10.5.1 Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|------------------------------------|--|---|---|-----------------|
| Assign simulation process variable | - | Select a process variable for the simulation process that is activated. | <ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature <p> The range of options increases if the measuring device has one or more application packages.</p> | Off |
| Value process variable | A process variable is selected in the Assign simulation process variable parameter. | Enter the simulation value for the selected process variable. | Depends on the process variable selected | - |
| Simulation device alarm | - | Switch the device alarm on and off. | <ul style="list-style-type: none"> ■ Off ■ On | Off |

10.6 Protecting settings from unauthorized access

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

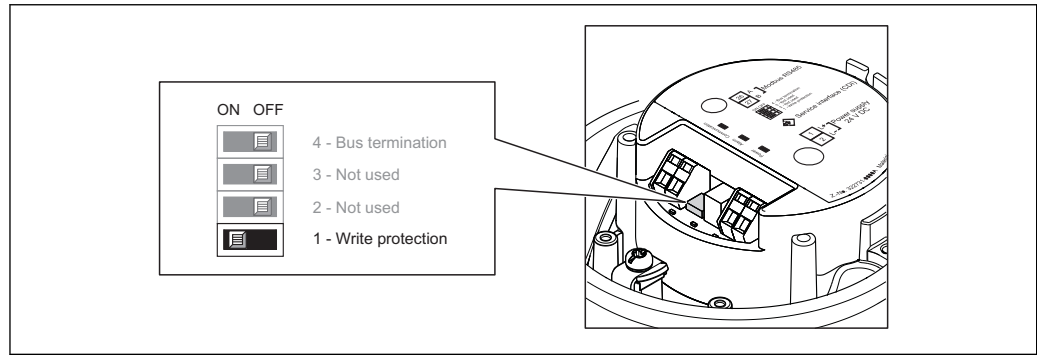
10.6.1 Write protection via write protection switch

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

- External pressure
- External temperature
- Reference density
- All parameters for configuring the totalizer

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

- Via service interface (CDI)
- Via Modbus RS485



1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version, unscrew or open the housing cover.
3. Setting the write protection switch on the main electronics module to the ON position enables the hardware write protection. Setting the write protection switch on the main electronics module to the OFF position (factory setting) disables the hardware write protection.
 - ↳ If hardware write protection is enabled, the **Hardware locked** option is displayed in the **Locking status** parameter → 59; if disabled, no option is displayed in the **Locking status** parameter → 59
4. Reverse the removal procedure to reassemble the transmitter.

11 Operation

11.1 Read device locking status

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

Navigation path

"Display/operation" menu → Locking status

Function scope of "Locking status" parameter

| Options | Description |
|--------------------|--|
| Hardware locked | The write protection switch (DIP switch) for hardware locking is activated on the main electronics module. This prevents write access to the parameters → 57. |
| Temporarily locked | Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc). Once the internal processing has been completed, the parameters can be changed once again. |

11.2 Reading measured values

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

Navigation path

Diagnostics → Measured values

11.2.1 Process variables

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

Navigation path

"Diagnostics" menu → Measured values → Process variables

Structure of the submenu

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

Parameter overview with brief description

Parameter overview with brief description

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

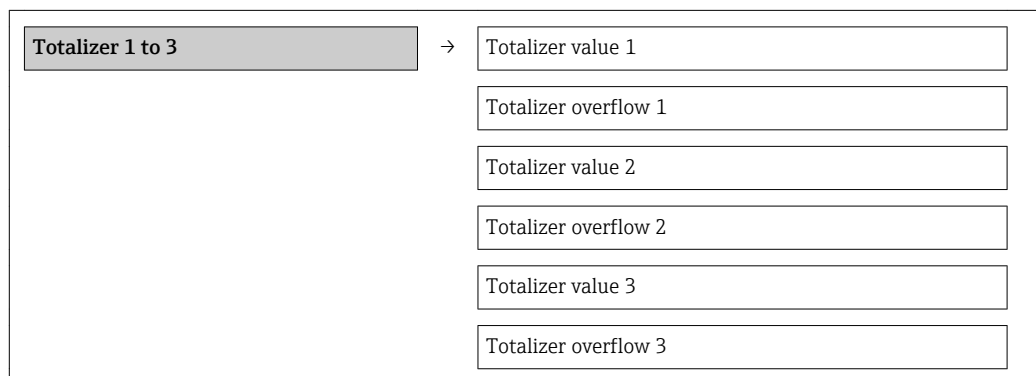
11.2.2 Totalizer

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

Navigation path

"Diagnostics" menu → Measured values → Totalizer

Structure of the submenu



Parameter overview with brief description

| Parameter | Prerequisite | Description | Display |
|------------------------|--|---|---------------------------------|
| Totalizer value 1-3 | One of the following options is selected in the Assign process variable parameter of the Totalizer 1-3 submenu: <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow | Displays the current totalizer counter value. | Floating point number with sign |
| Totalizer overflow 1-3 | One of the following options is selected in the Assign process variable parameter of the Totalizer 1-3 submenu: <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow | Displays the current totalizer overflow. | Integer |

11.3 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu →  45
- Advanced settings using the **Advanced setup** menu →  53

11.4 Performing a totalizer reset

In the **Operation** submenu, 2 parameters with various options for resetting the three totalizers are available:

- Control totalizer 1-3
- Reset all totalizers

Navigation path

"Display/operat." menu → Operation

Function scope of the "Control totalizer" parameter

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

Function scope of the "Reset all totalizers" parameter

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

"Operation" submenu

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

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection/ User entry | Factory setting |
|-----------------------|---|--------------------------------------|--|---|
| Control totalizer 1-3 | A process variable is selected in the Assign process variable parameter of the Totalizer 1-3 submenu. | Control totalizer value. | <ul style="list-style-type: none"> ■ Totalize ■ Reset + hold ■ Preset + hold ■ Reset + totalize ■ Preset + totalize | Totalize |
| Preset value 1-3 | A process variable is selected in the Assign process variable parameter of the Totalizer 1-3 submenu. | Specify start value for totalizer. | Floating-point number with sign | Country-dependent: <ul style="list-style-type: none"> ■ 0 kg ■ 0 lb |
| Reset all totalizers | - | Reset all totalizers to 0 and start. | <ul style="list-style-type: none"> ■ Cancel ■ Reset + totalize | Cancel |


12 Diagnostics and troubleshooting

12.1 General troubleshooting

For output signals

| Problem | Possible causes | Remedy |
|---|--|---|
| Green power LED on the main electronics module of the transmitter is dark | Supply voltage does not match that specified on the nameplate. | Apply the correct supply voltage → 31. |
| 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 → 31. |
| Green power LED on Safety Barrier Promass 100 is dark | Power supply cable connected incorrectly | Check the terminal assignment → 29. |
| Device measures incorrectly. | Configuration error or device is operated outside the application. | 1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data". |

For access

| Problem | Possible causes | Remedy |
|-------------------------------------|---|--|
| No write access to parameters | Hardware write protection enabled | Set the write protection switch on the main electronics module to the OFF position → 57. |
| 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 → 29. |
| No connection via Modbus RS485 | Modbus RS485 cable incorrectly terminated | Check terminating resistor → 33. |
| No connection via Modbus RS485 | Incorrect settings for the communication interface | Check the Modbus RS485 configuration → 49. |
| 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 | Meaning |
|---------------|----------------|---------------------------------------|
| Power | Off | Supply voltage is off or too low. |
| | Green | Supply voltage is ok. |
| Communication | Flashing white | Modbus RS485 communication is active. |

12.3 Diagnostic information in FieldCare

12.3.1 Diagnostic options

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

1 Status area with status signal

2 Diagnostic information

3 Remedy information with Service ID

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

- Via parameters
- Via submenu → 71

Status signals

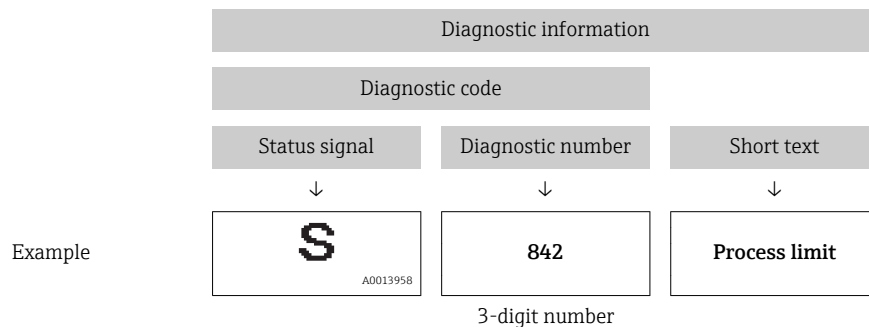
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

| 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.



12.3.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:

- On the home page
Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu
Remedy information can be called up in the working area of the user interface.

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



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

12.4 Diagnostic information via communication interface

12.4.1 Reading out diagnostic information

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

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

 For an overview of diagnostic events with diagnosis number and diagnosis code
→  68



12.4.2 Configuring error response mode

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

Navigation path

"Setup" menu → Communication

Parameter overview with brief description

| Parameter | Description | Options | Factory setting |
|----------------------------|--|--|-----------------|
| Assign diagnostic behavior | Select diagnostic behavior for MODBUS communication. | <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 |

12.5 Adapting the diagnostic information

12.5.1 Adapting the diagnostic behavior

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

Navigation path

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

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

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

12.6 Overview of diagnostic information



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

Diagnostics for the sensor

| Diagnostic number | Short text | Remedial measures | Status signal from the factory | Diagnostic behavior from the factory |
|---|--------------------|---|--------------------------------|--------------------------------------|
| 022 | Sensor temperature | 1. Change main electronic module. 2. Change sensor. | F | Alarm |
| 044 | Sensor drift | 1. Check or change main electronics. 2. Change sensor. | S | Alarm* |
| 046 | Sensor limit | 1. Inspect sensor. 2. Check process conditions. | S | Alarm* |
| 062 | Sensor connection | 1. Change main electronic module. 2. Change sensor. | F | Alarm |
| 082 | Data storage | 1. Change main electronic module. 2. Change sensor. | F | Alarm |
| 083 | Memory content | 1. Restart device. 2. Restore S-DAT data. 3. Change sensor. | F | Alarm |
| * Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 67 | | | | |

Diagnostics for the electronics



| Diagnostic number | Short text | Remedial measures | Status signal from the factory | Diagnostic behavior from the factory |
|---|-------------------------|---|--------------------------------|--------------------------------------|
| 242 | Software incompatible | 1. Check software. 2. Flash or change main electronic module. | F | Alarm |
| 261 | Electronic modules | 1. Restart device. 2. Check electronic modules. 3. Change I/O module or main electronics. | F | Alarm |
| 270 | Main electronic failure | Change main electronic module. | F | Alarm |
| 271 | Main electronic failure | 1. Restart device. 2. Change main electronic module. | F | Alarm |
| 272 | Main electronic failure | 1. Restart device. 2. Contact service. | F | Alarm |
| 273 | Main electronic failure | Replace electronics. | F | Alarm |
| 274 | Main electronic failure | Replace electronics. | S | Warning* |
| 311 | Electronic failure | 1. Transfer data or reset device. 2. Contact service. | F | Alarm |
| * Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 67 | | | | |

Diagnostics for the configuration

| Diagnostic number | Short text | Remedial measures | Status signal from the factory | Diagnostic behavior from the factory |
|---|-----------------------------|---|--------------------------------|--------------------------------------|
| 410 | Data transfer | 1. Check connection. 2. Retry data transfer. | F | Alarm |
| 411 | Up-/download active | Up-/download active, please wait | C | Warning |
| 438 | Dataset | 1. Check data set file. 2. Check device configuration. 3. Up- and download new configuration. | M | Warning |
| 453 | Flow override | Deactivate flow override. | C | Warning |
| 484 | Simulation failsafe mode | Deactivate simulation. | C | Alarm |
| 485 | Simulation process variable | Deactivate simulation. | C | Warning |
| * Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section → 67 | | | | |

Diagnostics for the process

| Diagnostic number | Short text | Remedial measures | Status signal from the factory | Diagnostic behavior from the factory |
|-------------------|---------------------------------|---|--------------------------------|--------------------------------------|
| 830 | Ambient temperature | Reduce the ambient temperature around the sensor housing. | S | Warning |
| 831 | Ambient temperature | Increase the ambient temperature around the sensor housing. | S | Warning |
| 832 | Ambient temperature | Reduce ambient temperature. | S | Warning* |
| 833 | Ambient temperature | Increase ambient temperature. | S | Warning* |
| 834 | Process temperature | Reduce process temperature. | S | Warning* |
| 835 | Process temperature | Increase process temperature. | S | Warning* |
| 843 | Process limit | Check process conditions. | S | Warning |
| 862 | Partly filled pipe | 1. Check for gas in process. 2. Check detection limits. | S | Warning |
| 910 | Measuring tube does not vibrate | 1. Check electronics. 2. Inspect sensor. | F | Alarm |

| Diagnostic number | Short text | Remedial measures | Status signal from the factory | Diagnostic behavior from the factory |
|---|---------------|--|--------------------------------|--------------------------------------|
| 912 | Inhomogeneous | <p>Fluid is inhomogeneous, e.g. gas or solid content!</p> <ol style="list-style-type: none"> 1. Check process conditions. 2. Increase system pressure. <p> In particular with outgassing media and/or increased gas content, the following measures are recommended to increase system pressure:</p> <ul style="list-style-type: none"> ■ Install the instrument at the outlet side of a pump. ■ Install the instrument at the lowest point of an ascending pipeline. ■ Install a flow restriction, e.g. reducer or orifice plate, downstream from the instrument. | S | Warning* |
| 913 | Inhomogeneous | <p>Oscillation amplitude limit!</p> <p>The fluid properties do not allow a precise measurement.</p> <p>Cause: Process fluid is very inhomogeneous (gas or solid content)</p> <ol style="list-style-type: none"> 1. Check process conditions. 2. Increase voltage. 3. Check main electronic module or sensor. | S | Alarm* |
| * Diagnostic behavior can be changed: "Adapting the diagnostic behavior" section →  67 | | | | |


12.7 Pending diagnostic events



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



Navigation path

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

Parameter overview with brief description

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

 To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool →  66



 Other diagnostic events that are pending can be viewed in the **Diagnostic list** submenu →  71

12.8 Diagnostic list

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

Navigation path

"Diagnostics" menu → Diagnostic list

 To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool →  66



12.9 Event logbook

12.9.1 Event history



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

Navigation path




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

 For information on the event list, see the FieldCare user interface →  40


This event history includes entries for:

- Diagnostic events →  68
- Information events →  72

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

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



To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool →  66



For filtering the displayed event messages →  72

12.9.2 Filtering the event logbook

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

Navigation path

"Diagnostics" menu → Event logbook → Filter options

Filter categories

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

12.9.3 Overview of information events

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

| Information event | Event text |
|-------------------|---------------------------------|
| I1000 | ----- (device ok) |
| I1089 | Power on |
| I1090 | Configuration reset |
| I1091 | Configuration changed |
| I1110 | Write protection switch changed |
| I1111 | Density adjust. error |
| I1151 | History reset |
| I1209 | Density adjustment OK |
| I1221 | Zero point adjust failure |
| I1222 | Zero point adjustment OK |


12.10 Resetting the measuring device

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

Navigation path

"Diagnostics" menu → Device reset → Device reset

Function scope of the "Device reset" parameter

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


12.11 Device information

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


Navigation path




"Diagnostics" menu → Device information

Structure of the submenu

| | | | |
|---------------------------|---|------------------------------|--|
| Device information | → | Device tag | →  53 |
| | | Serial number | |
| | | Firmware version | |
| | | Device name | |
| | | Order code | |
| | | Extended order code 1 | |
| | | Extended order code 2 | |
| | | Extended order code 3 | |
| | | ENP version | |

Parameter overview with brief description


| Parameter | Prerequisite | Description | Display |
|------------------|--------------|--|---|
| Serial number | - | Displays the serial number of the measuring device.  The number can be found on the nameplate of the sensor and transmitter. | Max. 11-digit character string comprising letters and numbers |
| Firmware version | - | Displays the device firmware version installed. | Character string in the format xx.yy.zz |


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

12.12 Firmware history

| Release date | Firmware version | Order code for "Firmware version" | Firmware changes | Documentation type | Documentation |
|--------------|------------------|-----------------------------------|-------------------|------------------------|--|
| 04.2013 | 01.02.00 | Option 74 | Update | Operating Instructions | BA016580/06/DE/02.13 BA016580/06/EN/02.13 |
| 06.2012 | 01.01.00 | Option 78 | Original firmware | Operating Instructions | BA016580/06/DE/01.12 BA016580/06/EN/01.12 |

 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.

13.1.2 Interior cleaning

Observe the following points for CIP and SIP cleaning:

- Use only cleaning agents to which the process-wetted materials are adequately resistant.
- Observe the maximum permitted medium temperature for the measuring device
→  89.

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 →  73.

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 repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at

www.services.endress.com/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 Device-specific accessories


15.1.1 For the sensor

| Accessories | Description |
|----------------|--|
| Heating jacket | <p>Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids. If using oil as a heating medium, please consult with Endress+Hauser. Heating jackets cannot be used with sensors fitted with a rupture disk.</p> <p> For details, see Operating Instructions BA00099D</p> |





15.2 Communication-specific accessories

| Accessories | Description |
|-----------------------------|--|
| Commubox FXA195 HART | <p>For intrinsically safe HART communication with FieldCare via the USB interface.</p> <p> For details, see "Technical Information" TI00404F</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> |
| HART Loop Converter HMX50 | <p>Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.</p> <p> For details, see "Technical Information" TI00429F and Operating Instructions BA00371F</p> |
| Wireless HART adapter SWA70 | <p>Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.</p> <p> For details, see Operating Instructions BA00061S</p> |
| Fieldgate FXA320 | <p>Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser.</p> <p> For details, see "Technical Information" TI00025S and Operating Instructions BA00053S</p> |
| Fieldgate FXA520 | <p>Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser.</p> <p> For details, see "Technical Information" TI00025S and Operating Instructions BA00051S</p> |
| Field Xpert SFX100 | <p>Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA).</p> <p> For details, see Operating Instructions BA00060S</p> |

15.3 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 over 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> |

15.4 System components

| Accessories | Description |
|--------------------------------------|---|
| Memograph M graphic display recorder | <p>The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.</p> <p> For details, see "Technical Information" TI00133R and Operating Instructions BA00247R</p> |
| Cerabar M | <p>The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value via Modbus RS485 or EtherNet/IP.</p> <p> For details, see "Technical Information" TI00426P, TI00436P and Operating Instructions BA00200P, BA00382P</p> |
| Cerabar S | <p>The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value via Modbus RS485 or EtherNet/IP.</p> <p> For details, see "Technical Information" TI00383P and Operating Instructions BA00271P</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 medium temperature via analog or digital communication.</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 | <p>Direct measured variables</p> <ul style="list-style-type: none"> ■ Mass flow ■ Density ■ Temperature <p>Calculated measured variables</p> <ul style="list-style-type: none"> ■ Volume flow ■ Corrected volume flow ■ Reference density |
|-------------------|---|

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

| DN | | Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$ | |
|------|------|--|------------|
| [mm] | [in] | [kg/h] | [lb/min] |
| 50 | 2 | 0 to 70 000 | 0 to 2 570 |
| 80 | 3 | 0 to 180 000 | 0 to 6 600 |

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 |

| DN | | x |
|------|---------------|----------------------|
| [mm] | [in] | [kg/m ³] |
| 8 | $\frac{3}{8}$ | 85 |
| 15 | $\frac{1}{2}$ | 110 |
| 25 | 1 | 125 |
| 40 | 1½ | 125 |
| 50 | 2 | 125 |
| 80 | 3 | 155 |

Calculation example for gas

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

Maximum possible full scale value:

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

Recommended measuring range

"Flow limit" section →  90

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.

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:

- 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

16.4 Output

Output signal

Modbus RS485

| | |
|-----------------------------|--|
| 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 |
|---------------------------|---|


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 |
|---------------------------|---|

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> | | | |
| * The gas group depends on the sensor and nominal diameter. | | | | |
| <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 register ■ 04: Read input register ■ 06: Write single registers ■ 08: Diagnostics ■ 16: Write multiple registers ■ 23: Read/write multiple registers |
| Broadcast messages | <p>Supported by the following function codes:</p> <ul style="list-style-type: none"> ■ 06: Write single registers ■ 16: Write multiple registers ■ 23: Read/write multiple registers |
| Supported baud rate | <ul style="list-style-type: none"> ■ 1 200 BAUD ■ 2 400 BAUD ■ 4 800 BAUD ■ 9 600 BAUD ■ 19 200 BAUD ■ 38 400 BAUD ■ 57 600 BAUD ■ 115 200 BAUD |

| | |
|--------------------|---|
| Data transfer mode | <ul style="list-style-type: none"> ■ ASCII ■ RTU |
| Data access | Each device parameter can be accessed via Modbus RS485.  For Modbus register information →  96 |

16.5 Power supply

Terminal assignment →  27

Pin assignment, device plug →  29

Supply voltage

Transmitter

- For device version with all communication types except Modbus RS485 intrinsically safe: DC20 to 30 V
- For device version with Modbus RS485 100 intrinsically safe: power supply via Safety Barrier Promass 100

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

Safety Barrier Promass 100

DC20 to 30 V

Power consumption

Transmitter

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

Safety Barrier Promass 100

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

Current consumption

Transmitter


| Order code for "Output" | Maximum Current consumption | Maximum switch-on current |
|--|-----------------------------|---------------------------|
| Option M : Modbus RS485, for use in 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 →  31

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 →  25

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 →  95

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

Base accuracy

Mass flow and volume flow (liquids)

±0.15 % o.r.

Mass flow (gases)

±0.75 % o.r.

 Design fundamentals →  88

Density (liquids)

- Reference conditions:±0.0005 g/cm³
- Standard density calibration:±0.02 g/cm³
(valid over the entire temperature range and density range)

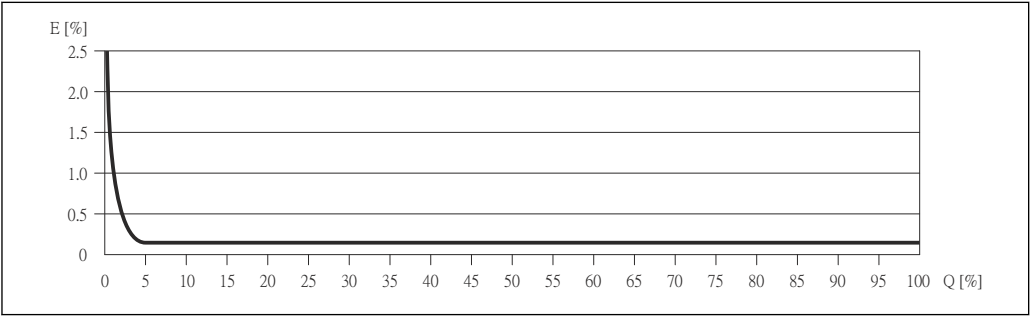
Temperature

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

Zero point stability



| DN | | Zero point stability | |
|------|------|----------------------|----------|
| [mm] | [in] | [kg/h] | [lb/min] |
| 8 | 3⁄8 | 0.2 | 0.0074 |
| 15 | 1⁄2 | 0.65 | 0.0239 |
| 25 | 1 | 1.8 | 0.0662 |
| 40 | 1½ | 4.5 | 0.1654 |
| 50 | 2 | 7.0 | 0.2573 |
| 80 | 3 | 18.0 | 0.6615 |

Example for max. measured error



A0019869

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

 Design fundamentals →  88

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

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

US units

| DN | 1:1 | 1:10 | 1:20 | 1:50 | 1:100 | 1:500 |
|----------------|----------|----------|----------|----------|----------|----------|
| [inch] | [lb/min] | [lb/min] | [lb/min] | [lb/min] | [lb/min] | [lb/min] |
| $\frac{3}{8}$ | 73.5 | 7.35 | 3.675 | 1.47 | 0.735 | 0.147 |
| $\frac{1}{2}$ | 238 | 23.8 | 11.9 | 4.76 | 2.38 | 476 |
| 1 | 660 | 66 | 33 | 13.2 | 6.6 | 1.32 |
| $1\frac{1}{2}$ | 1 650 | 165 | 82.5 | 33 | 16.5 | 3.3 |
| 2 | 2 570 | 257 | 128.5 | 51.4 | 25.7 | 5.14 |
| 3 | 6 600 | 660 | 330 | 132 | 66 | 13.2 |

Repeatability

o.r. = of reading; $1 \text{ g/cm}^3 = 1 \text{ kg/l}$; T = medium temperature**Mass flow and volume flow (liquids)** $\pm 0.075 \%$ o.r.**Mass flow (gases)** $\pm 0.35 \%$ o.r.

Design fundamentals → 88

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

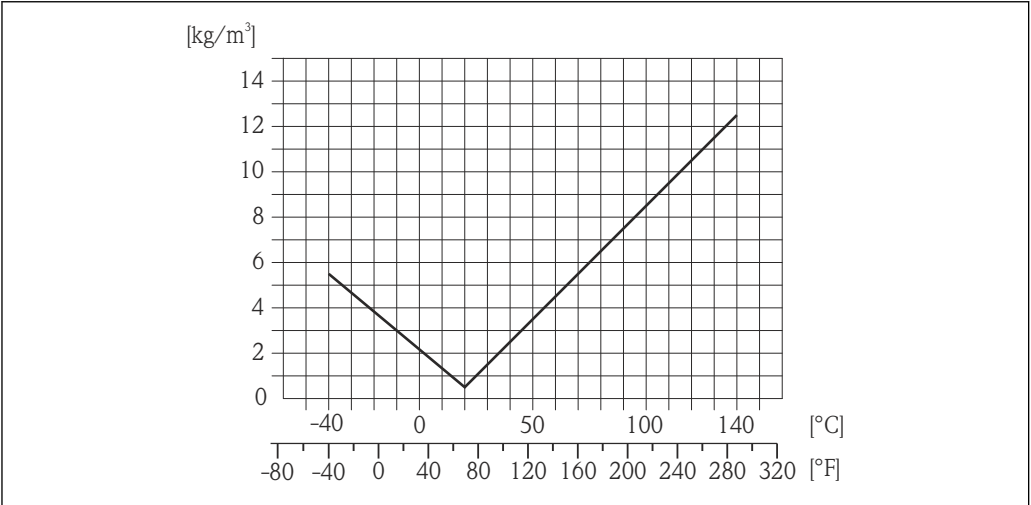
Influence of medium temperature

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 $\pm 0.0001 \text{ g/cm}^3 \text{ } ^\circ\text{C}$ ($\pm 0.00005 \text{ g/cm}^3 \text{ } ^\circ\text{F}$). Field density calibration is possible.



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

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] | | |
| 8 | ⅜ | no influence | |
| 15 | ½ | no influence | |
| 25 | 1 | no influence | |
| 40 | 1½ | no influence | |
| 50 | 2 | -0.009 | -0.0006 |
| 80 | 3 | -0.020 | -0.0014 |

Design fundamentals

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

Dependent on the flow:

- Flow in % o.f.s. \geq (zero point stability : base accuracy in % o.r.) $\cdot 100$
 - Maximum measured error in % o.r.: \pm base 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.) $\cdot 100$
 - 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 | 0.15 |
| Volume flow, liquids | 0.15 |
| Mass flow, gases | 0.75 |

16.7 Installation

"Mounting requirements" →  18

16.8 Environment

Ambient temperature range →  21

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**

- 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

Interior cleaning

- SIP cleaning
- CIP cleaning

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Complies with emission limits for industry as per EN 55011 (Class A)












Details are provided in the Declaration of Conformity.

16.9 Process

Medium temperature range **Sensor**
-40 to +140 °C (-40 to +284 °F)

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. |
| Secondary containment pressure range | <p>The sensor housing is filled with dry nitrogen and protects the electronics and mechanics inside.</p> <p>The secondary containment does not have pressure vessel classification.</p> <p>Reference value for the pressure loading capacity of the sensor housing: 16 bar (232 psi)</p> |
| Rupture disk | <p>To increase the level of safety, a device version with a rupture disk with a triggering pressure of 10 to 15 bar (145 to 217.5 psi) can be used. Special mounting instructions: →  22</p> <p>Rupture disks cannot be combined with the separately available heating jacket →  78 →  78.</p> |
| Flow limit | <p>Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.</p> <p> For an overview of the measuring range full scale values, see the "Measuring range" section →  80</p> <ul style="list-style-type: none"> ■ The minimum recommended full scale value is approx. 1/20 of the maximum full scale value ■ In most applications, 20 to 50 % of the maximum full scale value can be considered ideal ■ 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: <ul style="list-style-type: none"> – 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 →  81 |
| Pressure loss |  To calculate the pressure loss, use the <i>Applicator</i> sizing tool →  95 |

16.10 Mechanical construction

Design, dimensions



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

Weight

Compact version

Weight in SI units

All values (weight) refer to devices with EN/DIN PN 40 flanges. Weight information in [kg].

| DN [mm] | Weight [kg] |
|------------|-------------|
| 8 | 6 |
| 15 | 6 |
| 25 | 8 |
| 40 | 13 |
| 50 | 20 |
| 80 | 29 |

Weight in US units

All values (weight) refer to devices with EN/DIN PN 40 flanges. Weight information in [lbs].

| DN [in] | Weight [lbs] |
|-----------------|--------------|
| $\frac{3}{8}$ | 13 |
| $\frac{1}{2}$ | 13 |
| 1 | 18 |
| 1 $\frac{1}{2}$ | 29 |
| 2 | 44 |
| 3 | 64 |

Safety Barrier Promass 100

49 g (25 ounce)

Materials

Transmitter housing

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

Cable entries

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

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

| Electrical connection | Material |
|----------------------------|---------------------|
| Cable gland M20 × 1.5 | Nickel-plated brass |
| Thread G ½", via adapter | |
| Thread NPT ½", via adapter | |

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

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

| Electrical connection | Material |
|----------------------------|-------------------------------|
| Cable gland M20 × 1.5 | Stainless steel 1.4404 (316L) |
| Thread G ½", via adapter | |
| Thread NPT ½", via adapter | |

Device plug

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

Sensor housing

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

Measuring tubes

- Stainless steel 1.4539 (904L); manifold: 1.4404 (316L)
- Surface quality:
 - Not polished
 - Ra_{max} = 0.8 µm (32 µin)
 - Ra_{max} = 0.4 µm (16 µin)

Process connections

- For all process connections (except flanges as per JIS B2220):
Stainless steel 1.4404 (316/316L)
- For flanges as per JIS B2220:
Stainless steel SUS 316L



List of all available process connections → 93

Seals

Welded process connections without internal seals

Safety Barrier Promass 100

Housing: Polyamide

Process connections

- Flanges:
 - EN 1092-1 (DIN 2501)
 - Namur lengths in accordance with NE 132
 - ASME B16.5
 - JIS B2220
- VCO connections
- Tri-Clamp (OD tubes)
- Threaded hygienic connection:
 - DIN 11851
 - SMS 1145
 - ISO 2853
 - DIN 11864-1 Form A
- Flange:
 - DIN 11864-2 Form A



For information on the materials of the process connections → 92

16.11 Operability**Remote operation****Service interface (CDI)**

Operation of the measuring device with the service interface (CDI) via:
 "FieldCare" operating tool with COM DTM "CDI Communication FXA291" via Commubox
 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.

| | |
|--------------------------------|--|
| Hygienic compatibility | 3A approval |
| 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 |

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.</p> <p>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 → 78

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 | KA01296O |
| ---- | Technical Information | TI01317O |

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 | SD01903O |
| Special documentation | Concentration Measurement | SD01905O |
| Special documentation | Viscosity Measurement | SD01151D |
| Special documentation | Heartbeat Technology | SD01904O |
| Installation Instructions | | Specified for each individual accessory → 78 Overview of accessories available for order → 78 |

17 Appendix

17.1 Overview of the operating menu

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

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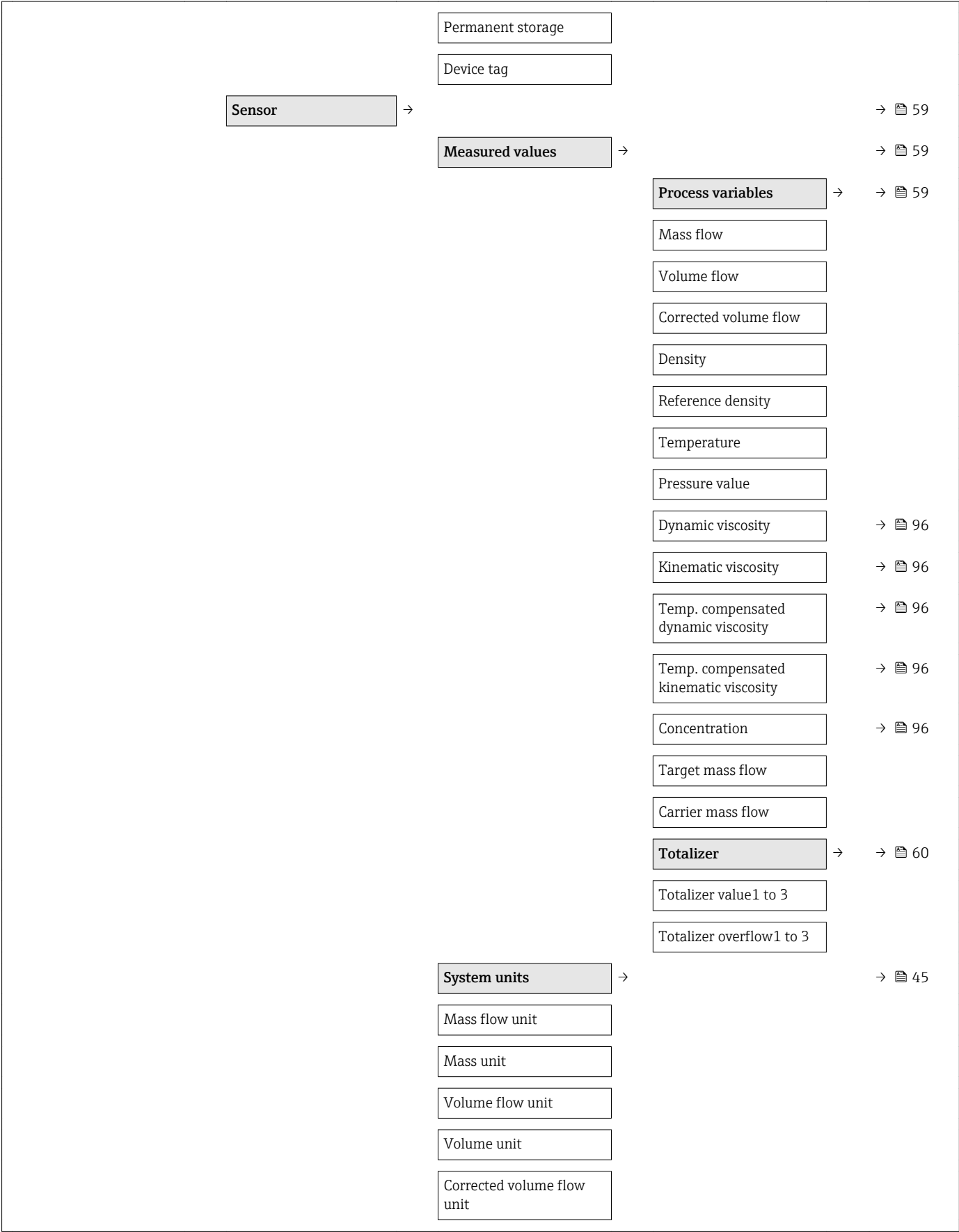
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| | | Dynamic viscosity unit |
| | | User dynamic viscosity text |

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| | | User dynamic viscosity offset | |
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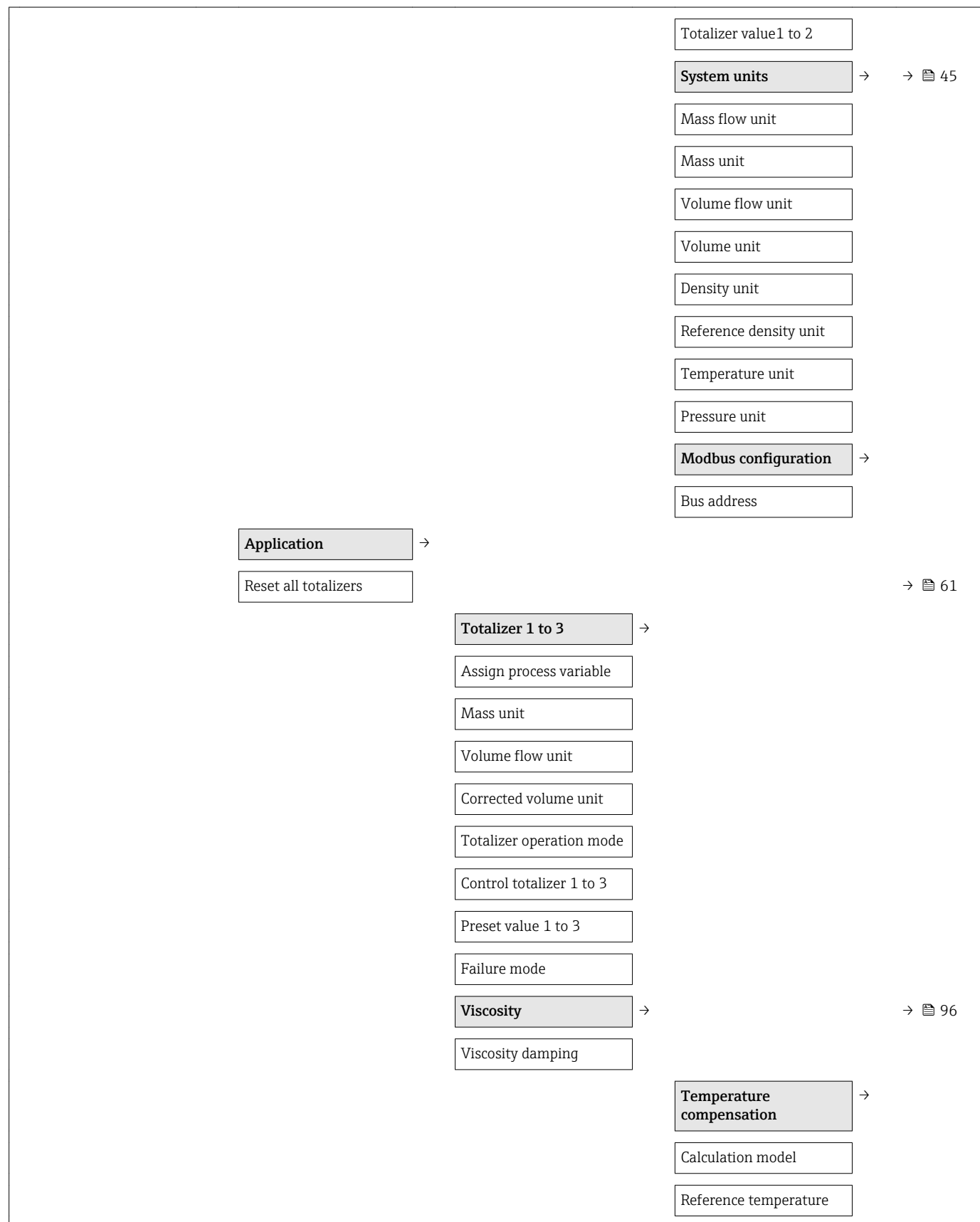


| | |
|------------------------|--------------------------------|
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| | | User dynamic viscosity factor | |
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| Timestamp | | | |
| Previous diagnostics | | | |
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| Operating time from restart | | | |
| Operating time | | | |
| | Diagnostic list | → | |

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| | 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 | |
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| | | Minimum value | |
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| | | Month | |
| | | Day | |
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| | | AM/PM | |
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