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71575025
2022-08-01

Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Proline Promass K 10

Coriolis flowmeter
Modbus RS485

Endress+Hauser
People for Process Automation

Table of contents

1 About this document

Document function

These Operating Instructions provide all of the information that is required in various phases of the life cycle of the device:
- Incoming acceptance and product identification
- Storage and transport
- Installation and connection
- Commissioning and operation
- Diagnostics and troubleshooting
- Maintenance and disposal

Associated documentation

Technical Information	Overview of the device with the most important technical data.
Operating Instructions	All the information that is required in the 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 as well as the technical data and dimensions.
Sensor Brief Operating Instructions	Incoming acceptance, transport, storage and mounting of the device.
Transmitter Brief Operating Instructions	Electrical connection and commissioning of the device.
Description of Parameters	Detailed explanation of the menus and parameters.
Safety Instructions	Documents for the use of the device in hazardous areas.
Special Documentation	Documents with more detailed information on specific topics.
Installation Instructions	Installation of spare parts and accessories.

The related documentation is available online:

W@M Device Viewer	On the www.endress.com/deviceviewer website, enter the serial number of the device: nameplate → *Product identification*, 17
Endress+Hauser Operations App	▶ Scan the Data Matrix code: nameplate → *Product identification*, 17 ▶ Enter the serial number of the device: nameplate → *Product identification*, 17

Symbols

Warnings

DANGER
This symbol alerts you to an immediate dangerous situation. Failure to avoid the situation will result in a fatal or serious injury.

WARNING
This symbol alerts you to a potentially dangerous situation. Failure to avoid the situation may result in a fatal or serious injury.

CAUTION
This symbol alerts you to a potentially dangerous situation. Failure to avoid the situation may result in a minor or mild injury.

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid the situation may result in damage to the facility or to something in the facility's vicinity.

Electronics

- Direct current
- Alternating current
- Direct current and alternating current
- Terminal connection for potential equalization

Device communication

- Bluetooth is enabled.
- LED is off.
- LED flashing.
- LED lit.

Tools

- Flat blade screwdriver
- Hexagon wrench
- Wrench

Types of information

- Preferred procedures, processes or actions
- Permitted procedures, processes or actions
- Forbidden procedures, processes or actions
- Additional information
- Reference to documentation
- Reference to page
- Reference to graphic
- Measure or individual action to be observed

1., 2.,... Series of steps

Result of a step

Help in the event of a problem

Visual inspection

Write-protected parameter

Explosion protection

Hazardous area

Non-hazardous area

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2 Safety instructions

Requirements for specialist personnel

- Installation, electrical connection, commissioning, diagnostics and maintenance of the device must only be carried out by trained, specialist personnel authorized by the facility's owner-operator.
- Before commencing work, the trained, specialist personnel must carefully read, understand and adhere to the Operating Instructions, additional documentation and certificates.
- Comply with national regulations.

Requirements for operating personnel

- Operating personnel are authorized by the facility's owner-operator and are instructed according to the requirements of the task.
- Before commencing work, the operating personnel must carefully read, understand and adhere to the instructions provided in the Operating Instructions and additional documentation.

Incoming acceptance and transport

- Transport the device in a correct and appropriate manner.

Adhesive labels, tags and engravings

- Pay attention to all the safety instructions and symbols on the device.

Environment and process

- Only use the device for the measurement of appropriate media.
- Keep within the device-specific pressure range and temperature range.
- Protect the device from corrosion and the influence of environmental factors.

Occupational safety

- Wear the required protective equipment according to national regulations.
- Do not ground the welding unit by means of the device.
- Wear protective gloves if working on and with the device with wet hands.

Installation

- Do not remove protective covers or protective caps on the process connections until just before you install the sensor.
- Do not damage or remove the liner on the flange.
- Observe tightening torques.

Electrical connection

- Comply with national installation regulations and guidelines.
- Observe cable specifications and device specifications.
- Check the cable for damage.
- If using the device in hazardous areas, observe the "Safety Instructions" documentation.

- ▶ Provide (establish) potential equalization.
- ▶ Provide (establish) grounding.

Surface temperature

Media with elevated temperatures can cause the surfaces of the device to become hot. For this reason, note the following:

- ▶ Mount suitable touch protection.
- ▶ Wear suitable protective gloves.

Commissioning

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ Only put the device into operation once you have performed the post-installation check and post-connection check.

Modifications to the device

Modifications or repairs are not permitted and can pose a danger. For this reason, note the following:

- ▶ Only carry out modifications or repairs after consulting beforehand with an Endress+Hauser service organization.
- ▶ Only use original spare parts and original accessories from Endress+Hauser.
- ▶ Install original spare parts and original accessories according to the Installation Instructions.

3 Product information

Measuring principle

Mass flow measurement according to the Coriolis measuring principle.

Designated use

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

Depending on the version ordered, the device measures potentially explosive, flammable, poisonous and oxidizing media.

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

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

Incoming acceptance

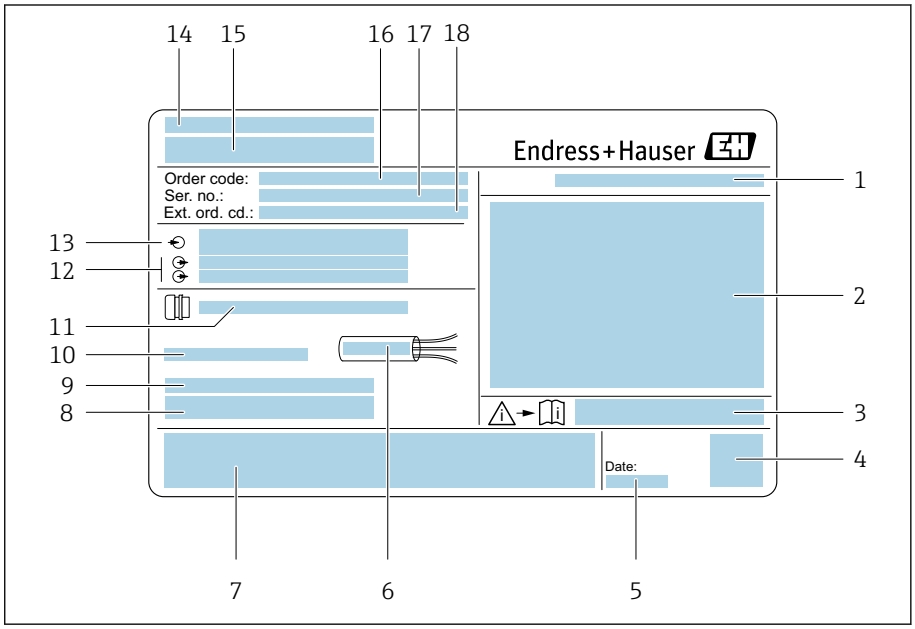
Is technical documentation provided with the device?	❑
Does the scope of supply match the specifications on the delivery note?	❑
Is the order code on the delivery note and nameplate identical?	❑
Does the device bear any signs of damage from transportation?	❑
Has an incorrect device been ordered or delivered or has the device been damaged in transit? Complaints or returns: www.services.endress.com/return-material	❑

Product identification

Device name

The device comprises the following parts:
- Proline 10 transmitter
- Promass K sensor

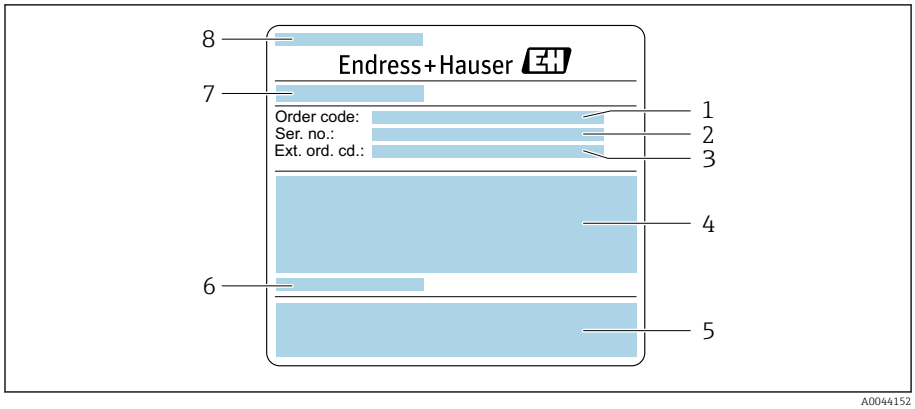
Transmitter nameplate



1 *Example of a transmitter nameplate*

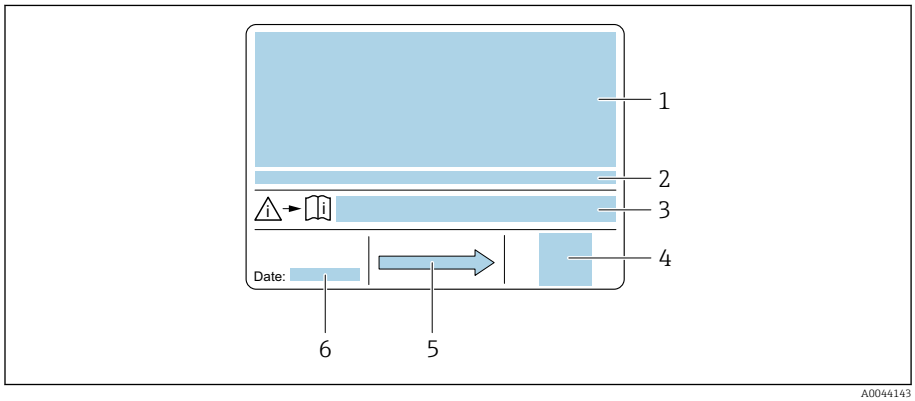
1 *Degree of protection*
2 *Approvals for hazardous area, electrical connection data*
3 *Document number of safety-related supplementary documentation*
4 *Data Matrix code*
5 *Manufacturing date: year-month*
6 *Permitted temperature range for cable*
7 *CE mark and other approval marks*
8 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
9 *Additional information in the case of special products*
10 *Permitted ambient temperature (T_a)*
11 *Information on the cable entry*
12 *Available inputs and outputs: supply voltage*
13 *Electrical connection data: supply voltage and supply power*
14 *Place of manufacture*
15 *Transmitter name*
16 *Order code*
17 *Serial number*
18 *Extended order code*

Sensor nameplate



2 *Example of a sensor nameplate, part 1*

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



3 *Example of a sensor nameplate, part 2*

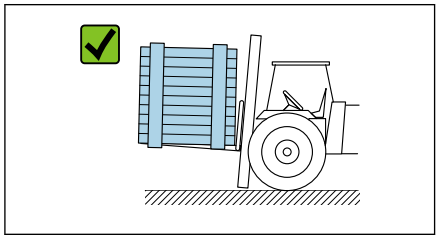
1 *Approval information for explosion protection, Pressure Equipment Directive and degree of protection*
2 *Permitted ambient temperature (T_a)*
3 *Document number of safety-related supplementary documentation*
4 *2-D matrix code*
5 *Flow direction*
6 *Manufacturing date: year-month*

Transport

Protective packaging

Protective covers or protective caps are fitted on the process connections to protect against damage and dirt.

Transporting in the original packaging



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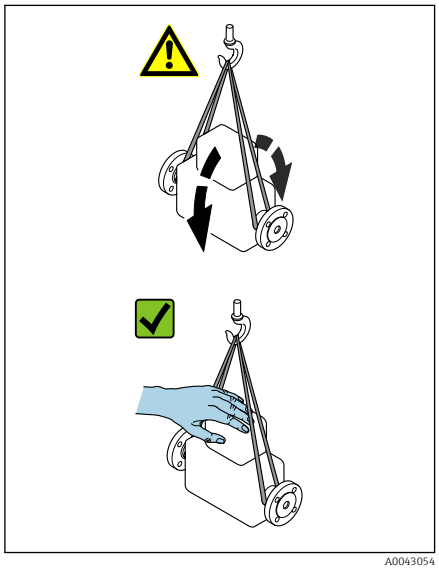
NOTICE

Original packaging is missing!

Damage to the device.

- Only lift and transport the device in the original packaging.

Transporting without lifting lugs



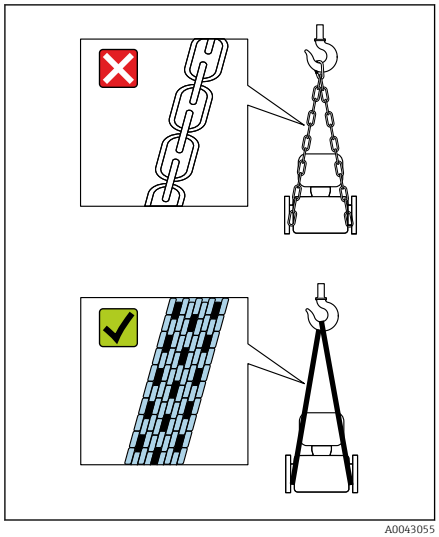
A0043054

DANGER

Potentially life-threatening hazard from suspended loads!

The device could fall.

- Secure the device against slipping and turning.
- Do not move suspended loads over people.
- Do not move suspended loads over unprotected areas.



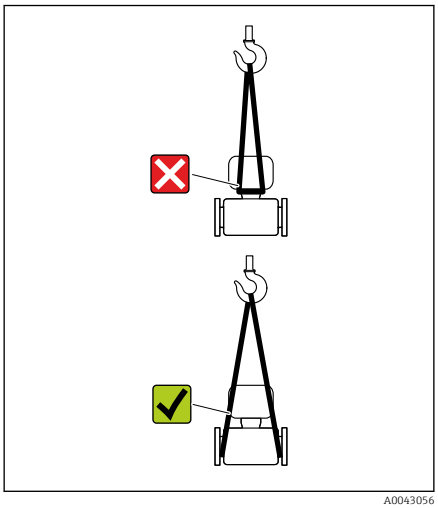
A0043055

NOTICE

Incorrect lifting equipment can damage the device!

The use of chains as hoists can damage the device.

- Use textile hoists.


A0043056

NOTICE

Lifting equipment incorrectly attached!

Lifting equipment attached to unsuitable points can damage the device.

- ▶ Attach lifting equipment to both process connections of the device.

Checking the storage conditions

Are the protective covers or protection caps on the process connections?	❑
Is the device in the original packaging?	❑
Is the device protected against sunlight?	❑
Is it guaranteed that the device is not stored outdoors?	❑
Is the device stored in a dry and dust-free place?	❑
Does the storage temperature match the device ambient temperature specified on the nameplate?	❑

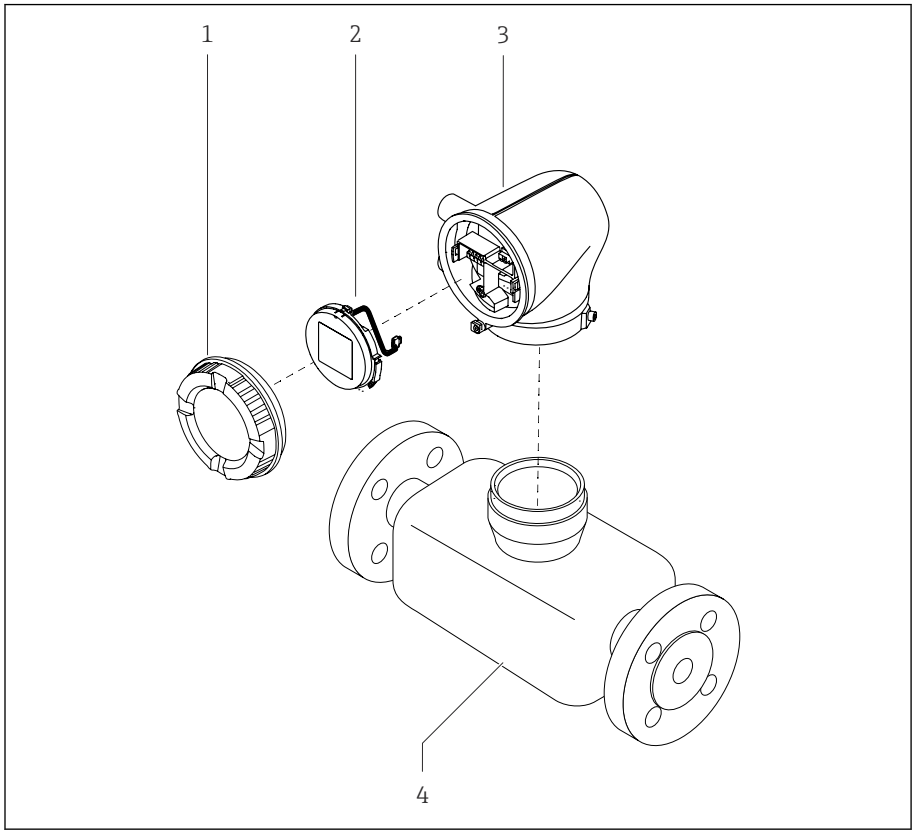
Recycling of packaging materials

All packaging materials and packaging aids must be recycled as specified by national regulations.

- Stretch wrap: polymer in accordance with EU Directive 2002/95/EC (RoHS)
- Crate: wood in accordance with ISPM 15 standard, confirmed by IPPC logo
- Cardboard box: in accordance with European Packaging Directive 94/62/EC, confirmed by Resy symbol
- Disposable pallet: plastic or wood
- Packaging straps: plastic
- Adhesive strips: plastic
- Padding: paper

Product design

The transmitter and sensor form a mechanical unit.



4 *Main device components*

1 *Housing cover*
2 *Display module*
3 *Transmitter housing*
4 *Sensor*

Firmware history

List of firmware versions and changes since previous version

Firmware version 01.00.zz		
Release date	2021-07-01	Original firmware
Version of the Operating Instructions	01.21	
Order code for "Firmware version"	Option 77	

Device history and compatibility

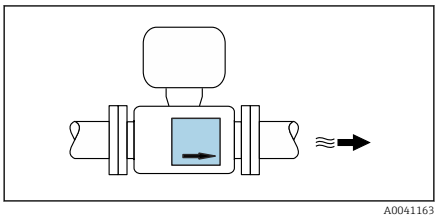
List of device models and changes since previous model

Device model A1		
Release	2021-07-01	–
Version of the Operating Instructions	01.21	
Compatibility with previous model	–	

4 Installation

Installation conditions

Flow direction

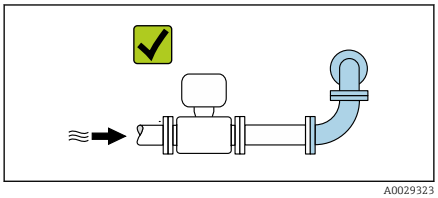


A0041163

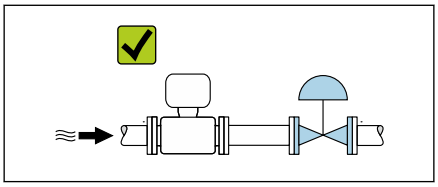
Install the device in the direction of flow.

Note the direction of arrow on the nameplate.

Inlet runs and outlet runs



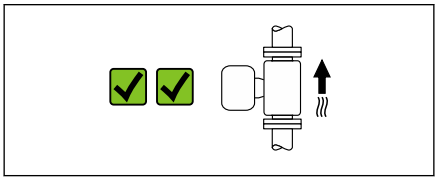
A0029323



A0029322

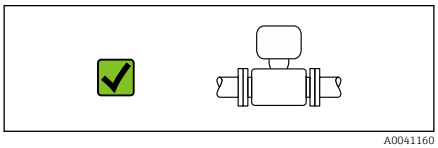
If no cavitation effects occur, requirements regarding inlet and outlet runs do not need to be considered during the installation.
To avoid negative pressure, install the sensor upstream from assemblies that produce turbulence, e.g. valves, T-sections, and downstream from pumps .

Orientations



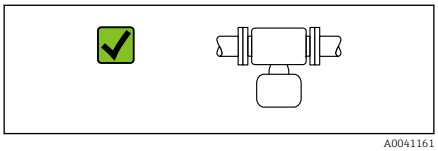
A0041159

Vertical orientation, upward direction of flow
For all applications e.g. self-draining applications



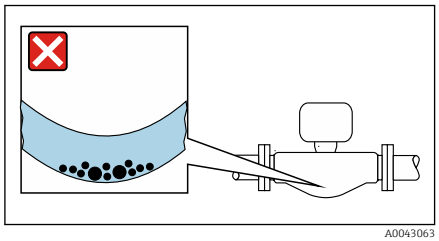
A0041160

Horizontal orientation, transmitter at top
- For applications with low process temperatures in order to maintain the minimum ambient temperature for the transmitter.
- For outgassing media in order to avoid the accumulation of gas.

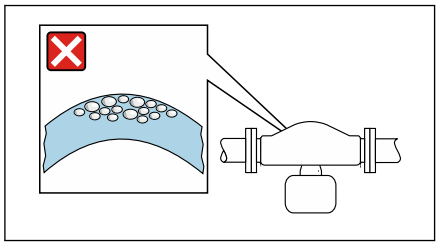


A0041161

Horizontal orientation, transmitter at bottom
- For applications with high process temperatures in order to maintain the maximum ambient temperature for the transmitter.
- For media with entrained solids in order to avoid the accumulation of solids.

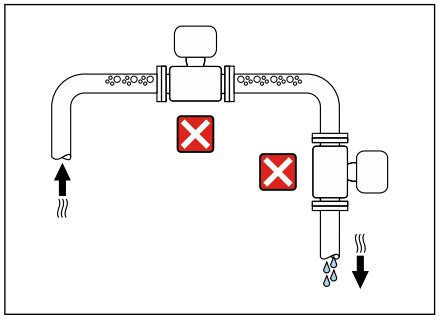

A0043063

Horizontal orientation, transmitter with measuring pipe curved downwards
Match the sensor position to the medium properties.
Not suitable for media with entrained solids: solids may accumulate.

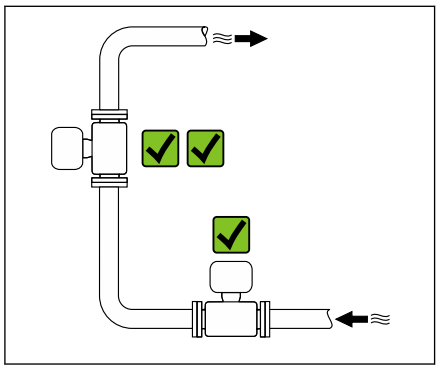

A0044717

Horizontal orientation, transmitter with measuring pipe curved upwards
Match the sensor position to the medium properties.
Not suitable for outgassing media: gas may accumulate.

Mounting locations

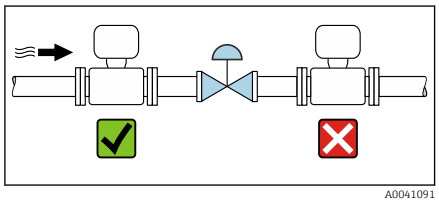

A0042131

- Do not install the device at the highest point of the pipe.
- Do not install the device upstream from a free pipe outlet in a down pipe.


A0042317

The device should ideally be installed in an ascending pipe.

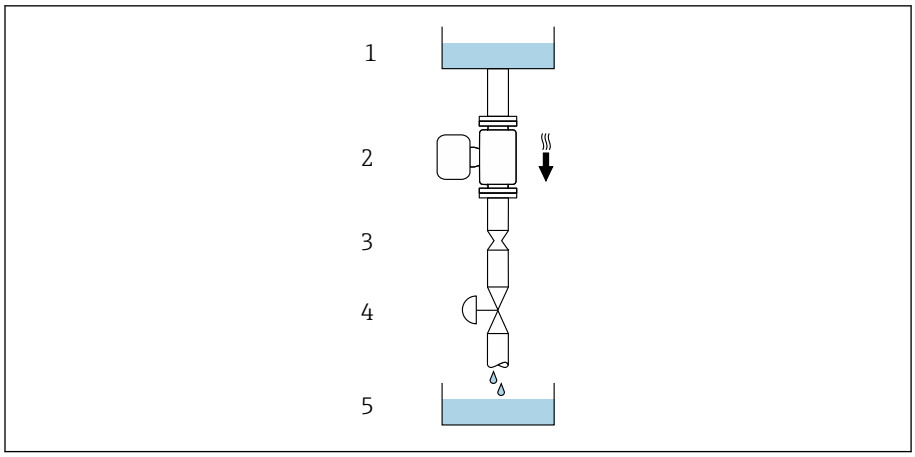
Installation near control valves


A0041091

Install the device in the direction of flow upstream from the control valve.

Installation in a down pipe

Installation suggestion for installation in an open down pipe, e.g. for bottling applications. A pipe restriction or the use of an orifice plate with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



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

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

Rupture disk

Information that is relevant to the process → *Rupture disk*, 📄 101.

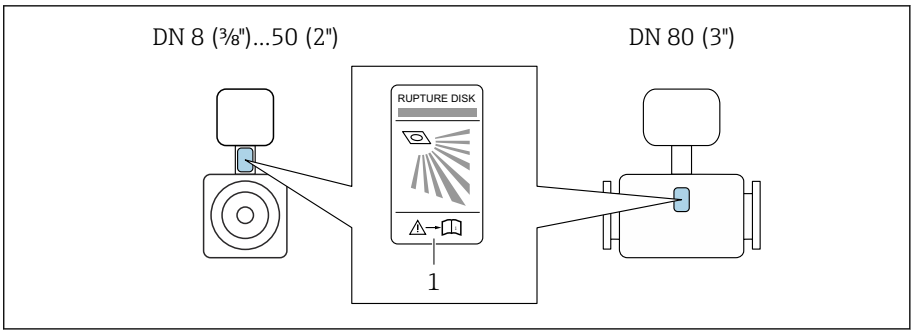
⚠ WARNING

A missing or damaged rupture disk can put staff at risk!

Medium escaping under pressure can cause serious injury or material damage.

- ▶ Ensure that any danger to persons or material damage is ruled out if the rupture disk is actuated.
- ▶ Observe information on the rupture disk sticker.
- ▶ Make sure that the function and operation of the rupture disk is not impeded during the installation of the device.
- ▶ Do not use a heating jacket.
- ▶ Do not remove or damage the rupture disk.
- ▶ After the rupture disk is actuated, do not operate the device any longer.

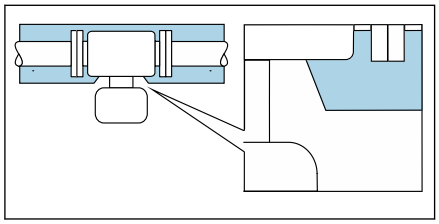
The position of the rupture disk is indicated by a sticker affixed to the device. If the rupture disk is triggered, the sticker is destroyed. The disk can therefore be visually monitored.



A0029956

1 Rupture disk sticker

Sensor thermal insulation



A0044122

NOTICE

If the meter electronics overheat this can damage the device!

- ▶ Keep the housing support completely free (heat dissipation).

- ▶ Provide insulation but make sure it does not go beyond the upper edge of the two sensor half-shells.

Heating

NOTICE

Ambient temperature too high!

If the electronics overheat this can damage the transmitter housing.

- ▶ Do not exceed the permissible temperature range for the ambient temperature.
- ▶ Use a weather protection cover.

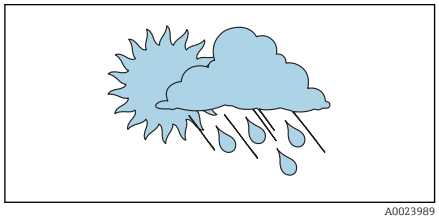
- ▶ Mount the device correctly.

Heating options

- Electrical heating, e.g. with electric band heaters [1)]
- Via pipes carrying hot water or steam
- Via heating jackets

Heating jackets for the sensors can be ordered as accessories from Endress +Hauser: .

Outdoor use



A0023989

- Avoid exposure to direct sunlight.
- Install in a location protected from sunlight.
- Avoid direct exposure to weather conditions.
- Use a weather protection cover → *Transmitter*, 🖹 132.

1) The use of parallel electric band heaters is generally recommended (bidirectional electricity flow). Particular considerations must be made if a single-wire heating cable is to be used. Additional information is provided in the document EA01339D "Installation instructions for electrical trace heating systems" → *Associated documentation*, 🖹 6

Installing the device

Preparing the device

1. Remove the entire transportation packaging.
2. Remove protective covers or protective caps on the device.

Installing seals

WARNING

Improper process sealing can put staff at risk!

- Check whether the seals are clean and undamaged.

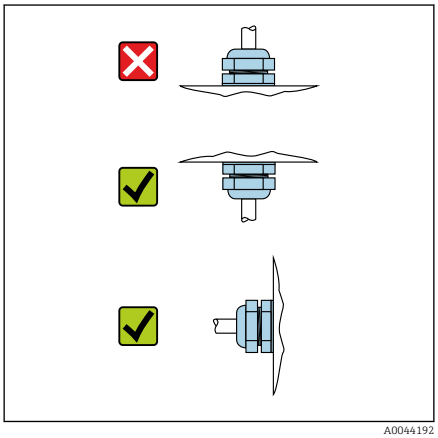
NOTICE

Incorrect installation can lead to incorrect measurement results!

- The internal diameter of the seal must be greater than or equal to that of the process connection and pipe.
- Fit the seals and measuring pipe centrically.
- Make sure that the seals do not protrude into the pipe cross-section.

Installing the sensor

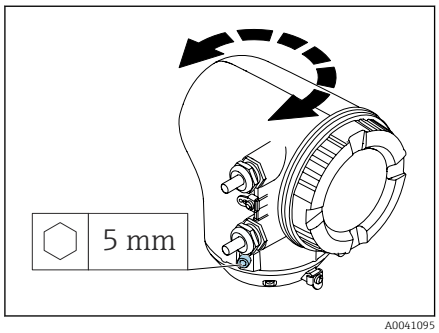
1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
2. Install and turn the device or transmitter housing in such a way that the cable entries point down or to the side.



A0044192

Turning the transmitter housing

Order code for "Housing", option "Aluminum"

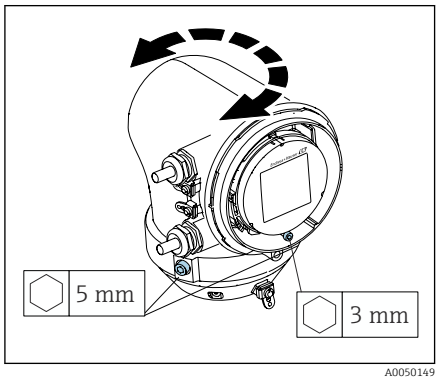


A0041095

1. Loosen the fixing screws on both sides of the transmitter housing.
2. NOTICE
   Overrotation of the transmitter housing!
   Interior cables are damaged.
   ▶ Turn the transmitter housing a maximum of 180° in each direction.

   Turn the transmitter housing to the desired position.
3. Tighten the screws in the logically reverse sequence.

Order code for "Housing", option "Polycarbonate"



A0050149

1. Loosen the screw on the housing cover.
2. Open the housing cover.
3. Loosen the grounding screw (below the display).
4. Loosen the fixing screws on both sides of the transmitter housing.
5. NOTICE
   Overrotation of the transmitter housing!
   Interior cables are damaged.
   ▶ Turn the transmitter housing a maximum of 180° in each direction.

   Turn the transmitter housing to the desired position.
6. Tighten the screws in the logically reverse sequence.

Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the device comply with the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation been selected for the device?	❑
Does the direction of the arrow on the device match the flow direction of the medium?	❑
Is the device protected against precipitation and sunlight?	❑

5 Electrical connection

Connection conditions

Notes on the electrical connection

⚠ WARNING

Components carry voltage!
Incorrect work performed on the electrical connections can result in an electric shock.

- ▶ Have electrical connection work carried out by appropriately trained specialists only.
- ▶ Comply with applicable federal/national installation codes and regulations.
- ▶ Comply with national and local workplace safety regulations.
- ▶ Establish the connections in the correct order: always make sure to first connect the protective earth (PE) to the inner ground terminal.
- ▶ When using in hazardous areas, observe the "Safety Instructions" document.
- ▶ Ground the device carefully and provide potential equalization.
- ▶ Connect protective earthing to all outer ground terminals.

Additional protective measures

The following protective measures are required:

- Set up a disconnecting device (switch or power-circuit breaker) to easily disconnect the device from the supply voltage.
- In addition to the device fuse, include an overcurrent protection unit, with max. 10 A, in the facility installation.
- Plastic sealing plugs act as safeguards during transportation and must be replaced by suitable, individually approved installation material.
- Connection examples: → *Examples for electric terminals*, 📄 136

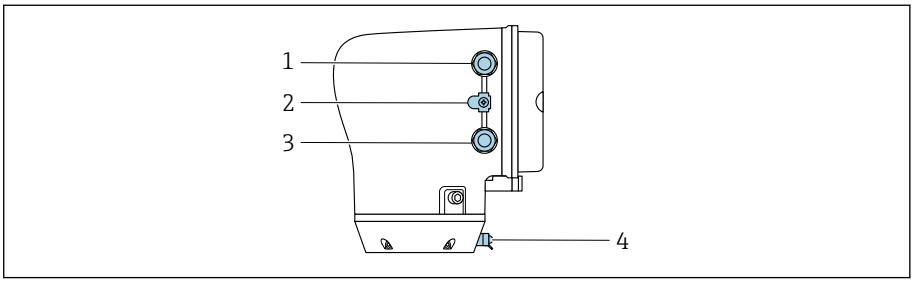
Connecting the cable shield

To avoid power (mains) frequency equalizing currents over the cable shield, the potential equalization of the facility must be ensured. If potential equalization (equipotential bonding) of the facility is not possible, only connect the cable shield to the facility on one side. Shielding against electromagnetic interference is then only partially ensured.

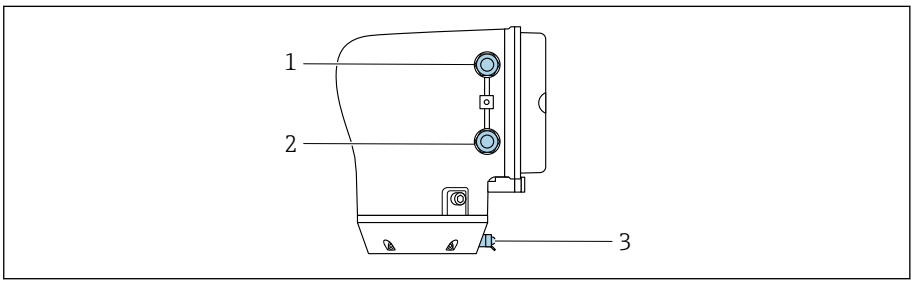
1. Keep stripped and twisted cable shields to the inner ground terminal as short as possible.
2. Shield cables fully.
3. Connect the cable shield to the potential equalization of the facility on both sides.

Connecting the transmitter

Transmitter terminal connections



1 *Cable entry for power supply cable: supply voltage*
2 *Outer ground terminal: on transmitters made of polycarbonate with a metal pipe adapter*
3 *Cable entry for signal cable*
4 *Outer ground terminal*



1 *Cable entry for power supply cable: supply voltage*
2 *Cable entry for signal cable*
3 *Outer ground terminal*

Terminal assignment

The terminal assignment is documented on an adhesive label.

The following terminal assignment is available:

Modbus RS485 and current output 4 to 20 mA (active)

Supply voltage		Output 1				Output 2	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (B)	23 (A)
L/+	N/–	Current output 4 to 20 mA (active)		–		Modbus RS485	

Modbus RS485 and current output 4 to 20 mA (passive)

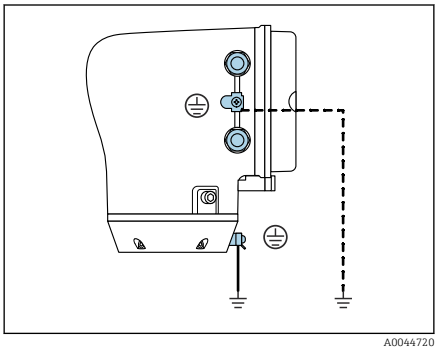
Supply voltage		Output 1				Output 2	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (B)	23 (A)
L/+	N/–	–		Current output 4 to 20 mA (passive)		Modbus RS485	

Wiring the transmitter

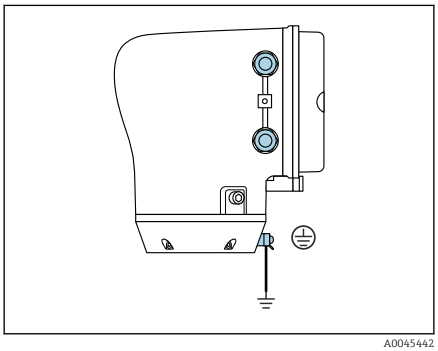
- Use a suitable cable gland for the power supply cable and signal cable.
- Pay attention to the requirements for the power supply cable and signal cable → *Requirements for connecting cable*, 90 .
- Use shielded cables for digital communication.

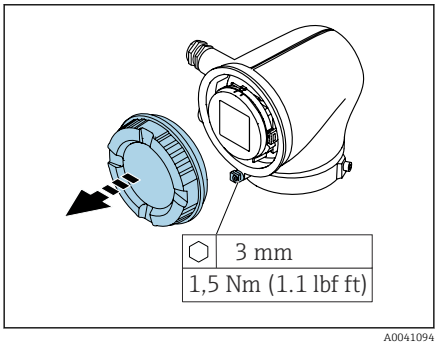
NOTICE

If the cable gland is incorrect, this compromises the sealing of the housing!
Damage to the device.
▶ Use a suitable cable gland corresponding to the degree of protection.


A0044720

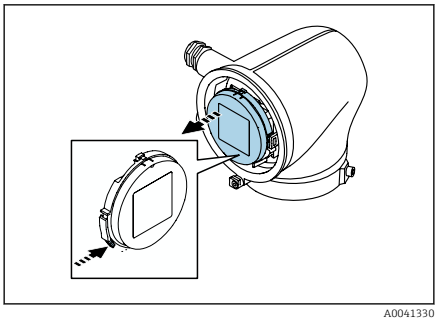
1. Ground the device carefully and provide potential equalization.
2. Connect protective earthing to the outer ground terminals.


A0045442

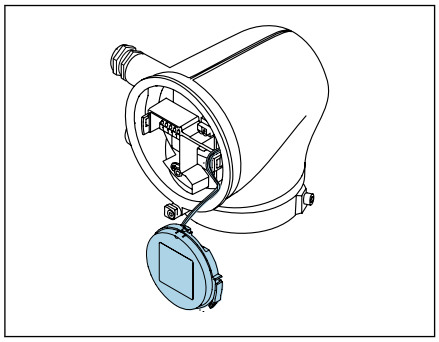


A0041094

3. Loosen the Allen key of the securing clamp.
4. Open the housing cover counterclockwise.

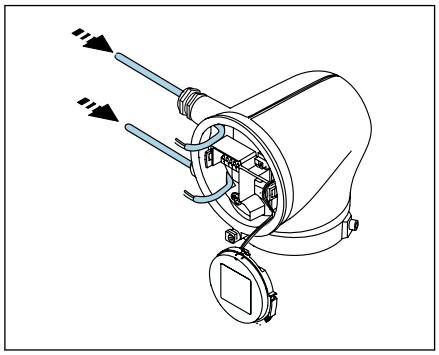

A0041330

5. Press the tab of the display module holder.
6. Remove the display module from the display module holder.


A0041354

The cable must be in the tab for strain relief.

7. Let the display module hang down.

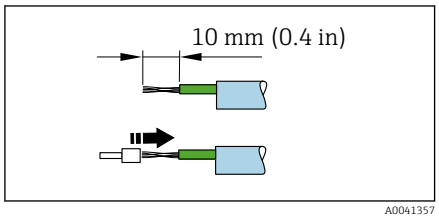

A0041356

8. Remove dummy plug if present.

NOTICE

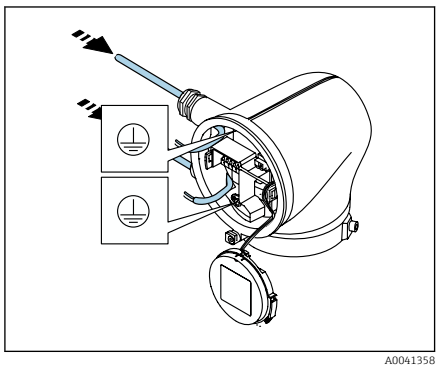
If the sealing ring is missing, the housing is not sealed tight!
Damage to the device.
- Do not remove the sealing ring from the cable entry.

9. Feed the power supply cable and signal cable through the corresponding cable entry.



A0041357

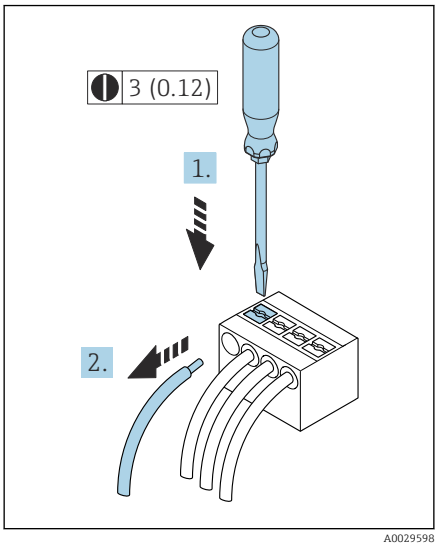
10. Strip the cable and cable ends.
11. Fit ferrules over the strands and press in place.


A0041358

The terminal assignment is documented on an adhesive label.

12. Connect the protective ground (PE) to the inner ground terminal.
13. Connect the power supply cable and signal cable as per the terminal assignment.
14. Connect the cable shields to the inner ground terminal.
15. Tighten the cable glands.
16. Follow the sequence in the reverse order to reassemble.

Removing a cable



5 *Engineering unit mm (in)*

1. Use a flat-blade screwdriver to press down on the slot between the two terminal holes and hold.
2. Remove the cable end from the terminal.

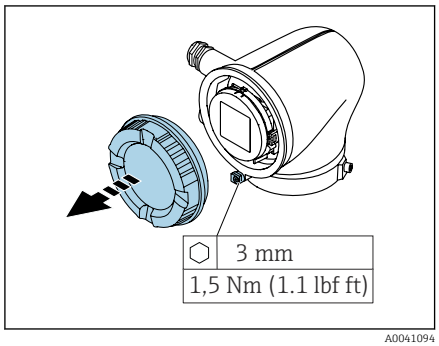
Ensuring potential equalization

No special measures for potential equalization are required.

For devices intended for use in hazardous areas, observe the instructions in the Ex documentation (XA).

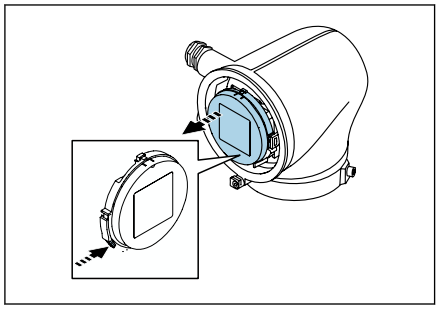
Hardware settings

Enabling write protection

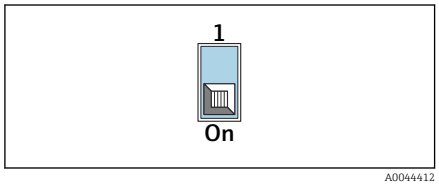


A0041094

1. Loosen the Allen key of the securing clamp.
2. Open the housing cover counterclockwise.


A0041330

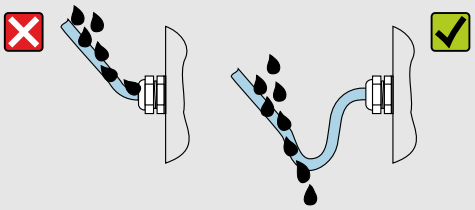
3. Press the tab of the display module holder.
4. Remove the display module from the display module holder.



A0044412

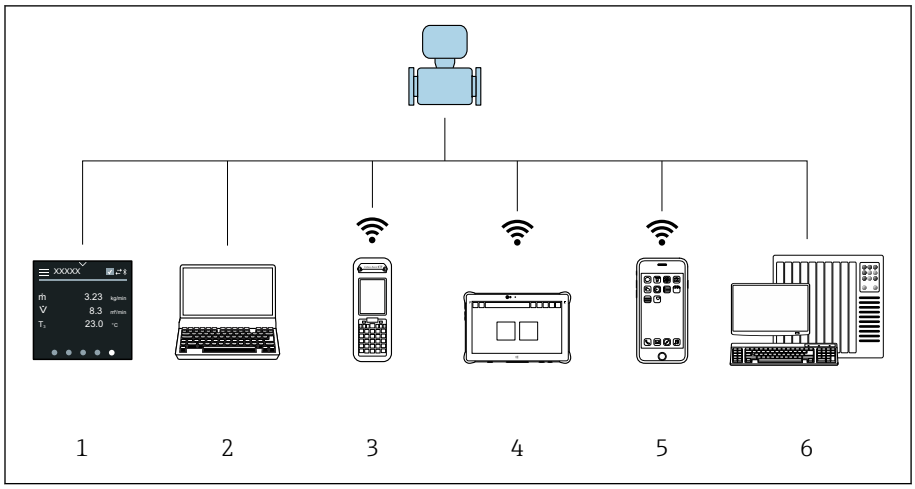
5. Set the write protection switch on the back of the display module to the **On** position.
   ↳ Write protection is enabled.
6. Follow the sequence in the reverse order to reassemble.

Post-connection check

Is the protective earthing established correctly?	❑
Are the device and cable undamaged (visual check)?	❑
Do the cables meet the requirements?	❑
Is the terminal assignment correct?	❑
Are all the cable glands installed, firmly tightened and leak-tight?	❑
Are dummy plugs inserted in unused cable entries?	❑
Are transportation plugs replaced by dummy plugs?	❑
Are the housing screws and housing cover tightened?	❑
Do the cables loop down before the cable gland ("water trap")?  A0042316	❑
Does the supply voltage match the specifications on the transmitter nameplate?	❑

6 Operation

Overview of the operating options



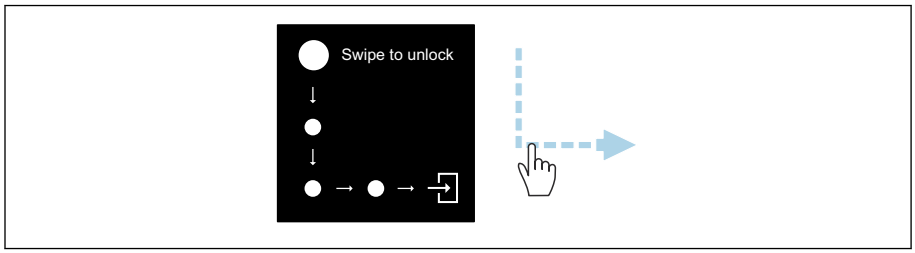
A0044206

1 *Local operation via touch screen*
2 *Computer with operating tool, e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM*
3 *Field Xpert SFX350 or SFX370 via Bluetooth, e.g. SmartBlue App*
4 *Field Xpert SMT70 via Bluetooth, e.g. SmartBlue App*
5 *Tablet or smartphone via Bluetooth, e.g. SmartBlue App*
6 *Automation system, e.g. PLC*

Local operation

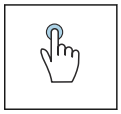
Unlocking local operation

Local operation must first be unlocked before the device can be operated via the touch screen. To unlock, draw the pattern "L" on the touch screen.



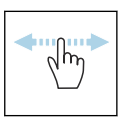
A0044415

Navigation



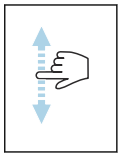
Tap

- Open menus.
- Select items in a list.
- Acknowledge buttons.
- Enter characters.



Swipe horizontally

Display next or previous page.



Swipe vertically

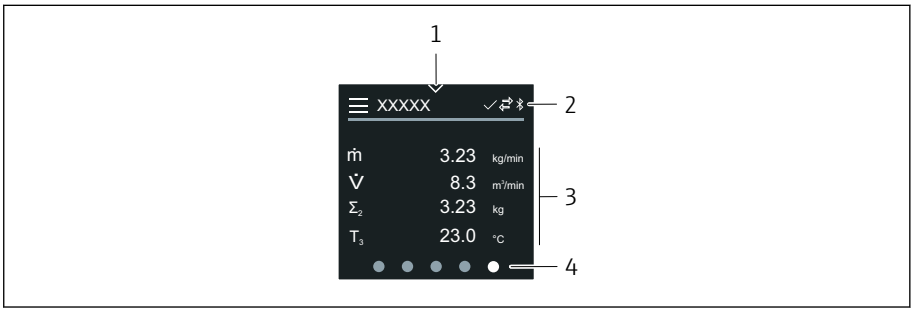
Display additional points in a list.

Operational display

During routine operation, the local display shows the operational display screen. The operational display consists of several windows which the user can toggle between.

The operational display can be customized: see the description of parameters → *Main menu*, 44.

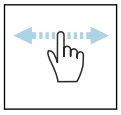
Operational display and navigation



1 *Quick access*
2 *Status symbols, communication symbols and diagnostic symbols*
3 *Measured values*
4 *Rotating page display*

Tap

- Open the main menu.
- Open quick access.



Swipe horizontally

Display next or previous page.

Symbols

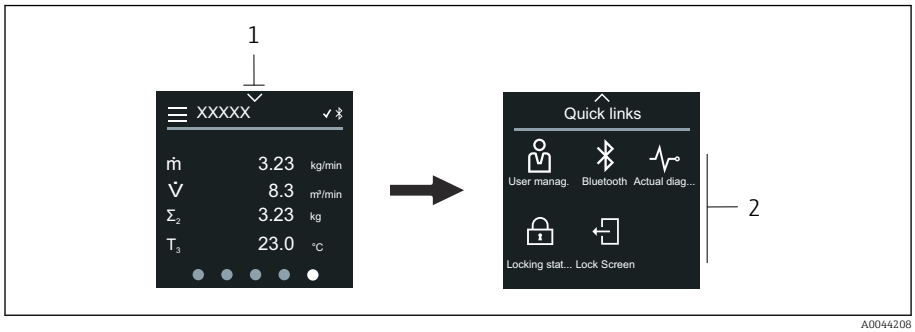
- Open the main menu.
- Quick access
- Locking status
- Bluetooth is active.
- Device communication is enabled.
- Status signal: function check
- Status signal: maintenance required
- Status signal: out of specification
- Status signal: failure
- Status signal: diagnostics active.

Quick access

The Quick access menu contains a selection of specific device functions.

Quick access is indicated by a triangle at the top of the local display in the middle.

Quick access and navigation



1 Quick access
2 Quick access with specific device functions

Tap

- Back to operational display.
- Open specific device functions.

Symbols

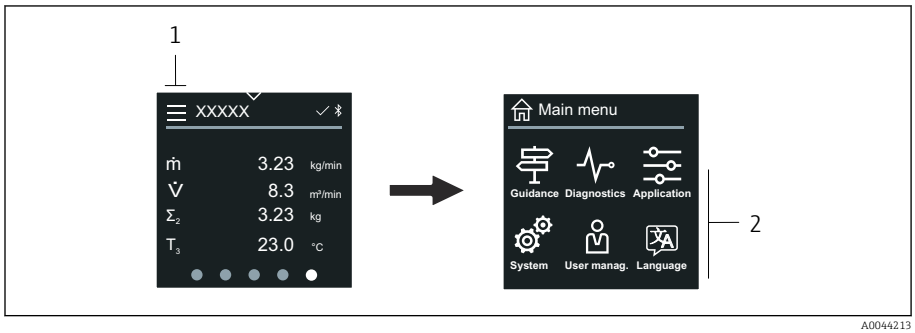
When a symbol is tapped, the local display shows the menu with the corresponding specific device functions.

- Enable or disable Bluetooth.
- Enter access code.
- Write protection is enabled.
- Back to operational display.

Main menu

The main menu contains all the menus required for the commissioning, configuration and operation of the device.

Main menu and navigation



1 Open the main menu.
2 Open menus for the specific device functions.

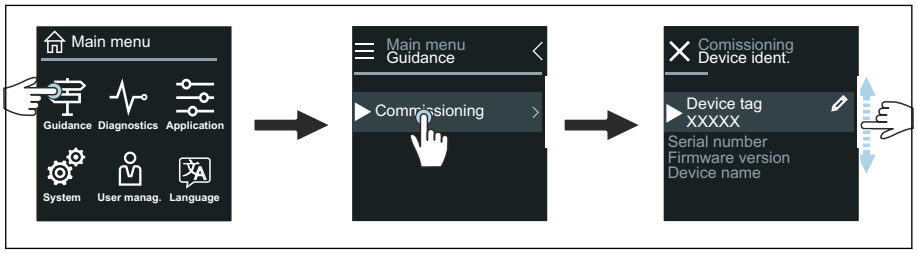
Tap

- Back to operational display.
- Open menus.

Symbols

- Back to operational display.
- **Guidance** menu
  Configuration of the device
- **Diagnostics** menu
  Troubleshooting and control of device behavior
- **Application** menu
  Application-specific adjustments
- **System** menu
  Device management and user administration
- Set display language.

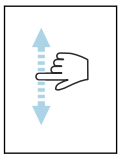
Submenus and navigation



A0044219

Tap

- Open the main menu.
- Open submenus or parameters.
- Select options.
- Skip items in list.



Swipe vertically

Select items in a list on a step-by-step basis.

Symbols

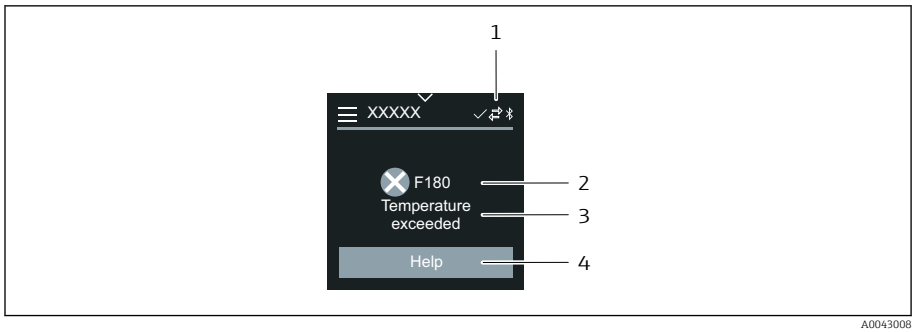
- Return to previous menu.
- Skip to bottom of list.
- Skip to top of list.

Diagnostic information

Diagnostic information displays additional instructions or background information for diagnostic events.

Opening the diagnostic message

The diagnostic behavior is indicated on the top right of the local display by a diagnostics symbol. Tap the symbol or the "Help" button to open the diagnostic message.



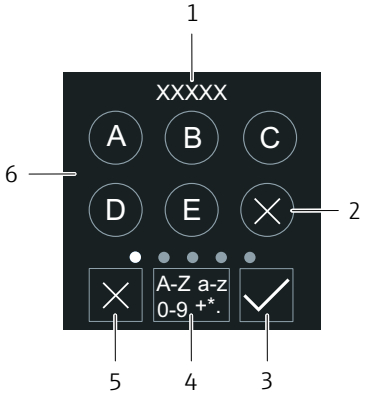
1 *Device status*
2 *Diagnostic behavior with diagnostic code*
3 *Short text*
4 *Open the troubleshooting measures.*

Editing view

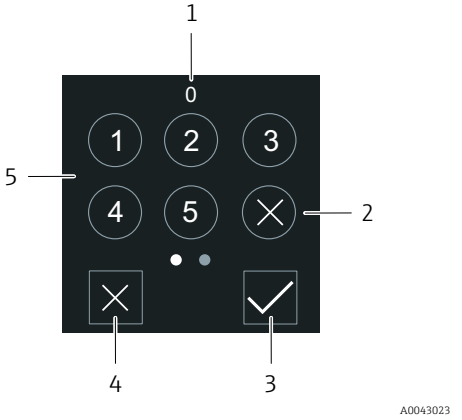
Editor and navigation

The text editor is used to enter characters.

Text editor	Numeric editor



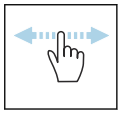
1 *Entry display area*
2 *Delete character.*
3 *Confirm your entry.*
4 *Switch input field.*
5 *Cancel editor.*
6 *Input field*



1 *Entry display area*
2 *Delete character.*
3 *Confirm your entry.*
4 *Cancel editor.*
5 *Input field*

Tap

- Enter characters.
- Select next character set.

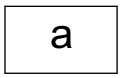


Swipe horizontally

Display next or previous page.

Input field

Upper case

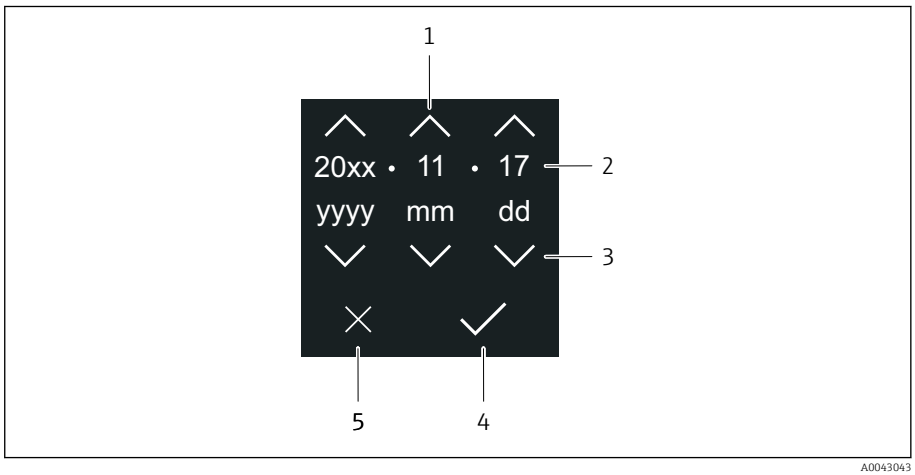


Lower case

1	Numbers
+*(	Special characters

Date

The device has a real-time clock for all log functions. The time can be configured here.



1 *Increase date by 1.*
2 *Actual value*
3 *Decrease date by 1.*
4 *Confirm settings.*
5 *Cancel editor.*

Tap

- Make settings.
- Confirm settings.
- Cancel editor.

SmartBlue app

The device has a Bluetooth interface and can be operated and configured using the SmartBlue App. The SmartBlue App must be downloaded onto a terminal device for this purpose. Any terminal device can be used.

- The range is 20 m (65.6 ft) under reference conditions.
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption.
- Bluetooth can be disabled.

Download	Endress+Hauser SmartBlue App: ▪ Google Playstore (Android) ▪ iTunes Apple Shop (iOS devices) ANDROID APP ON Google Play Download on the App Store
Supported functions	▪ Configuration of the device ▪ Access to measured values, device status and diagnostic information

Downloading the SmartBlue app:

1. Install and start the SmartBlue app.
   ↳ A Live List shows all the devices available.
   The list displays the devices with the configured tag name. The default setting of the device tag is **EH_**BB_XXYYZZ** (XXYYZZ = the first 6 characters of the device serial number).
2. For Android devices, activate GPS positioning (not necessary for devices with IOS)
3. Select the device from the Live List.
   ↳ The Login dialog box opens.

- For energy-saving reasons, if the device is not powered by a power unit, it is only visible in the live list for 10 seconds every minute.
- The device appears immediately in the live list if the local display is touched for 5 seconds.
- The device with the highest signal strength appears at the very top of the live list.

Logging in:

4. Enter the user name: **admin**
5. Enter the initial password: serial number of the device.
   ↳ When you log in for the first time, a message is displayed advising you to change the password.
6. Confirm your entry.
   ↳ The main menu opens.
7. Optional: Change Bluetooth® password: System → Connectivity → Bluetooth configuration → Change Bluetooth password

Forgotten your password: contact Endress+Hauser Service.

Performing a firmware update via the SmartBlue app

The flash file must be uploaded to the desired terminal (e.g. smartphone) beforehand.

1. In the SmartBlue app: open system.
2. Open the software configuration.
3. Open the firmware update.
   ↳ The wizard now guides you through the firmware update.

7 System integration

Device description files

Version data

Firmware version	01.00.zz	▪ On the title page of the Operating instructions ▪ On the transmitter nameplate → *Transmitter nameplate*, 17 ▪ System → Information → Device → Firmware version
Release date of firmware version	04.2021	-

Operating tools

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

Operating tools via service interface (CDI) or Modbus interface	Sources for obtaining device descriptions
FieldCare	▪ www.endress.com → Downloads ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	▪ www.endress.com → Downloads ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)

Modbus RS485 information

Technical data → *Protocol-specific data*, 87

Function codes

The function code determines which read or write actions should be performed via the Modbus protocol.

Code	Name	Description	Application
03	Read holding register	Modbus master reads 1 Modbus register from the device. A maximum of 125 consecutive Modbus registers can be read with 1 telegram: 1 Modbus register = 2 bytes Function codes 03 and 04 produce the same result.	Read parameters with read access and write access Example: Read mass flow
04	Read input register	Modbus master reads 1 Modbus register from the device. A maximum of 125 consecutive Modbus registers can be read with 1 telegram: 1 Modbus register = 2 bytes Function codes 03 and 04 produce the same result.	Read parameters with read access Example: Read totalizer value
06	Write single registers	Modbus Master writes 1 new value to 1 Modbus register of the device. Function code 16 can be used to write to multiple registers with 1 telegram.	Write only 1 parameter Example: reset the totalizer
08	Diagnostics	Modbus master checks the communication with the device. The following "Diagnostics codes" are supported: ▪ Sub-function 00 = Return query data (loopback test) ▪ Sub-function 02 = Return diagnostics register	

Code	Name	Description	Application
16	Write multiple registers	Modbus master writes 1 new value to multiple Modbus registers of the device. A maximum of 120 consecutive Modbus registers can be written with 1 telegram. If the required device parameters are not available as a group, but must be addressed with a single telegram, use the Modbus data map .	Write multiple parameters Example: ▪ Mass flow unit ▪ Mass unit
23	Read/Write multiple registers	Modbus master reads and writes a maximum of 118 Modbus registers of the device simultaneously with 1 telegram. Write access is executed before read access.	Read and write multiple parameters Example: ▪ Read mass flow ▪ Reset the totalizer

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

Modbus register information

Overview of parameters with the Modbus register information: Description of Parameters → 6.

Response time

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

Data types

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

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

STRING	Byte 17	Byte 16	...	Byte 1	Byte 0
▪ Data length = depends on parameter ▪ Example of a parameter with a data length = 18 bytes (9 registers)	Most significant byte (MSB)		...		Least significant byte (LSB)

Byte sequence

Byte addressing (the byte sequence) is not specified in the Modbus specification. During commissioning, it is necessary to configure the addressing between the master and slave with the **"Byte order" parameter**.

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

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

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

STRING	Selection	Byte sequence				
		1.	2.	...	17.	18.
Example of a parameter with a data length = 18 bytes (9 registers)	**1** – **0** – 3 – 2 * 3 – 2 – **1** – **0**	Byte 17 (MSB)	Byte 16	...	Byte 1	Byte 0 (LSB)
	0 – **1** – 2 – 3 2 – 3 – **0** – **1**	Byte 16	Byte 17 (MSB)	...	Byte 0 (LSB)	Byte 1
	* = factory setting, MSB = most significant byte, LSB = least significant byte					

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 parameters), so that the calling of parameters via Modbus RS485 is no longer limited to individual parameters or a group of consecutive parameters.

Parameters can be grouped flexibly. The Modbus master can read and write to the entire data block via a single telegram.

Structure of the Modbus data map

The Modbus data map consists of two data sets:

- Scan list: Configuration area
  The parameters to be grouped are defined in a scan list by entering their Modbus register addresses in the scan list.
- Data area
  The device cyclically reads out the Modbus register addresses entered in the scan list and writes the associated values for the parameters to the data area.

Overview of parameters with the Modbus register information: Description of Parameters → 6.

Scan list configuration

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

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

Configuration of the scan list via the local display or the SmartBlue App

The scan list is configured with FieldCare or DeviceCare via the **Scan list register 0 to 15** parameter.

Navigation
Application → Communication → Modbus data map → Scan list register 0 to 15

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

Configuration of the scan list via Modbus RS485

The scan list is configured via Modbus register addresses 5001 to 5016

No.	Modbus register address	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

- Values for the parameters have been defined in the scan list.
- To read out the values, the Modbus master accesses the data area of the Modbus data map.
- Modbus master access to the data area via Modbus register addresses 5051 to 5081.

Data area				
Parameter value	**Modbus register addresses**		**Data type** [1]	**Access** [2]
	Start register	**End register (Float only)**		
Value of scan list register 0	5051	5052	Integer/float	Read/write
Value of scan list register 1	5053	5054	Integer/float	Read/write
Value of scan list register ...	...	...	...	...
Value of scan list register 15	5081	5082	Integer/float	Read/write

1) The data type depends on the parameter entered in the scan list.
2) The data access depends on the parameter entered in the scan list. If the parameter entered supports read access and write access, the parameter can be accessed via the data area.

8 Commissioning

Post-installation check and post-connection check

Before commissioning the device, make sure that the post-installation and post-connection checks have been performed:
- Post-installation check → *Post-installation check*, 32
- Post-connection check → *Post-connection check*, 40

IT security

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

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

Device-specific IT security

Access via Bluetooth

Secure signal transmission via Bluetooth uses an encryption method tested by the Fraunhofer Institute.

- Without the SmartBlue App, the device is not visible via Bluetooth.
- Only one point-to-point connection is established between the device and a smartphone or tablet.

Access via the SmartBlue app

Two access levels (user roles) are defined for the device: the **Operator** user role and the **Maintenance** user role. The **Maintenance** user role is configured when the device leaves the factory.

If a user-specific access code is not defined (in the Enter access code parameter), the default setting **0000** continues to apply and the **Maintenance** user role is automatically enabled. The device's configuration data are not write-protected and can be edited at all times.

If a user-specific access code has been defined (in the Enter access code parameter), all the parameters are write-protected. The device is accessed with the **Operator** user role. When the user-specific access code is entered a second time, the **Maintenance** user role is enabled. All parameters can be written to.

For detailed information, see the "Description of Device Parameters" document pertaining to the device.

Protecting access via a password

There are a variety of ways to protect against write access to the device parameters:
- User-specific access code:
  Protect write access to the device parameters via all the interfaces.
- Bluetooth key:
  The password protects access and the connection between an operating unit, e.g. a smartphone or tablet, and the device via the Bluetooth interface.

General notes on the use of passwords

- The access code and Bluetooth key that are valid when the device is delivered must be redefined during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code and Bluetooth key.
- The user is responsible for the management and careful handling of the access code and Bluetooth key.

Write protection switch

The entire operating menu can be locked via the write protection switch. The values of the parameters cannot be changed. Write protection is disabled when the device leaves the factory.

Access authorization with write protection:

- Disabled: write access to the parameters
- Enabled: read-only access to the parameters

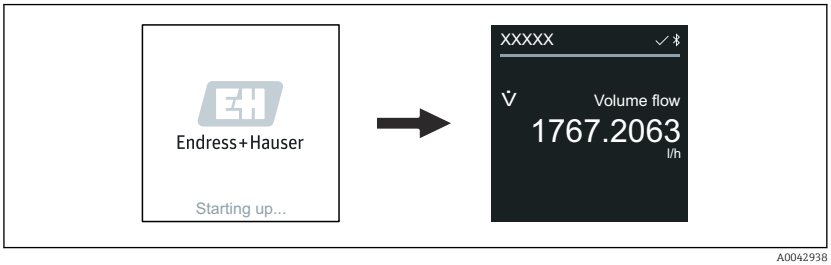
Write protection is enabled with the write protection switch on the back of the display module→ *Hardware settings*, 39.

The local display indicates that write protection is enabled on the top right of the display: .

Switching on the device

▶ Switch on the supply voltage for the device.

↳ The local display switches from the start screen to the operational display.



A0042938

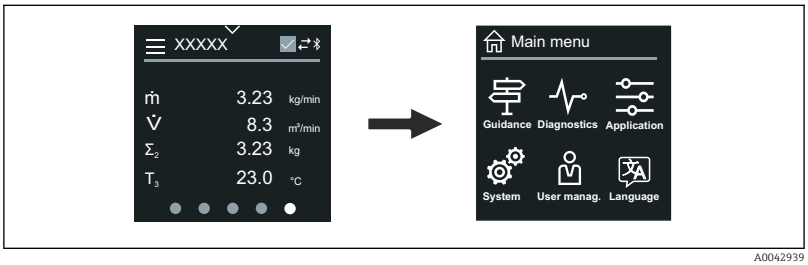
If device startup is not successful, the device displays an error message to this effect → *Diagnostics and troubleshooting*, 66.

Commissioning the device

Local operation

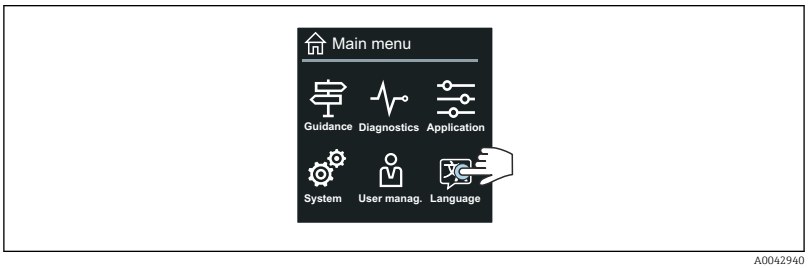
Detailed information on local operation: → *Operation*, 42

1. Via the "Menu" symbol, open the main menu.



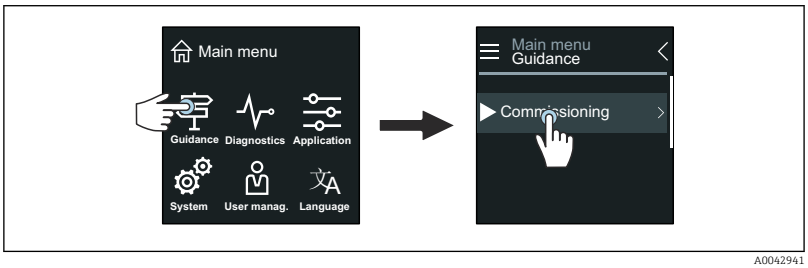
A0042939

2. Via the "Language" symbol, select the desired language.



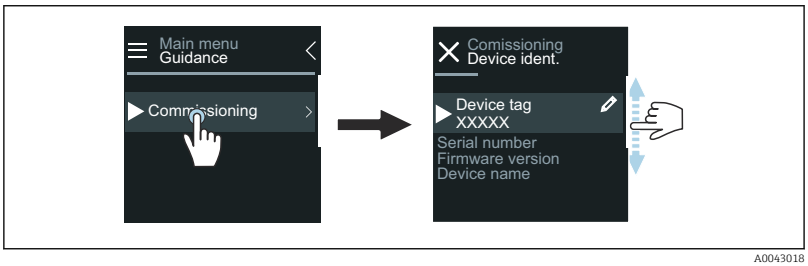
A0042940

3. Via the "Guidance" symbol, open the **Commissioning** wizard.



A0042941

4. Start the **Commissioning** wizard.



A0043018

5. Follow the instructions on the local display.
   → The **Commissioning** wizard goes through all the device parameters that are necessary to commission the device.

For detailed information, see the "Description of Device Parameters" document pertaining to the device.

SmartBlue App

Information on the SmartBlue App → *SmartBlue app*, 47.

Connecting the SmartBlue App to the device

1. Enable Bluetooth on the mobile handheld terminal, tablet or smartphone.
2. Start the SmartBlue App.
   ↳ A Live List shows all the devices available.
3. Select the desired device.
   ↳ The SmartBlue App shows the device login.
4. Under user name, enter **admin**.
5. Under password, enter the device's serial number. Serial number:
   → *Transmitter nameplate*, 🖹 17.
6. Confirm your entries.
   ↳ The SmartBlue App connects to the device and displays the main menu.

Opening the "Commissioning" wizard

1. Via the **Guidance** menu, open the **Commissioning** wizard.
2. Follow the instructions on the local display.
   ↳ The **Commissioning** wizard goes through all the device parameters that are necessary to commission the device.

9 Operation

Reading the device locking status

Indicates the write protection with the highest priority that is currently active.

Navigation
"System" menu → Device management → Locking status

Parameter overview with brief description

Parameter	Description	User interface
Locking status	Indicates the write protection with the highest priority that is currently active.	▪ Hardware locked ▪ Temporarily locked

Zero adjustment

All devices are calibrated in accordance with state-of-the-art technology and under reference conditions. A zero adjustment is generally not necessary. A zero adjustment is advisable only in special cases:
- To achieve maximum measuring accuracy even with low flow rates
- In the event of extreme process conditions or operating conditions, e.g. very high process temperatures or very high-viscosity media.

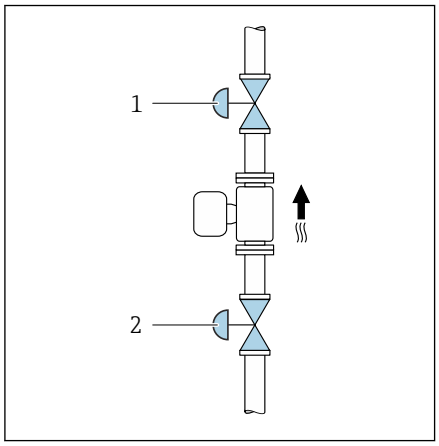
To get a representative zero point, ensure that:
- any flow in the device is prevented during the adjustment
- the process conditions (e.g. pressure, temperature) are stable and representative

Verification and adjustment cannot be performed if the following process conditions are present:
- Gas pockets
  Ensure that the system has been sufficiently flushed with the medium. Repeat flushing can help to eliminate gas pockets
- Thermal circulation
  In the event of temperature differences (e.g. between the measuring tube inlet and outlet section), induced flow can occur even if the valves are closed due to thermal circulation in the device
- Leaks at the valves
  If the valves are not leak-tight, flow is not sufficiently prevented when determining the zero point

If these conditions cannot be avoided, it is advisable to keep the factory setting for the zero point.

Prerequisite

- The zero adjustment can only be performed with media that have no gas or solid contents.
- Zero adjustment is performed at operating pressure and operating temperature with the measuring pipes completely filled and at zero flow (v = 0 m/s). For this purpose, shut-off valves (for example) can be provided upstream or downstream from the sensor, or existing valves and gate valves may be used.



- Normal operation: shutoff valve 1 and 2 open.
- Zero adjustment with pump pressure: shutoff valve 1 closed, shutoff valve 2 open.
- Zero adjustment without pump pressure: shutoff valve 1 open, shutoff valve 2 closed.

Performing zero adjustment

1. Let the system run until process conditions and operating conditions are normal.
2. Stop the flow.
3. Check that the sealing of the shutoff valves is tight (no leaks).
4. Check the operating pressure.
5. Via Application → Sensor → Sensor adjustment → Zero point adjustment select the **Zero point adjustment control** parameter.
   ↳ Zero adjustment is started. In the **Zero point adjustment status** parameter, the **Busy** option is displayed. When the zero adjustment is finished, the **Ok** option is displayed.

HistoROM data management

The device features HistoROM data management. Device data and process data can be saved, imported and exported with the HistoROM data management function, making operation and servicing far more reliable, secure and efficient.

Data backup

Automatic
The most important device data, e.g. the transmitter and sensor, are automatically saved in the S+T-DAT.
When the sensor is replaced, the customer-specific sensor data is adopted in the device. The device goes into operation immediately without any problems.

Manuell
The transmitter data (customer settings) must be saved manually.

Storage concept

	HistoROM backup	S+T-DAT
Available data	▪ Event logbook, e.g. diagnostic events ▪ Parameter data record backup	▪ Sensor data, e.g. nominal diameter ▪ Serial number ▪ Calibration data ▪ Configuration of the device, e.g. software options
Storage location	On the sensor electronics module (ISEM)	In the sensor connector in the sensor neck

Data transfer

A parameter configuration can be transferred to another device using the export function of the operating tool. The parameter configuration can be duplicated or saved in an archive.

10 Diagnostics and troubleshooting

General troubleshooting

Local display

Error	Possible causes	Remedial action
Local display dark, no output signals	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage.
	The polarity of the supply voltage is wrong.	Correct the polarity.
	No contact between cables and terminals.	▪ Check contact of cables. ▪ Connect the cables to the terminals again.
	Terminals are not plugged into the electronics module correctly.	▪ Check the terminals. ▪ Plug the terminals into the electronics module again.
	Electronics module is defective.	Order the appropriate spare part.
Local display is dark, but signal output is within the valid range.	Incorrect contrast setting of local display.	Adjust the contrast of the local display to ambient conditions.
	Cable connector for the local display is not correctly connected.	Plug in the cable connector correctly.
	Local display is defective.	Order the appropriate spare part.
Display alternates between error message and operational display	Diagnostic event has occurred.	Carry out appropriate troubleshooting measures.
Local display shows text in a foreign, incomprehensible language.	A foreign language is set.	Set the language of the local display.

Output signal

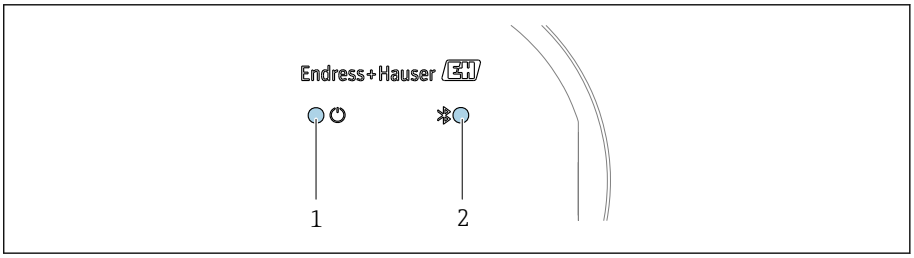
Error	Possible causes	Remedial action
Signal output is outside the valid current range (< 3.5 mA or > 23 mA).	Electronics module is defective.	Order the appropriate spare part.
Local display shows the correct value, but signal output is incorrect, though in the valid range.	Configuration error	▪ Check parameter configuration. ▪ Correct parameter configuration.
Device measures incorrectly.	▪ Configuration error ▪ The device is being operated outside the application range.	▪ Check parameter configuration. ▪ Correct parameter configuration. ▪ Observe limit values indicated.
No signal at frequency output	Device uses passive frequency output.	Wire the device correctly as described in the Operating Instructions .

Access and communication

Error	Possible causes	Remedial action
Not possible to write-access the parameter.	Write protection is enabled.	Set the write protection switch on the local display to the **Off** position.
	Current user role has limited access authorization.	1. Check user role. 2. Enter correct customer-specific access code.
Modbus communication is not possible.	Modbus RS485 bus cable is connected incorrectly.	Check the terminal assignment.
	Modbus RS485 cable is incorrectly terminated.	Check terminating resistor .
Device communication is not possible.	Settings for the communication interface are incorrect.	Check the Modbus RS485 configuration.
	Data transfer is active.	Wait until the data transfer or the current action is finished.
SmartBlue App does not show the device in the live list.	▪ Bluetooth is disabled on the device. ▪ Bluetooth is disabled on the smartphone or tablet.	1. Check whether the Bluetooth symbol appears on the local display. 2. Enable Bluetooth on the device. 3. Enable Bluetooth on the smartphone or tablet.
Device cannot be operated with the SmartBlue App.	▪ Bluetooth connection is not available. ▪ The device is already connected to another smartphone or tablet.	1. Check whether other devices are connected to the SmartBlue App. 2. Disconnect any other device connected to the SmartBlue App.
	▪ Incorrect password entered. ▪ Password forgotten.	1. Enter correct password. 2. Contact Endress+Hauser service organization.
Login with user data is not possible with the SmartBlue App.	Device in operation for the first time.	1. Enter the initial password (serial number of the device). 2. Change the initial password.

Diagnostic information via LED

Only for devices with the order code for "Display; operation", option H



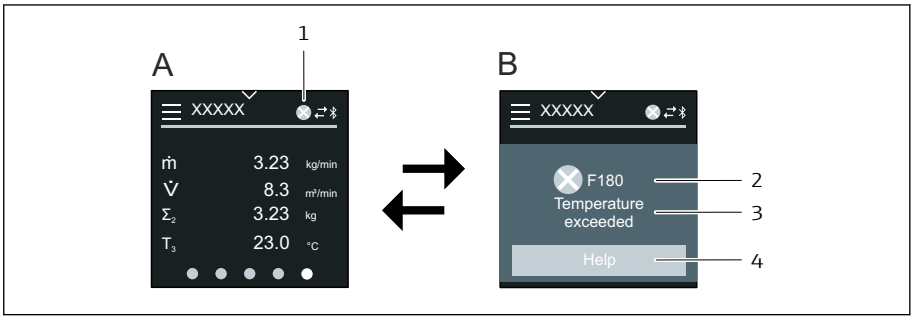
1 *Device status*
2 *Bluetooth*

LED		Status	Meaning
1	Device status (normal operation)	Off	No power supply
		Permanently green	Device status is OK. No warning / failure / alarm
		Flashing red	Warning is active.
		Permanently red	Alarm is active.
2	Bluetooth	Off	Bluetooth is disabled.
		Permanently blue	Bluetooth is enabled.
		Flashing blue	Data transfer in progress.

Diagnostic information on local display

Diagnostic message

The local display alternates between displaying faults as a diagnostic message and displaying the operational display screen.



A Operational display in alarm condition
B Diagnostic message
1 Diagnostic behavior
2 Status signal
3 Diagnostic behavior with diagnostic code
4 Short text
5 Open information on remedial measures.

If two or more diagnostics events are pending simultaneously, the local display only shows the diagnostic message with the highest priority.

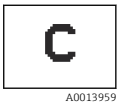
Other diagnostic events that have occurred can be opened in the **Diagnostics** menu as follows:
- Via parameters
- Via submenus

Status signals

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

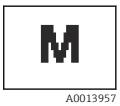
The status signals are categorized according to NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required, N = No Effect

Failure
- A device error has occurred.
- Measured value is no longer valid.



Function check
Device is in the service mode, e.g. during a simulation.

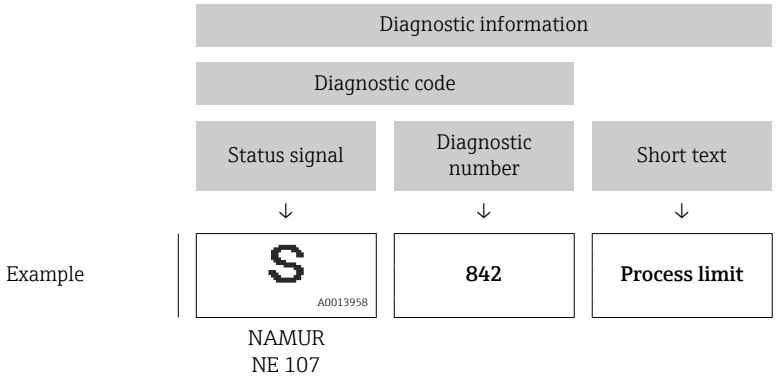
Out of specification
Device is being operated outside the technical specification limits, e.g. outside the process temperature range.



Maintenance required
- Maintenance is required.
- Measured value is still valid.

Diagnostic information

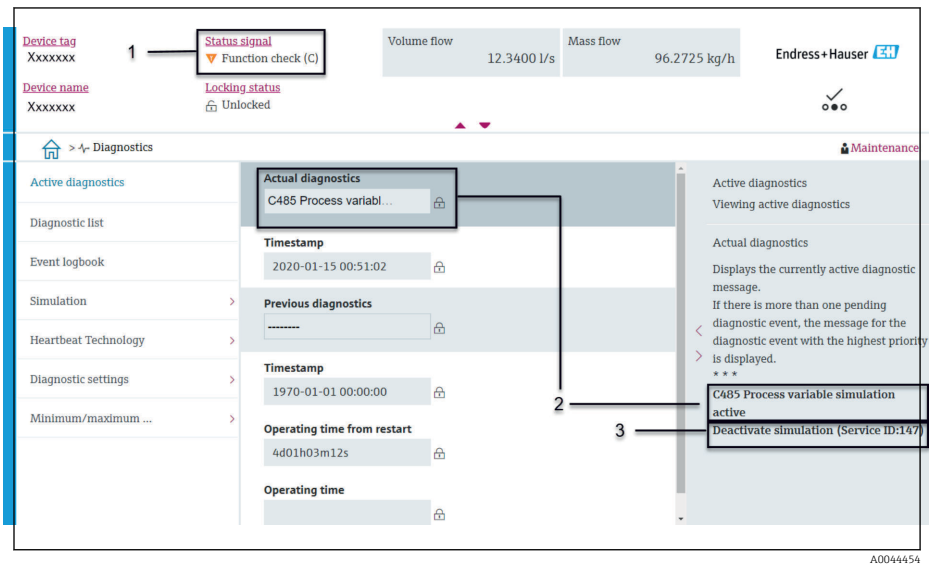
The fault can be identified using the diagnostic information. The short text displays a tip about the fault.



Diagnostic information in FieldCare or DeviceCare

Diagnostic options

After the connection has been established, the device shows faults on the home page.

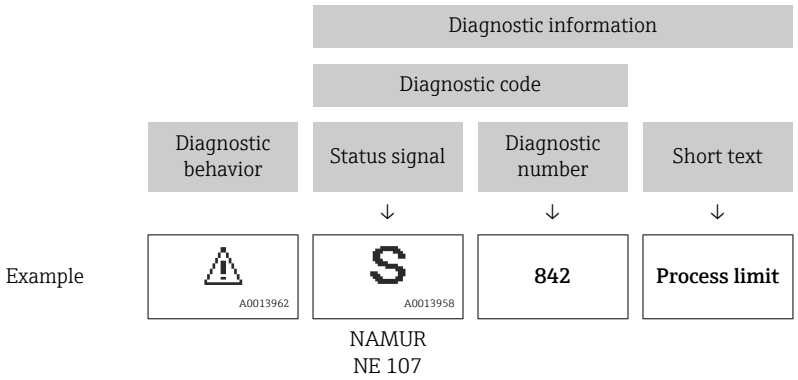


1 *Status area with diagnostic behavior and status signal*
2 *Diagnostic code and short message*
3 *Troubleshooting measures with service ID*

Other diagnostic events that have occurred can be opened in the **Diagnostics** menu as follows:
- Via parameter
- Via submenus

Diagnostic information

The fault can be identified using the diagnostic information. The short text displays a tip about the fault. The corresponding symbol for the diagnostic behavior appears at the start.



Changing the diagnostic information

Adapting the diagnostic behavior

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

Navigation path
Diagnostics → Diagnostic settings

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

Options	Description
Alarm	▪ Device stops measurement. ▪ Signal outputs and totalizers assume a defined alarm condition. ▪ Diagnostic message is generated. ▪ Background lighting changes to red. ▪ Device stops measurement. ▪ Measured value output via Modbus RS485 and totalizers assume a defined alarm condition. ▪ Diagnostic message is generated.
Warning	▪ Device continues measuring. ▪ Measured value output via Modbus RS485 and totalizers are not affected. ▪ Diagnostic message is generated.
Logbook entry only	▪ Device continues measuring. ▪ The local display shows the diagnostic message in the **Event logbook** submenu (**Event list** submenu) and does not alternate with the operational display.
Off	▪ Diagnostic event is ignored. ▪ Diagnostic message is not generated and not entered.

Overview of diagnostic information

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

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
022	Temperature sensor defective	1. Check or replace sensor electronic module (ISEM) 2. If available: Check connection cable between sensor and transmitter 3. Replace sensor	F	Alarm
046	Sensor limit exceeded	1. Check sensor 2. Check process conditions	S	Warning [1)]
062	Sensor connection faulty	1. Check or replace sensor electronic module (ISEM) 2. If available: Check connection cable between sensor and transmitter 3. Replace sensor	F	Alarm
063	Exciter current faulty	1. Check or replace sensor electronic module (ISEM) 2. If available: Check connection cable between sensor and transmitter 3. Replace sensor	F	Alarm
082	Data storage inconsistent	1. Check module connections 2. Contact service	F	Alarm
083	Memory content inconsistent	1. Restart device 2. Restore HistoROM S-DAT backup ('Device reset' parameter) 3. Replace HistoROM S-DAT	F	Alarm
140	Sensor signal asymmetrical	1. Check or replace sensor electronic module (ISEM) 2. If available: Check connection cable between sensor and transmitter 3. Replace sensor	S	Alarm [1)]
144	Measurement error too high	1. Check or change sensor 2. Check process conditions	F	Alarm [1)]
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
222	Voltage drift detected	Replace sensor electronic module (ISEM)	F	Alarm
230	Date/time incorrect	1. Replace RTC buffer battery 2. Set date and time	M	Warning [1)]
231	Date/time not available	1. Replace display module or its cable 2. Set date and time	M	Warning [1)]
242	Firmware incompatible	1. Check firmware version 2. Flash or replace electronic module	F	Alarm
252	Module incompatible	1. Check electronic modules 2. Check if correct modules are available (e.g. NEx, Ex) 3. Replace electronic modules	F	Alarm
270	Electronic module defective	Replace electronic module	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
278	Display module defective	Replace display module	F	Alarm
283	Memory content inconsistent	1. Reset device 2. Contact service	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning [1)]
311	Sensor electronics (ISEM) faulty	1. Do not reset device 2. Contact service	M	Warning
331	Firmware update failed in module 1 to n	1. Update firmware of device 2. Restart device	F	Warning
372	Sensor electronics (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
373	Sensor electronics (ISEM) faulty	Contact service	F	Alarm
374	Main electronics faulty	1. Restart device 2. Contact service	S	Warning [1)]
378	Electronic module supply voltage faulty	1. Restart device 2. Check if failure recurs 3. Replace electronic module	F	Alarm
383	Memory content	1. Restart device 2. Delete T-DAT via 'Reset device' parameter 3. Replace T-DAT	F	Alarm
387	HistoROM data faulty	Contact service organization	F	Alarm
Diagnostic of configuration				
410	Data transfer failed	1. Check connection 2. Retry data transfer	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 required	Carry out trim	C	Warning
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset different	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output faulty	1. Check process 2. Check current output settings	S	Warning [1)]
453	Flow override active	Deactivate flow override	C	Warning
484	Failure mode simulation active	Deactivate simulation	C	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
491	Current output 1 simulation active	Deactivate simulation	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of process				
832	Sensor electronics temperature too high	Reduce ambient temperature	S	Warning [1]
833	Sensor electronics temperature too low	Increase ambient temperature	S	Warning [1]
834	Process temperature too high	Reduce process temperature	S	Warning [1]
835	Process temperature too low	Increase process temperature	S	Warning [1]
842	Process value above limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning [1]
862	Partly filled pipe	1. Check for gas in process 2. Adjust detection limits	S	Warning [1]
910	Tubes not oscillating	1. Check sensor electronic module (ISEM) 2. Check sensor	F	Alarm
912	Medium inhomogeneous	1. Check process cond. 2. Increase system pressure	S	Warning [1]
913	Medium unsuitable	1. Check process conditions 2. Check electronic modules or sensor	S	Warning [1]
944	Monitoring failed	Check process conditions for Heartbeat Monitoring	S	Warning [1]
948	Oscillation damping too high	Check process conditions	S	Warning [1]

1) Diagnostic behavior can be changed.

Pending diagnostic events

The **Active diagnostics** submenu displays the current diagnostic event and the last diagnostic event to occur.

Diagnostics → Active diagnostics

The **Diagnostic list** submenu shows other diagnostic events that are pending.

Diagnostic list

The **Diagnostic list** submenu shows up to 5 currently pending diagnostic events with the related diagnostic information. If more than 5 diagnostic events are pending, the local display shows the diagnostic information with the highest priority.

Navigation path
Diagnostics → Diagnostic list

Event logbook

Reading out the event logbook

The event logbook is only available via FieldCare or SmartBlue App (Bluetooth).

The **Event logbook** submenu shows a chronological overview of the event messages that have occurred.

Navigation path
Diagnostics menu → **Event logbook** submenu

Chronological display with a maximum of 20 event messages.

The event history includes the following entries:
- Diagnostic event → *Overview of diagnostic information* , 📄 71
- Information event → *Overview of information events*, 📄 75

In addition to the operation time of the event occurrence, each event is also assigned a symbol that indicates whether the event has occurred or has ended:
- Diagnostic event
  - ⊕: Occurrence of the event
  - ⊖: End of the event
- Information event
  ⊕: Occurrence of the event

Filter event messages:

Filtering the event logbook

The **Event logbook** submenu displays the category of event messages that were configured with the **Filter options** parameter.

Navigation path
Diagnostics → Event logbook → Filter options

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

Overview of information events

The information event is only displayed in the event logbook.

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I11036	Date/time set successfully
I1111	Density adjust failure
I11167	Date/time resynchronized
I1137	Display module replaced

Info number	Info name
I1151	History reset
I1155	Sensor electronics temperature reset
I1157	Memory error event list
I1209	Density adjustment ok
I1221	Zero point adjust failure
I1222	Zero point adjustment ok
I1256	Display: access status changed
I1335	Firmware changed
I1351	Empty pipe detection adjustment failure
I1353	Empty pipe detection adjustment ok
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1448	Application reference data recorded
I1449	Recording application ref. data failed
I1459	I/O module verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1622	Calibration changed
I1624	All totalizers reset
I1625	Write protection activated
I1626	Write protection deactivated
I1629	CDI: login successful
I1632	Display: login failed
I1633	CDI: login failed
I1634	Reset to factory settings
I1635	Reset to delivery settings
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1712	New flash file received
I1725	Sensor electronic module (ISEM) changed

Device reset

The entire configuration, or a part of the configuration, can be reset to a defined state here.

Navigation path
System → Device management → Device reset

Options	Description
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to the customer-specific value. All other parameters are reset to the factory setting.
Of customer settings	Visibility depends on order options or device settings
Restart device	The restart resets every parameter with data stored in volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restore the data that is saved on the S-DAT. The data record is restored from the electronics memory to the S-DAT. Visibility depends on order options or device settings The local display only displays this option in an alarm condition.

11 Maintenance

Maintenance tasks

The device is maintenance-free. Modifications or repairs may only be carried out following consultation with an Endress+Hauser service organization. It is recommended to examine the device regularly for corrosion, mechanical wear and damage.

Exterior cleaning

Clean the device as follows:
- Use a dry or slightly damp lint-free cloth.
- Do not use sharp objects or aggressive cleaning agents.
- Do not use high-pressure steam.

Interior cleaning

Note the following for cleaning and sterilization in place (CIP/SIP):
- Only use cleaning agents to which the process-wetted materials are resistant.
- Observe the permitted maximum medium temperature → 97.

Services

Endress+Hauser offers a wide range of services for device maintenance, e.g. recalibration, maintenance service or device tests.

Endress+Hauser sales organizations can provide information about the services available.

12 Disposal

Removing the device

1. Disconnect the device from the supply voltage.
2. Remove all connecting cables.

⚠ WARNING

Process conditions can put staff at risk!

- ▶ Wear suitable protective equipment.
- ▶ Allow the device and pipe to cool.
- ▶ Empty the device and pipe so that they are unpressurized.
- ▶ Rinse the device and pipe if necessary.

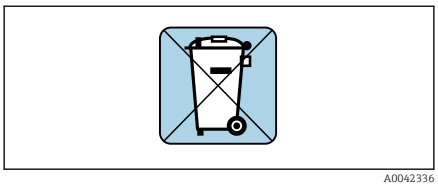
3. Remove the device correctly.

Disposing of the device

⚠ WARNING

Dangerous media can endanger staff and the environment!

- ▶ Ensure that the device and all cavities are free of medium residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.



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If required by the Directive 2012/19/EU of the European Parliament and the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), the device is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste.

- Do not dispose of devices bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.
- Observe applicable federal/national regulations.
- Ensure proper separation and reuse of the device components.
- Overview of installed materials: → *Materials*, 🖹 103

13 Technical data

Input

Measured variable

Direct measured variables	▪ Mass flow ▪ Temperature ▪ Density* * Visibility depends on order options or device settings
Calculated measured variables	▪ Volume flow ▪ Corrected volume flow

Operable flow range

Over 1000 : 1

Flow rates above the set end value do not overload the electronics. The totalized flow volume is measured correctly.

Measuring range

Measuring range for liquids

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

Measuring range for gases

The full scale value depends on the density and the sound velocity of the gas used and can be calculated with the formula below:
$\dot{m}_{max(G)}$ = minimum ($\dot{m}_{max(F)} \cdot \rho_G : x ; m = rho_G \cdot (c_G/2) \cdot d_i^2 \cdot (\pi/4) \cdot n \cdot 3600$)

$\dot{m}_{max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{max(F)}$	Maximum full scale value for liquid [kg/h]
$\dot{m}_{max(G)} < \dot{m}_{max(F)}$	$\dot{m}_{max(G)}$ can never be greater than $\dot{m}_{max(F)}$
ρ_G	Gas density in [kg/m³] at operating conditions
x	Limitation constant for max. gas flow [kg/m³]
m	Mass [kg/s]
rho_G	Density during operation [kg/m³]
c_G	Sound velocity (gas) [m/s]
d_i	Measuring tube internal diameter [m]
π	Pi
n	Number of pipes

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

To calculate the measuring range, use the *Applicator* sizing tool → *Service-specific accessory* , 133

Calculation example for gas

- Sensor: Promass K, 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 K, DN 50)

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

Output

Output signal

Output versions

Order code for 020: output; input	Output version
Option M	▪ Modbus RS485 ▪ Current output 4 to 20 mA
Option U	▪ Modbus RS485 Ex i ▪ Current output 4 to 20 mA Ex i

Modbus RS485

Physical interface	RS485 in accordance with EIA/TIA-485 standard

Current output 4 to 20 mA

Signal mode	Choose via terminal assignment: ▪ Active ▪ Passive
Current range	Can be set to: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA ▪ Fixed current
Max. output current	21.5 mA
Open-circuit voltage	DC < 28.8 V (active)
Max. input voltage	DC 30 V (passive)
Max. load	400 Ω
Resolution	1 µA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Temperature ▪ Density* ▪ Index inhomogeneous medium ▪ Exciter current ▪ Oscillation frequency ▪ Oscillation amplitude* ▪ Frequency fluctuation* ▪ Oscillation damping ▪ Oscillation damping fluctuation* ▪ Signal asymmetry ▪ HBSI* ▪ Electronics temperature * Visibility depends on order options or device settings

Signal on alarm

Output behavior in the event of a device alarm (failure mode)

Modbus RS485

Failure mode	Selectable: ▪ NaN value instead of current value ▪ Last valid value

Current output 4 to 20 mA

4 to 20 mA	Selectable: ▪ Min. value: 3.59 mA ▪ Max. value: 21.5 mA ▪ Freely definable value between: 3.59 to 21.5 mA ▪ Actual value ▪ Last valid value

Low flow cut off

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

Ex connection data

Pay attention to the documentation on Ex connection values .

Safety-related values and intrinsically safe values: Safety Instructions (XA)

Galvanic isolation

The outputs are galvanically isolated from one another and from earth.

Protocol-specific data

Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Not integrated
Protocol	Modbus Applications Protocol Specification V1.1
Response times	▪ Direct data access: typically 25 to 50 ms ▪ Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers

Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transfer mode	RTU
Data access	Each parameter can be accessed via Modbus RS485. For Modbus register information
System integration	Information on system integration . ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

Power supply

Terminal assignment

The terminal assignment is documented on an adhesive label.

The following terminal assignment is available:

Modbus RS485 and current output 4 to 20 mA (active)

Supply voltage		Output 1				Output 2	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (B)	23 (A)
L/+	N/–	Current output 4 to 20 mA (active)		–		Modbus RS485	

Modbus RS485 and current output 4 to 20 mA (passive)

Supply voltage		Output 1				Output 2	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (B)	23 (A)
L/+	N/–	–		Current output 4 to 20 mA (passive)		Modbus RS485	

Supply voltage

Order code for "Power supply"	Terminal voltage		Frequency range
Option **D**	DC 24 V	–20 to +30 %	–
Option **E**	AC 100 to 240 V	–15 to +10 %	50/60 Hz,±5 Hz
Option **I**	DC 24 V	–20 to +30 %	–
	AC 100 to 240 V	–15 to +10 %	50/60 Hz, ±5 Hz
Option **M** non-hazardous area	DC 24 V	–20 to +30 %	–
	AC 100 to 240 V	–15 to +10 %	50/60 Hz, ±5 Hz

Power consumption

- Transmitter: max. 10 W (active power)
- Switch-on current: max. 36 A (< 5 ms) as per NAMUR Recommendation NE 21

Current consumption

- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)

Power supply failure

- Totalizers stop at the last value measured.
- Device configuration remains unchanged.
- Error messages (incl. total operated hours) are stored.

Terminals

Spring terminals
- Suitable for strands and strands with ferrules.
- Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG).

Cable entries

- Cable gland: M20 × 1.5 for cable Ø6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½", G ½" Ex d
  - M20

Overvoltage protection

Mains voltage fluctuations	→ *Supply voltage*, 89
Overvoltage category	Overvoltage category II
Short-term, temporary overvoltage	Between cable and neutral conductor up to 1200 V for max. 5s
Long-term, temporary overvoltage	Up to 500 V between cable and ground

Cable specification

Requirements for connecting cable

Electrical safety

As per applicable national regulations.

Permitted temperature range

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

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

- A standard installation cable is sufficient.
- Provide grounding according to applicable national codes and regulations.

Signal cable

- Modbus RS485:
  Cable type A according to EIA/TIA-485 standard is recommended
- Current output 4 to 20 mA:
  Standard installation cable

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)
- Data as indicated in the calibration protocol
- Accuracy based on accredited calibration rigs according to ISO 17025

To obtain measured errors, use the *Applicator* sizing tool → *Service-specific accessory* , 133

Maximum measured error

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

Base accuracy

→ *Design fundamentals*, 94

Mass flow and volume flow (liquids)	±0.5 % o.r. ▪ Order code for "Calibration flow" option G: ±0.2 % ▪ Order code for "Calibration flow" option O: ±0.15 %
Mass flow (gases)	±0.75 % o.r.
Density (liquids)	Only devices with the order code for "Application package", option EF ▪ Under reference operating conditions: ±0.0005 g/cm³ ▪ Standard density calibration: ±0.003 g/cm³ Valid over the entire temperature 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	⅜	0.20	0.007
15	½	0.65	0.024
25	1	1.80	0.066
40	1½	4.50	0.165
50	2	7.0	0.257
80	3	18.0	0.6615

Flow values

Flow values as turndown parameters depending on nominal diameter.

SI units	DN [mm]	1:1 [kg/h]	1:10 [kg/h]	1:20 [kg/h]	1:50 [kg/h]	1:100 [kg/h]	1:500 [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

SI units	DN [mm]	1:1 [kg/h]	1:10 [kg/h]	1:20 [kg/h]	1:50 [kg/h]	1:100 [kg/h]	1:500 [kg/h]
	50	70000	7000	3500	1400	700	140
	80	180000	18000	9000	3600	1800	360

US units	DN [inch]	1:1 [lb/min]	1:10 [lb/min]	1:20 [lb/min]	1:50 [lb/min]	1:100 [lb/min]	1:500 [lb/min]
	⅜	73.50	7.350	3.675	1.470	0.735	0.147
	½	238.9	23.89	11.95	4.778	2.389	0.478
	1	661.5	66.15	33.08	13.23	6.615	1.323
	1½	1654	165.4	82.70	33.08	16.54	3.308
	2	2573	257.3	128.7	51.46	25.73	5.146
	3	6615	661.5	330.8	132.3	66.15	13.23

Accuracy of outputs

Current output	±5 µA
Pulse/frequency output	Max. ±100 ppm o. r. (across the entire ambient temperature range)

Repeatability

o.r. = of reading; T = medium temperature

→ *Design fundamentals*, 94

Mass flow (liquids)	±0.1 % o.r.
Mass flow (gases)	±0.5 % o.r.
Density (liquids)	Only devices with the order code for "Application package", option EF ±0.00025 g/cm³ (1 kg/l)
Temperature	±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0015 · (T−32) °F)

Response time

The response time depends on the configuration (damping).

Influence of ambient temperature

Current output	Temperature coefficient max. 1 µA/°C
Pulse/frequency output	No additional effect. Is included in the accuracy.

Influence of medium temperature

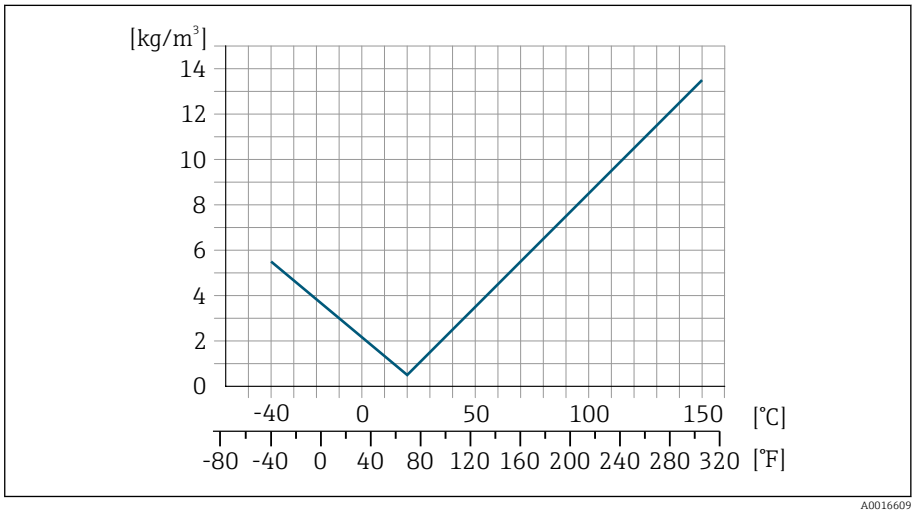
o.f.s. = of full scale value

Mass flow and volume flow

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

Density

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



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

Temperature

±0.005 · T °C (± 0.005 · (T − 32) °F)

Influence of medium pressure

o.r. = of reading

The table below shows the effect of a difference in pressure between the calibration pressure and process pressure on the accuracy with mass flow.

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

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

BaseAccu = base accuracy as % o.r

BaseRepeat = base repeatability as % o.r.

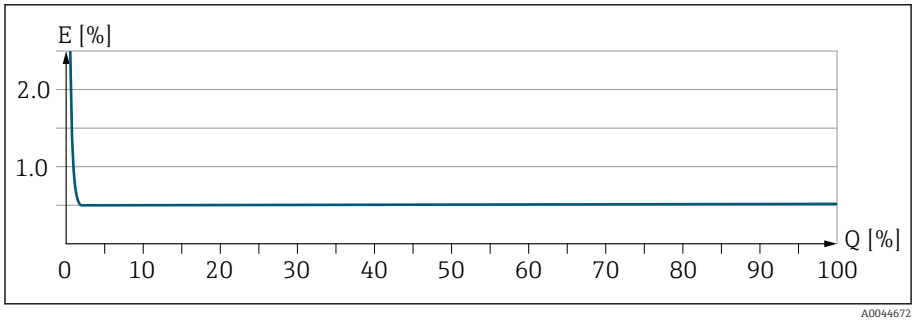
MeasValue = measured value

ZeroPoint = zero point stability

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

Flow rate	$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$	$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$
Maximum measured error in % o.r.	± BaseAccu	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$

Example for maximum measured error



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

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

Flow rate	$\geq \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$	$< \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$
Maximum measured error in % o.r.	± BaseRepeat	$\pm ½ \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$

Environment

Ambient temperature range

Transmitter and sensor	–40 to +60 °C (–40 to +140 °F)
Local display	–20 to +60 °C (–4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.

Dependency of ambient temperature on medium temperature → *Medium temperature range*, 97

If using the device in hazardous areas, observe the "Safety Instructions" documentation.

Storage temperature

The storage temperature corresponds to the ambient temperature range of the transmitter and sensor.

Atmosphere

According to IEC 60529: If a plastic housing is permanently exposed to certain steam and air mixtures, this can damage the housing.

More Informationen: Endress+Hauser sales organizations.

Climate class

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

Degree of protection

Transmitter	▪ IP66/67, Type 4X enclosure, suitable for pollution degree 4 ▪ Open housing: IP20, Type 1 enclosure, suitable for pollution degree 2
Sensor	IP66/67, Type 4X enclosure, suitable for pollution degree 4

Vibration-resistance and shock-resistance

Vibration, sinusoidal ▪ Following IEC 60068-2-6 ▪ 20 cycles per axis	2 to 8.4 Hz 8.4 to 2 000 Hz	3.5 mm peak 1 g peak
Vibration, broad-band random ▪ Following IEC 60068-2-64 ▪ 120 min per axis	10 to 200 Hz 200 to 2 000 Hz	0.003 g^2/Hz 0.001 g^2/Hz (1.54 g rms)
Shocks, half-sine ▪ Following IEC 60068-2-27 ▪ 3 positive and 3 negative shocks	6 ms 30 g	

Shock
Due to rough handling according to IEC 60068-2-31.

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR Recommendation NE 21.

For more information: Declaration of Conformity

Interior cleaning

Available methods of internal cleaning:
- Cleaning in place (CIP)
- Sterilization in place (SIP)

Process

Medium temperature range

−40 to +150 °C (−40 to +302 °F)

Density

0 to 5 000 kg/m³ (0 to 312 lb/cf)

Flow limit

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

For an overview of the measuring range full scale values: → *Measuring range*, 84

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value
- For the most common applications, 20 to 50 % of the maximum full scale value can be considered ideal
- A low full scale value must be selected for abrasive media (such as liquids with entrained solids): flow velocity < 1 m/s (< 3 ft/s).
- For gas measurement the following rules apply:
  - The flow velocity in the measuring pipes should not exceed half the sound velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula → *Measuring range for gases* , 84

To calculate the flow limit, use the *Applicator* sizing tool → *Service-specific accessory* , 133

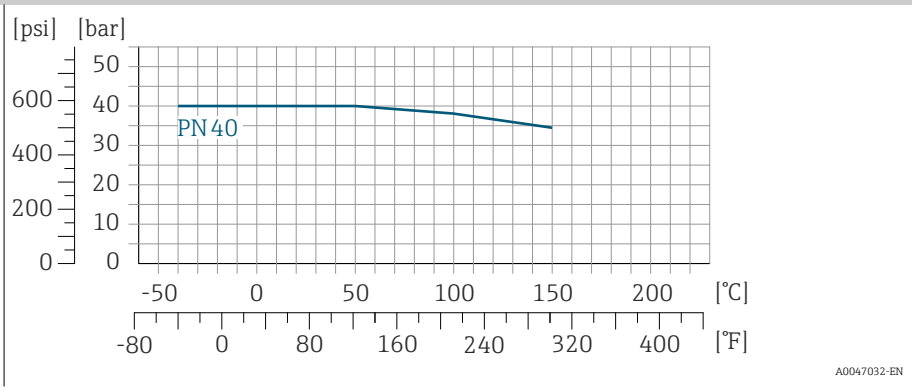
Pressure-temperature ratings

Maximum permitted medium pressure as a function of the medium temperature.

The data relate to all pressure bearing parts of the device.

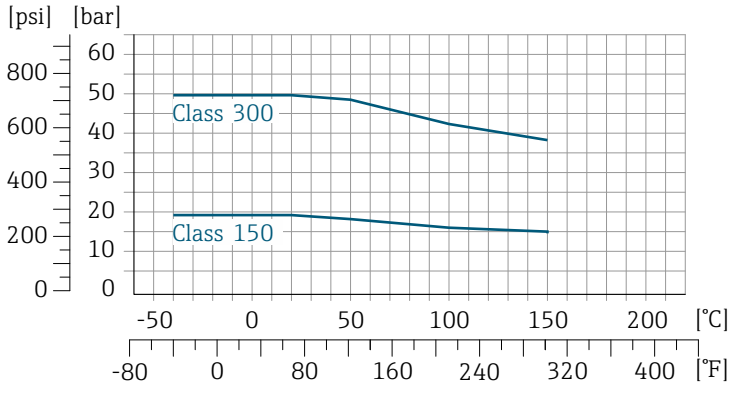
Flange according to EN 1092-1

Flange material 1.4404 (F316/F316L)



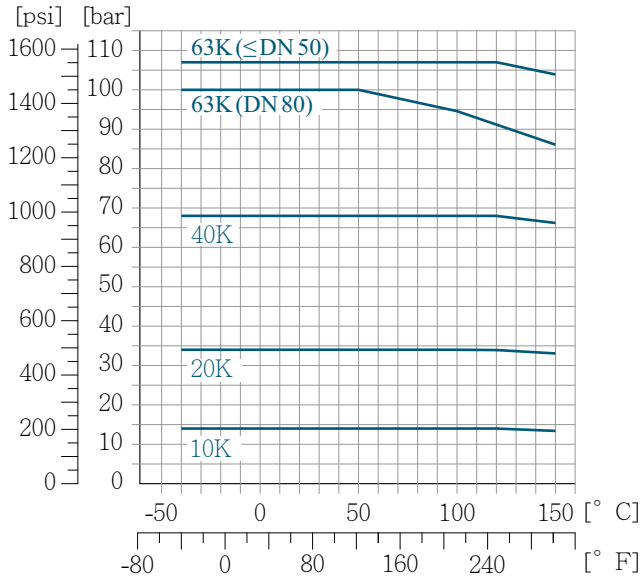
Flange according to ASME B16.5

Flange material 1.4404 (F316/F316L)



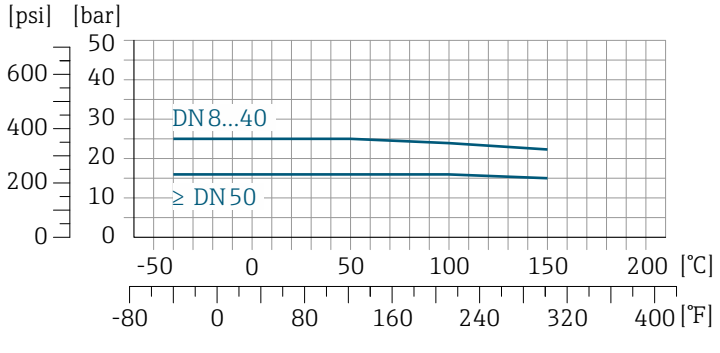
Fixed flange JIS B2220

Flange material 1.4404 (F316/F316L)



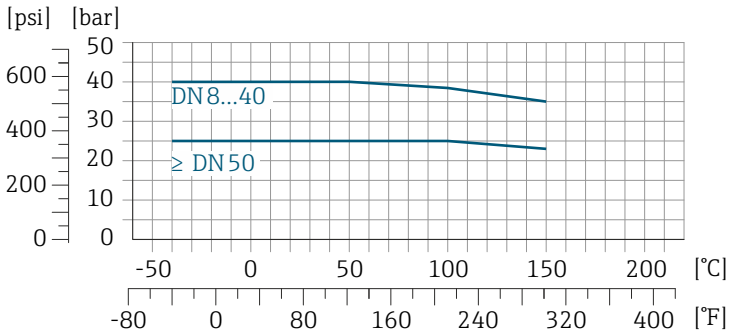
Flange DIN 11864-2 Form A

Flange material 1.4404 (F316/F316L)



Thread DIN 11864-1 Form A

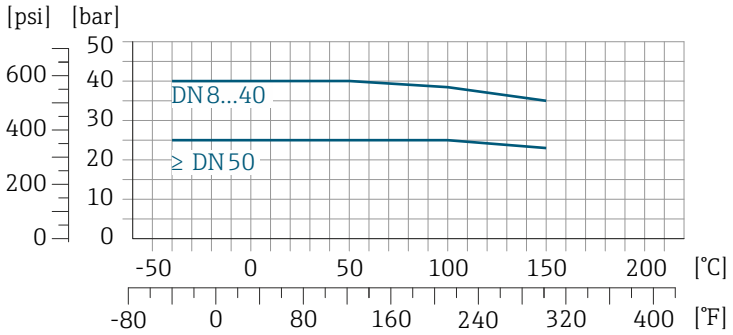
Connection material 1.4404 (F316/ F316L)



A0029848-EN

Thread DIN 11851

Connection material 1.4404 (F316/ F316L)

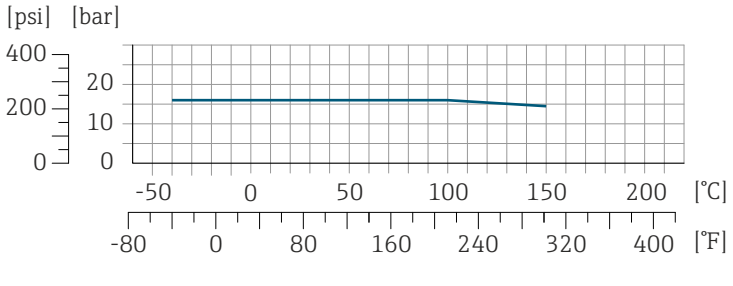


A0029848-EN

DIN 11851 allows for applications up to +140 °C (+284 °F) if suitable sealing materials are used. Please take this into account when selecting seals and counterparts, as these components can limit the pressure and temperature range.

Thread ISO 2853

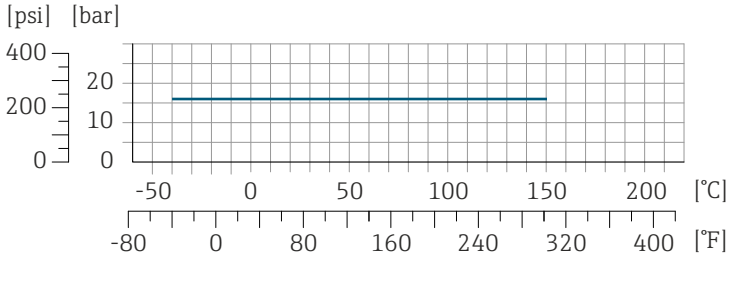
Connection material 1.4404 (F316/ F316L)



A0029853-EN

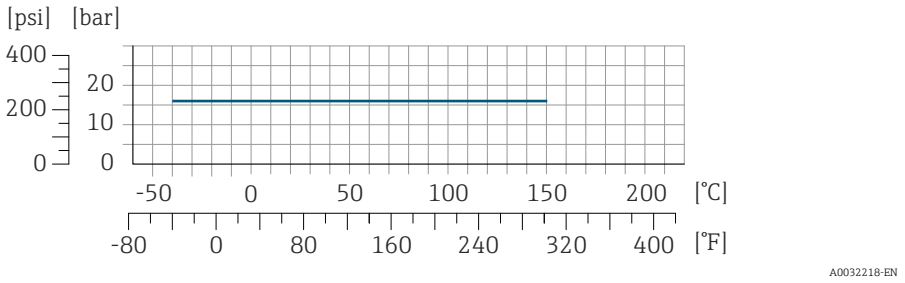
Thread SMS 1145

Connection material 1.4404 (F316/ F316L)



A0032218-EN

Tri-Clamp



The clamp connections are suitable up to a maximum pressure of 16 bar (232 psi). Please observe the operating limits of the clamp and seal used, as they can be over 16 bar (232 psi). The clamp and seal are not included in the scope of supply.

Sensor housing

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

If a measuring pipe fails , e.g. due to process characteristics like corrosive or abrasive media, the medium will be contained by the sensor housing.

If a measuring pipe fails, the pressure level inside the sensor housing will rise according to the operating pressure. If the user judges that the sensor housing burst pressure does not provide an adequate safety margin, the device can be fitted with a rupture disk. The rupture disk prevents excessively high pressure from forming inside the sensor housing. The rupture disk is urgently recommended in the following applications:

- For high gas pressures
- Process pressure is higher than 2/3 of the burst pressure of the sensor housing.

Sensor housing burst pressure

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

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

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

For information on the dimensions: see the "Mechanical construction" section
→ *Mechanical construction* , 🖹 102.

Rupture disk

- Order code for "Sensor option", option CA
- Trigger pressure: 10 to 15 bar (145 to 217.5 psi)

The use of a rupture disk cannot be combined with a heating jacket.

Pressure loss

To calculate the pressure loss, use the *Applicator* sizing tool → *Service-specific accessory* , 133

Mechanical construction

Weight

All values refer to devices with EN/DIN PN 40 flanges
Weight information including transmitter as per order code for "Housing", option A "Aluminum, coated".

Different values due to different transmitter versions:
Transmitter version for the hazardous area:+1 kg (+2.2 lbs)
Transmitter version, order code for "Housing", option M "Polycarbonate": −1 kg (−2.2 lbs)

Weight in SI units

DN [mm]	Weight [kg]
8	6
15	6.5
25	8
40	12
50	17
80	33

Weight in US units

DN [in]	Weight [lbs]
3/8	13
½	14
1	18
1 ½	26
2	37
3	73

Materials

Transmitter housing	
Order code for "Housing"	▪ Option A: aluminum, AlSi10Mg, coated ▪ Option M: polycarbonate
Window material	▪ Order code for "Housing" option A: glass ▪ Order code for "Housing" option M: polycarbonate
Cable glands and entries	
Cable gland M20×1.5	▪ Non-hazardous area: plastic ▪ Hazardous area: brass
Adapter for cable entry with female thread G ½" or NPT ½"	Nickel-plated brass
Sensor housing	
	▪ Acid and alkali-resistant outer surface ▪ Stainless steel 1.4301 (304)
Measuring tubes	
	Stainless steel: 1.4539 (904L) Manifold: stainless steel, 1.4404 (316L)
Seals	
	Welded process connections without internal seals
Process connections	
▪ EN 1092-1 (DIN 2501) ▪ ASME B16.5 ▪ JIS B2220	Stainless steel, 1.4404 (F316/F316L)
Other process connections	Stainless steel, 1.4404 (316/316L)
Accessories	
Protective cover	Stainless steel, 1.4404 (316L)

Process connections

- Fixed flange connections:
  - EN 1092-1 (DIN 2501) flange
  - ASME B16.5 flange
  - JIS B2220 flange
  - DIN 11864-2 Form A flange, DIN 11866 series A, flange with notch
- Clamp connections:
  Tri-Clamp (OD tubes), DIN 11866 series C
- Thread:
  - DIN 11851 thread, DIN 11866 series A
  - SMS 1145 thread
  - ISO 2853 thread, ISO 2037
  - DIN 11864-1 Form A thread, DIN 11866 series A

Surface roughness

All data relate to parts in contact with medium. The following surface roughnesses can be ordered:

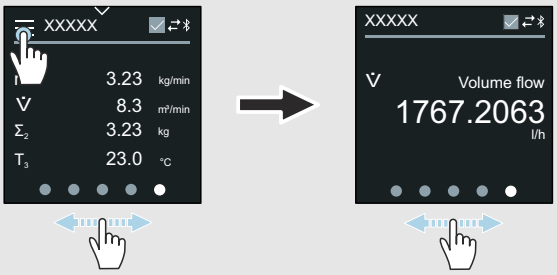
- Not polished
- Ra_{max} = 0.76 µm (30 µin)

Local display

Operating concept

Operation method	▪ Operation via local display with touch screen. ▪ Operation via SmartBlue App.
Menu structure	Operator-oriented menu structure for user-specific tasks: ▪ Diagnostics ▪ Application ▪ System ▪ Guidance ▪ Language
Commissioning	▪ Commissioning via a guided menu (**Commissioning** wizard). ▪ Menu guidance with interactive help function for individual parameters.
Reliable operation	▪ Operation in local language. ▪ Uniform operating philosophy in device and in the SmartBlue App. ▪ Write protection ▪ When electronics modules are replaced: configurations are transferred using the T-DAT Backup device memory. The device memory contains process data, device data and the event logbook. No reconfiguration is necessary.
Diagnostic behavior	Efficient diagnostic behavior increases measurement availability: ▪ Open troubleshooting measures via local display and SmartBlue App. ▪ Diverse simulation options. ▪ Logbook of events that have occurred.

Operating options

Local display	 A0042957 Display elements: ▪ LCD touch screen ▪ Depends on the orientation, automatic alignment of local display. ▪ Configuration of display format for measured variables and status variables. Operating elements: ▪ Touch screen ▪ Local display can also be accessed in the hazardous area.
SmartBlue App	▪ The SmartBlue App allows the user to put devices into operation and operate them. ▪ Based on Bluetooth. ▪ No separate driver required. ▪ Available for mobile handheld terminals, tablets and smartphones. ▪ Suitable for convenient and secure access to devices in hard-to-reach locations or in hazardous areas. ▪ Can be used within a 20 m (65.6 ft) radius of the device. ▪ Encrypted and secure data transmission. ▪ No data loss during commissioning and maintenance. ▪ Diagnostic information and process information in real time.

Operating tools

Operating tools	Operating unit	Interface	Additional information
DeviceCare SFE100	▪ Notebook ▪ PC ▪ Tablet with Microsoft Windows system	▪ CDI service interface ▪ Fieldbus protocol	Innovation brochure IN01047S
FieldCare SFE500	▪ Notebook ▪ PC ▪ Tablet with Microsoft Windows system	▪ CDI service interface ▪ Fieldbus protocol	Operating Instructions BA00027S and BA00059S
SmartBlue App	▪ Devices with iOS: iOS9.0 or higher ▪ Devices with Android: Android 4.4 KitKat or higher	Bluetooth	Endress+HauserSmartBlue App: ▪ Google Playstore (Android) ▪ iTunes Apple Shop (iOS devices)

Certificates and approvals

Ex approval

- ATEX
- IECEx
- cCSAus
- EAC
- NEPSI
- INMETRO
- JPN

Non-Ex approval

- cCSAus
- EAC
- UK
- KC

Pressure Equipment Directive

- CRN
- PED Cat. II/III

Sanitary compatibility

- 3-A approval
  - Only measuring devices with the order code for "Additional approval", option LP "3A" have 3-A approval.
  - The 3-A approval refers to the measuring device.
  - When installing the measuring device, ensure that no liquid can accumulate on the outside of the measuring device. Remote transmitters must be installed in accordance with the 3-A Standard.
  - Accessories (e.g. heating jacket, weather protection cover) must be installed in accordance with the 3-A Standard. Each accessory can be cleaned. Disassembly may be necessary under certain circumstances.
- Food Contact Materials Regulation (EC) 1935/2004
  A declaration for a specific serial number that confirms compliance with the requirements of (EC) 1935/2004 is only generated for measuring devices with the order code for "Test, Certificate", option J1 "EU Food Contact Materials (EC) 1935/2004.
- FDA
  A declaration for a specific serial number that confirms compliance with FDA requirements is only generated for measuring devices with the order code for "Test, Certificate", option J2 "US Food Contact Materials FDA CFR 21".
- Food Contact Materials Regulation GB 4806
  A declaration for a specific serial number that confirms compliance with the requirements of GB 4806 is only generated for measuring devices with the order code for "Test, Certificate", option J3 "CN Food Contact Materials GB 4806.

Pharmaceutical compatibility

- FDA
- USP Class VI
- TSE/BSE Certificate of Suitability
- cGMP
  Devices with the order code for "Test, Certificate", option JG "Conformity with cGMP-derived requirements, declaration" comply with the requirements of cGMP with regard to the surfaces of parts in contact with the medium, design, FDA 21 CFR material conformity, USP Class VI tests and TSE/BSE conformity. A serial number-specific declaration is generated.

Radio approval

The device has radio approvals.

Other standards and guidelines

- IEC/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.
- IEC/EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements.
- IEC/EN 61326
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements)

- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors.
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics.
- NAMUR NE 80
  The application of the pressure equipment directive to process control devices.
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices.
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices.
- NAMUR NE 131
  Requirements for field devices for standard applications.
- NAMUR NE 132
  Coriolis mass meter
- ETSI EN 300 328
  Guidelines for 2.4 GHz radio components
- EN 301489
  Electromagnetic compatibility and radio spectrum matters (ERM).

Application packages

Use

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

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

Heartbeat Verification + Monitoring

Heartbeat Verification

Availability depends on the product structure.

Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment":
- Functional testing in the installed state without interrupting the process.
- Traceable verification results on request, including a report.
- Simple testing process with local operation or other operating interfaces.
- Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications.
- Extension of calibration intervals according to operator's risk assessment.

Heartbeat Monitoring

Availability depends on the product structure.

Heartbeat Monitoring continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:

- Draw conclusions - using these data and other information - about the impact the process influences, e.g. corrosion, abrasion, formation of buildup, have on the measuring performance over time.
- Schedule servicing in time.
- Monitor the process quality or product quality, e.g. gas pockets.

Density output

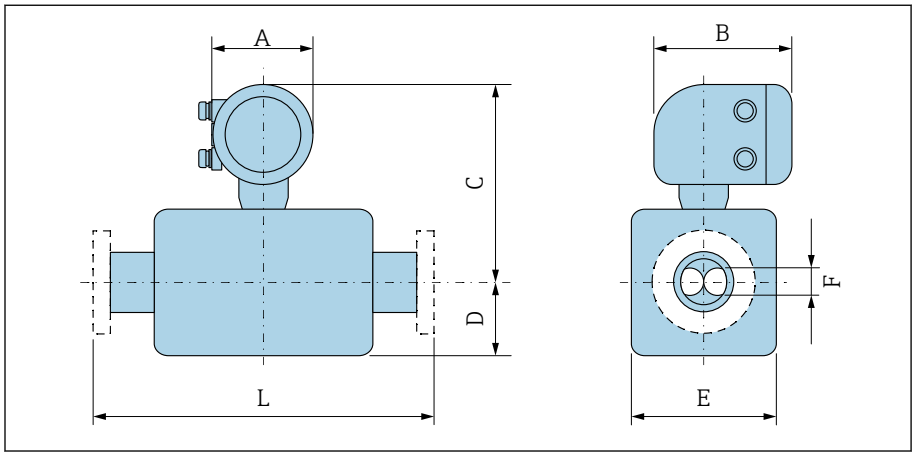
Many applications use density as a key measured value for monitoring quality or controlling processes. The device measures the density of the medium and makes this value available to the control system.

With this application package, the density can be assigned as a process variable and displayed.

14 Dimensions in SI units

Compact version

Order code for "Housing", option A "Aluminum, coated"

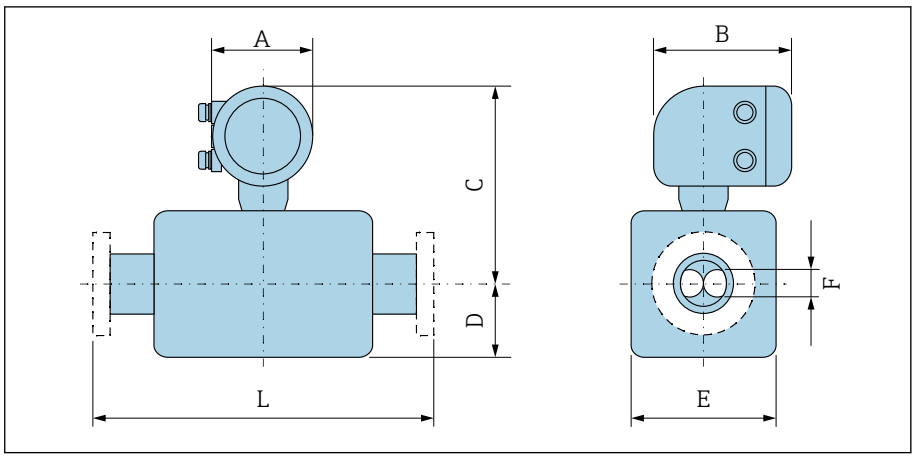


The dimension L depends on the specific process connection:

DN [mm]	A [1)] [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
8	139	178	254	89	45	5.35
15	139	178	254	100	45	8.30
25	139	178	251	102	51	12.0
40	139	178	257	121	65	17.6
50	139	178	271	175.5	95	26.0
80	139	178	291	205	127	40.5

1) Depending on the cable gland used: values up to +30 mm

Order code for "Housing", option A "Aluminum, coated"; Zone 1

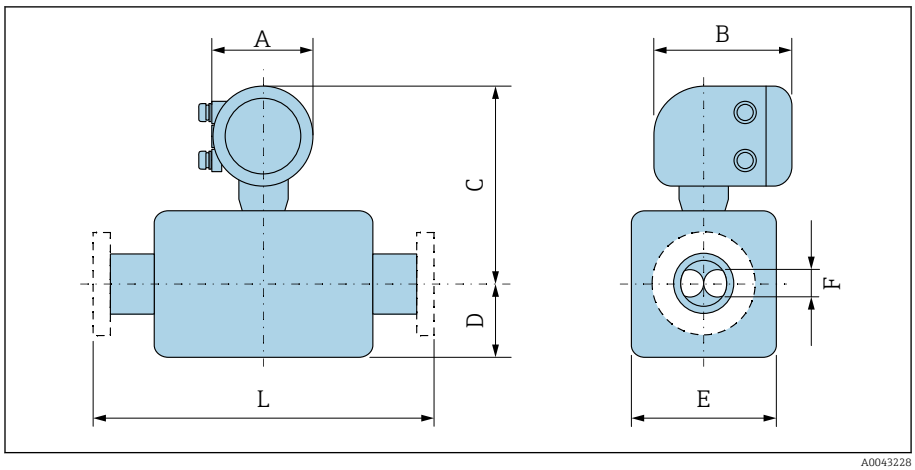


The dimension L depends on the specific process connection:

DN [mm]	A [1] [mm]	B [2] [mm]	C [mm]	D [mm]	E [mm]	F [mm]
8	139	206	246	89	45	5.35
15	139	206	246	100	45	8.30
25	139	206	243	102	51	12.0
40	139	206	249	121	65	17.6
50	139	206	263	175.5	95	26.0
80	139	206	282	205	127	40.5

1) Depending on the cable gland used: values up to +30 mm
2) For Ex de: values +10 mm

Order code for "Housing", option M "Polycarbonate"



The dimension L depends on the specific process connection:

DN [mm]	A [1)] [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
8	132	172	251	89	45	5.35
15	132	172	251	100	45	8.30
25	132	172	248	102	51	12.0
40	132	172	254	121	65	17.6
50	132	172	268	175.5	95	26.0
80	132	172	287	205	127	40.5

1) Depending on the cable gland used: values up to +30 mm

Fixed flange

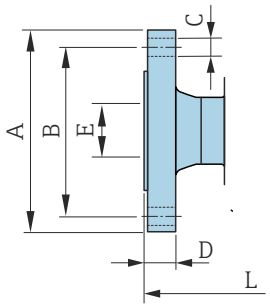
Flange according to EN 1092-1 (DIN 2501): PN 40

Order code for "Process connection", option D2S

1.4404 (F316/F316L)

DN 8 with DN 15 flanges as standard

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm



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DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95	65	4 × Ø14	16	17.3	232
15	95	65	4 × Ø14	16	17.3	279
25	115	85	4 × Ø14	18	28.5	329
40	150	110	4 × Ø18	18	43.1	445
50	165	125	4 × Ø18	20	54.5	556
80	200	160	8 × Ø18	24	82.5	611

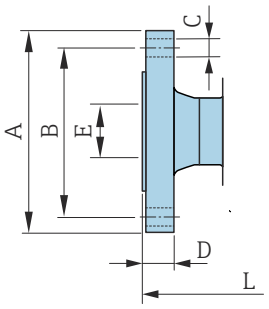
Flange according to ASME B16.5: Class 150

Order code for "Process connection", option AAS

1.4404 (F316/F316L)

DN 8 with DN 15 flanges as standard

Surface roughness (flange): Ra 3.2 to 12.5 µm



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DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	90	60.3	4 × Ø15.7	11.2	15.7	232
15	90	60.3	4 × Ø15.7	11.2	15.7	279
25	110	79.4	4 × Ø15.7	14.2	26.7	329
40	125	98.4	4 × Ø15.7	17.5	40.9	445
50	150	120.7	4 × Ø19.1	19.1	52.6	556
80	190	152.4	4 × Ø19.1	23.9	78.0	611

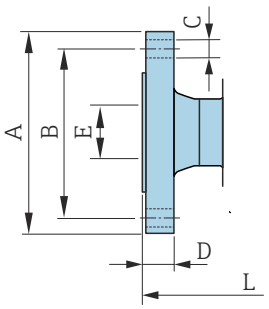
Flange according to ASME B16.5: Class 300

Order code for "Process connection", option ABS

1.4404 (F316/F316L)

DN 8 with DN 15 flanges as standard

Surface roughness (flange): Ra 3.2 to 12.5 µm



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DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95	66.7	4 × Ø15.7	14.2	15.7	232
15	95	66.7	4 × Ø15.7	14.2	15.7	279
25	125	88.9	4 × Ø19.0	17.5	26.7	329
40	155	114.3	4 × Ø22.3	20.6	40.9	445
50	165	127	8 × Ø19.0	22.3	52.6	556
80	210	168.3	8 × Ø22.3	28.4	78.0	611

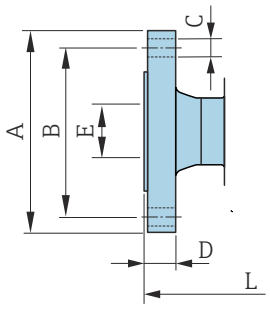
Flange JIS B2220: 20K

Order code for "Process connection", option NES

1.4404 (F316/F316L)

DN 8 with DN 15 flanges as standard

Surface roughness (flange): Ra 3.2 to 12.5 µm



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DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	95	70	4 × Ø15	14	15	232
15	95	70	4 × Ø15	14	15	279
25	125	90	4 × Ø19	16	25	329
40	140	105	4 × Ø19	18	40	445
50	155	120	8 × Ø19	18	50	556
80	200	160	8 × Ø23	22	80	603

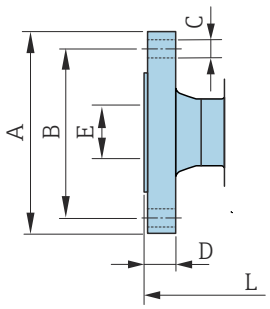
Flange JIS B2220: 40K

Order code for "Process connection", option NGS

1.4404 (F316/F316L)

DN 8 with DN 15 flanges as standard

Surface roughness (flange): Ra 3.2 to 12.5 µm



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DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	115	80	4 × Ø19	20	15	261
15	115	80	4 × Ø19	20	15	300
25	130	95	4 × Ø19	22	25	375
40	160	120	4 × Ø23	24	38	496
50	165	130	8 × Ø19	26	50	601
80	210	170	8 × Ø23	32	75	661

Flange DIN 11864-2 Form A, flange with notch

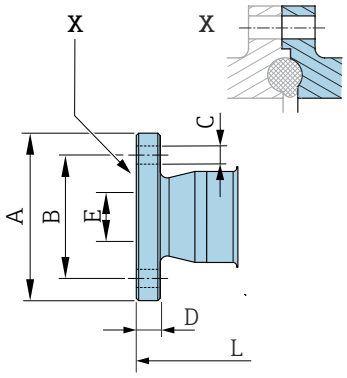
Order code for "Process connection", option KCS

1.4404 (316/316L)

Suitable for pipe as per DIN11866 series A, flange with notch

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 0.76 µm)

Length tolerance for dimension L in mm:
+1.5 / −2.0



DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
8	54	37	4 × Ø9	10	10	249
15	59	42	4 × Ø9	10	16	293
25	70	53	4 × Ø9	10	26	344
40	82	65	4 × Ø9	10	38	456
50	94	77	4 × Ø9	10	50	562
80	133	112	8 × Ø11	12	81	671

Clamp connections

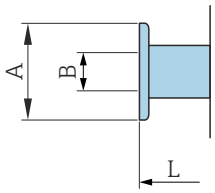
Tri-Clamp

Order code for "Process connection", option FTS

1.4404 (316/316L)

Suitable for pipe according to DIN 11866 series C

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 0.76 µm)



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DN [mm]	Clamp [mm]	A [mm]	B [mm]	L [mm]
8	1	50.4	22.1	229
15	1	50.4	22.1	273
25	1	50.4	22.1	324
40	1½	50.4	34.8	456
50	2	63.9	47.5	562
80	3	90.9	72.9	671

Couplings

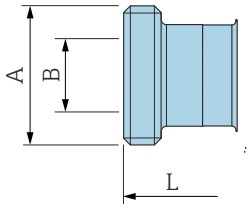
Thread according to DIN 11851

Order code for "Process connection", option FMW

1.4404/316L

Suitable for pipe as per DIN11866 series A

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 0.76 µm)



A0043257

DN [mm]	A [mm]	B [mm]	L [mm]
8	Rd 34 × 1/8	16	229
15	Rd 34 × 1/8	16	273
25	Rd 52 × 1/6	26	324
40	Rd 65 × 1/6	38	456
50	Rd 78 × 1/6	50	562
80	Rd 110 × 1/4	81	671

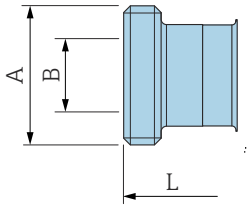
Thread according to DIN 11864-1 Form A

Order code for "Process connection", option FLW

1.4404/316L

Suitable for pipe as per DIN11866 series A

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 0.76 µm)



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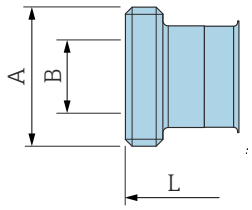
DN [mm]	A [mm]	B [mm]	L [mm]
8	Rd 28 × 1/8	10	229
15	Rd 34 × 1/8	16	273
25	Rd 52 × 1/6	26	324
40	Rd 65 × 1/6	38	456
50	Rd 78 × 1/6	50	562
80	Rd 110 × 1/4	81	671

Thread according to SMS 1145

Order code for "Process connection", option SCS

1.4404 (316/316L)

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 0.76 µm)



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DN [mm]	A [mm]	B [mm]	L [mm]
8	Rd 40 × ⅙	22.5	229
15	Rd 40 × ⅙	22.5	273
25	Rd 40 × ⅙	22.5	324
40	Rd 60 × ⅙	35.5	456
50	Rd 70 × ⅙	48.5	562
80	Rd 98 × ⅙	72.9	671

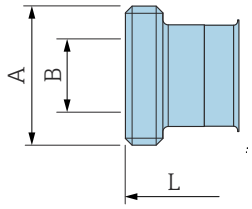
Thread according to ISO 2853

Order code for "Process connection", option JSF

1.4404 (316/316L)

Max. thread diameter A as per ISO 2853 Annex A

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 0.76 µm)



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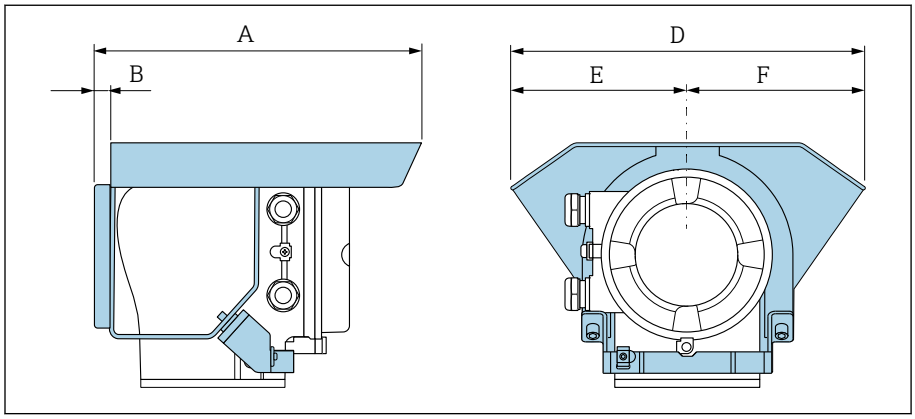
DN [mm]	A [mm]	B [mm]	L [mm]
8	37.13	22.6	229
15	37.13	22.6	273
25	37.13	22.6	324
40	50.68	35.6	456
50	64.16	48.6	562
80	91.19	72.9	671

Accessories

Protective cover

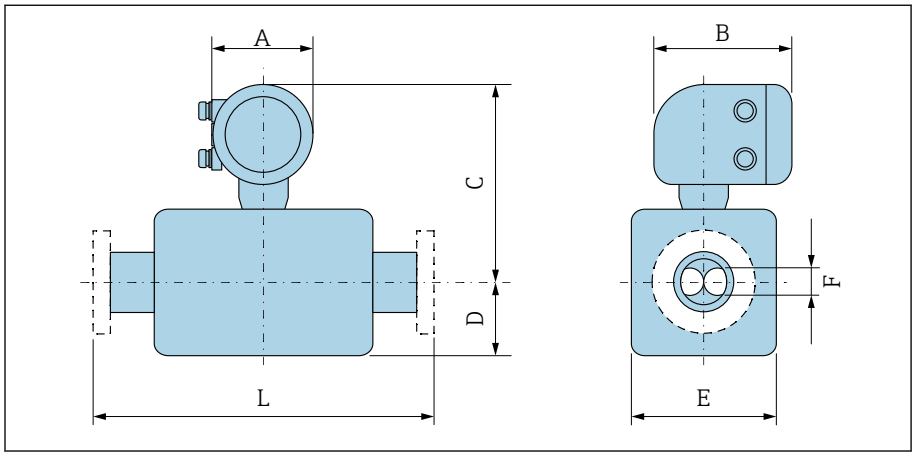


A [mm]	B [mm]	D [mm]	E [mm]	F [mm]
257	12	280	140	140

15 Dimensions in US units

Compact version

Order code for "Housing", option A "Aluminum, coated"

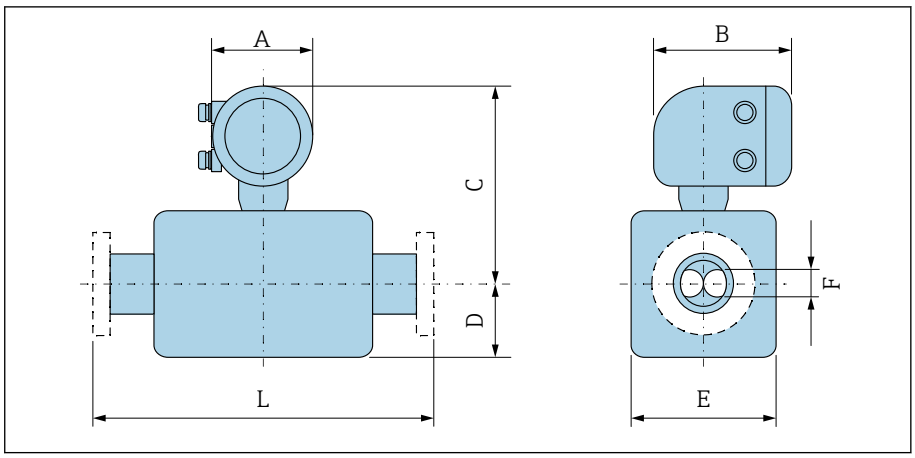


The dimension L depends on the specific process connection:

DN [in]	A [1] [in]	B [in]	C [in]	D [in]	E [in]	F [in]
⅜	5.47	7.01	10	3.5	1.77	0.21
½	5.47	7.01	10	3.94	1.77	0.33
1	5.47	7.01	9.88	4.02	2.01	0.47
1½	5.47	7.01	10.12	4.76	2.56	0.69
2	5.47	7.01	10.67	6.91	3.74	1.02
3	5.47	7.01	11.46	8.07	5	1.59

1) Depending on the cable gland used: values up to 1.18 in

Order code for "Housing", option A "Aluminum, coated"; Zone 1

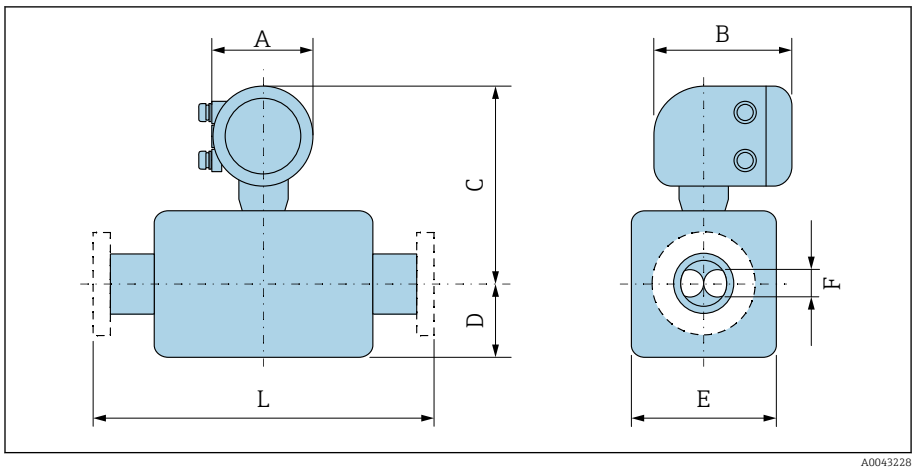


The dimension L depends on the specific process connection:

DN [in]	A [1] [in]	B [2] [in]	C [in]	D [in]	E [in]	F [in]
⅜	5.47	8.11	9.69	3.5	1.77	0.21
½	5.47	8.11	9.69	3.94	1.77	0.33
1	5.47	8.11	9.57	4.02	2.01	0.47
1½	5.47	8.11	9.8	4.76	2.56	0.69
2	5.47	8.11	10.35	6.91	3.74	1.02
3	5.47	8.11	11.1	8.07	5	1.59

1) Depending on the cable gland used: values up to 1.18 in
2) For Ex de: values 0.39 in

Order code for "Housing", option M "Polycarbonate"



The dimension L depends on the specific process connection:

DN [in]	A [1] [in]	B [in]	C [in]	D [in]	E [in]	F [in]
⅜	5.2	6.77	9.88	3.5	1.77	0.21
½	5.2	6.77	9.88	3.94	1.77	0.33
1	5.2	6.77	9.76	4.02	2.01	0.47
1½	5.2	6.77	10	4.76	2.56	0.69
2	5.2	6.77	10.55	6.91	3.74	1.02
3	5.2	6.77	11.3	8.07	5	1.59

1) Depending on the cable gland used: values up to 1.18 in

Fixed flange

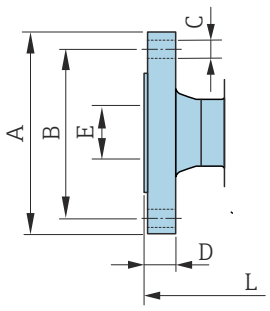
Flange according to ASME B16.5: Class 150

Order code for "Process connection", option AAS

1.4404 (F316/F316L)

DN ⅜" with DN ½" flanges as standard

Surface roughness (flange): Ra 12.5 to 492 µin



A0042813

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
⅜	3.54	2.37	4 × Ø0.62	0.44	0.62	9.13
½	3.54	2.37	4 × Ø0.62	0.44	0.62	10.98
1	4.33	3.13	4 × Ø0.62	0.56	1.05	12.95
1½	4.92	3.87	4 × Ø0.62	0.69	1.61	17.52
2	5.91	4.75	4 × Ø0.75	0.75	2.07	21.89
3	7.48	6	4 × Ø0.75	0.94	3.07	24.06

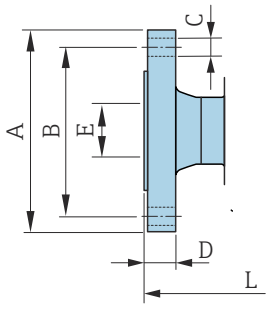
Flange according to ASME B16.5: Class 300

Order code for "Process connection", option ABS

1.4404 (F316/F316L)

DN ⅜" with DN ½" flanges as standard

Surface roughness (flange): Ra 12.5 to 492 µin



A0042813

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
⅜	3.74	2.63	4 × Ø0.62	0.56	0.62	9.13
½	3.74	2.63	4 × Ø0.62	0.56	0.62	10.98
1	4.92	3.5	4 × Ø0.75	0.69	1.05	12.95
1½	6.1	4.5	4 × Ø0.88	0.81	1.61	17.52
2	6.5	5	8 × Ø0.75	0.88	2.07	21.89
3	8.27	6.63	8 × Ø0.88	1.12	3.07	24.06

Clamp connections

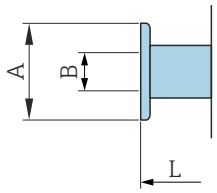
Tri-Clamp

Order code for "Process connection", option FTS

1.4404 (316/316L)

Suitable for pipe according to DIN 11866 series C

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 30 µin)



A0043179

DN [in]	Clamp [in]	A [in]	B [in]	L [in]
⅜	1	1.98	0.87	9.02
½	1	1.98	0.87	10.75
1	1	1.98	0.87	12.76
1½	1½	1.98	1.37	17.95
2	2	2.52	1.87	22.13
3	3	3.58	2.87	26.42

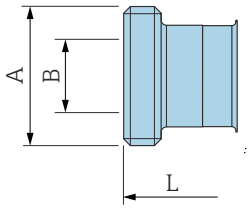
Couplings

Thread according to SMS 1145

Order code for "Process connection", option SCS

1.4404 (316/316L)

3-A version available: order code for "Additional approval", option LP in combination with order code for "Measuring tube mat., wetted surface", option BB (Ra_{max} = 30 µin)



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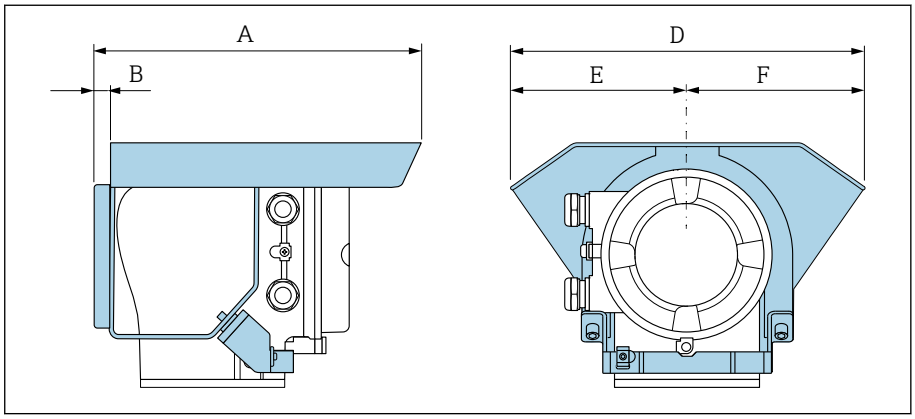
DN [in]	A [in]	B [in]	L [in]
⅜	Rd 40 × ⅙	0.89	9.02
½	Rd 40 × ⅙	0.89	10.75
1	Rd 40 × ⅙	0.89	12.76
1½	Rd 60 × ⅙	1.4	17.95
2	Rd 70 × ⅙	1.91	22.13
3	Rd 98 × ⅙	2.87	26.42

Accessories

Protective cover



A0042332

A [in]	B [in]	D [in]	E [in]	F [in]
10.12	0.47	11.02	5.51	5.51

16 Accessories

Device-specific accessories

Transmitter

Accessories	Description	Order number
Proline 10 transmitter	Installation Instructions EA01350D	8XBBXX-*...*
Weather protection cover	Protects the device from weather exposure: Installation Instructions EA01351D	71502730

Sensor

Accessories	Description

Heating jacket	The heating jacket is used to stabilize the temperature of the media in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as the medium.
	If using oil as a heating medium, please consult with an Endress+Hauser service organization.
	Heating jackets cannot be used with sensors fitted with a rupture disk.
	▪ If ordering with the device: order code for "Accessory enclosed"
	  ▪ Option RB "Heating jacket, G 1/2" female thread"
	  ▪ Option RC "Heating jacket, G 3/4" female thread"
	  ▪ Option RD "Heating jacket, NPT 1/2" female thread"
	  ▪ Option RE "Heating jacket, NPT 3/4" female thread"
	▪ If ordering subsequently: use the order code with the product root DK8003.
	Special Documentation SD02695D

Communication-specific accessories

Accessories	Description
Commubox FXA291	Connects the Endress+Hauser devices with the CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or laptop. Technical Information TI405C/07
Fieldgate FXA42	Transmission of measured values from connected 4 to 20 mA analog and digital devices. ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42
Field Xpert SMT70	Tablet PC for the configuration of the device. Enables mobile Plant Asset Management to manage the devices with a digital communication interface. Suitable for Zone 2. ▪ Technical Information TI01342S ▪ Operating Instructions BA01709S ▪ Product page: www.endress.com/smt70
Field Xpert SMT77	Tablet PC for the configuration of the device. Enables mobile Plant Asset Management to manage the devices with a digital communication interface. Suitable for Zone 1. ▪ Technical Information TI01418S ▪ Operating Instructions BA01923S ▪ Product page: www.endress.com/smt77

Service-specific accessory

Accessories	Description	Order number
Applicator	Software for selecting and sizing Endress+Hauser devices.	https://portal.endress.com/webapp/applicator
W@M Life Cycle Management	▪ Information platform with software applications and services ▪ Supports the entire life cycle of the facility.	www.endress.com/lifecyclemanagement
FieldCare	FDT-based plant asset management software from Endress+Hauser. Management and configuration of Endress+Hauser devices. Operating Instructions BA00027S and BA00059S	▪ Device driver: www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	Software for connecting and configuring Endress+Hauser devices. Innovation brochure IN01047S	▪ Device driver: www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)

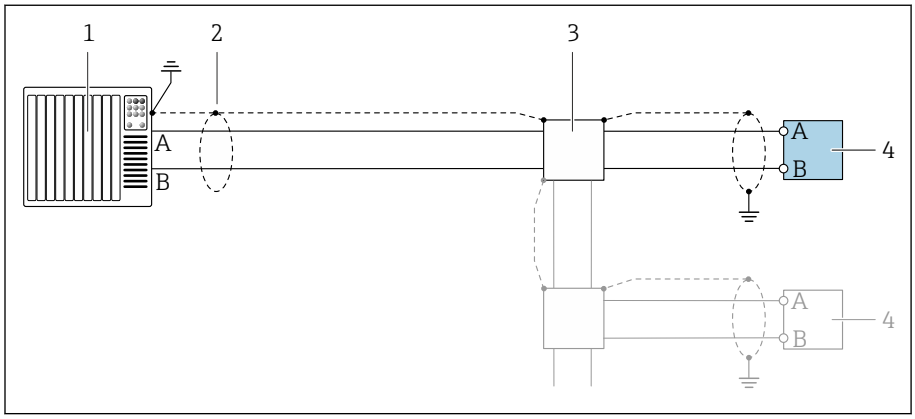
System components

Accessories	Description
Memograph M	Graphic data manager: ▪ Record measured values ▪ Monitor limit values ▪ Analyze measuring points ▪ Technical Information TI00133R ▪ Operating Instructions BA00247R
iTEMP	Temperature transmitter: ▪ Measure the absolute pressure and gauge pressure of gases, vapors and liquids ▪ Read the medium temperature "Fields of Activity" document FA00006T
Cerabar M	Pressure device: ▪ Measure the absolute pressure and gauge pressure of gases, vapors and liquids ▪ Read the operating pressure value ▪ Technical Information TI00426P and TI00436P ▪ Operating Instructions BA00200P and BA00382P
Cerabar S	Pressure device: ▪ Measure the absolute pressure and gauge pressure of gases, vapors and liquids ▪ Read the operating pressure value ▪ Technical Information TI00383P ▪ Operating Instructions BA00271P

17 Appendix

Examples for electric terminals

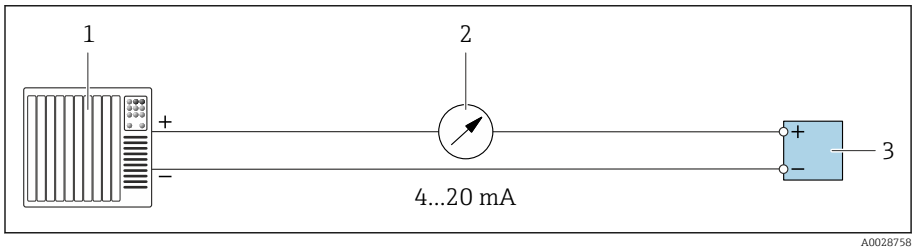
Modbus RS485



7 *Connection example for Modbus RS485, non-hazardous area and Zone 2; Class I, Division 2*

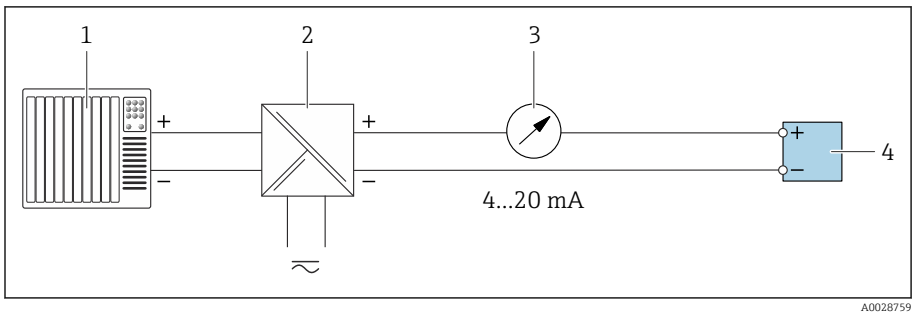
1 *Control system (e.g. PLC)*
2 *Cable shield*
3 *Distribution box*
4 *Transmitter*

Current output 4 to 20 mA (active)



1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe max. load*
3 *Transmitter*

Current output 4 to 20 mA (passive)



1 *Automation system with current input (e.g. PLC)*
2 *Active barrier for supply voltage (e.g. RN221N)*
3 *Analog display unit: observe max. load*
4 *Transmitter*

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