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# Technical Information
# **Proline Promass K 10**

Coriolis flowmeter



## Flowmeter with minimized total cost of ownership with easy-to-use operation concept

### Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Measurement of liquids and gases in utilities and basic applications

*Device properties*

- Compact dual-tube sensor
- Medium temperature up to +150 °C (+302 °F)
- Process pressure up to 100 bar (1450 psi)
- System integration with HART, IO-link, Modbus RS485
- Flexible operation with app and optional display

### Your benefits

- Easy integration into your plant infrastructure with IO-link
- Cost effective device for basic process and hygienic applications (3-A and cGMP, EHEDG)
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no in-/outlet run needs
- Optimum usability – display with touch screen (HART and Modbus RS485 communication only) or operation with mobile devices and SmartBlue app
- Simple, time-saving commissioning – guided parameterization in advance and in the field
- Integrated verification – Heartbeat Technology

Endress+Hauser
People for Process Automation

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## Symbols

### Electronics

⎓ Direct current

~ Alternating current

⎓~ Direct current and alternating current

⏚ Terminal connection for potential equalization

### Device communication

Communication via a wireless, local area network.

Bluetooth is enabled.

### 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

### Explosion protection

Hazardous area

Non-hazardous area

## Related 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 device documentation is available online on the device product page and in the Downloads area: www.endress.com

## Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.

2. Open the product page.
3. Select **Configuration**.

**Product Configurator - the tool for individual product configuration**
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

## Registered trademarks

**HART®**
Registered trademark of the FieldComm Group, Austin, Texas USA

**Modbus®**
Registered trademark of SCHNEIDER AUTOMATION, INC.

**IO-Link®**
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**Android®**
Android, Google Play and the Google Play logo are trademarks of Google Inc.

# Function and system design

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## Measuring principle

The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present in a system when both translational and rotational movements are superimposed.

$F_c = 2 \cdot \Delta m\ (v \cdot \omega)$

$F_c$ = Coriolis force

$\Delta m$ = moving mass

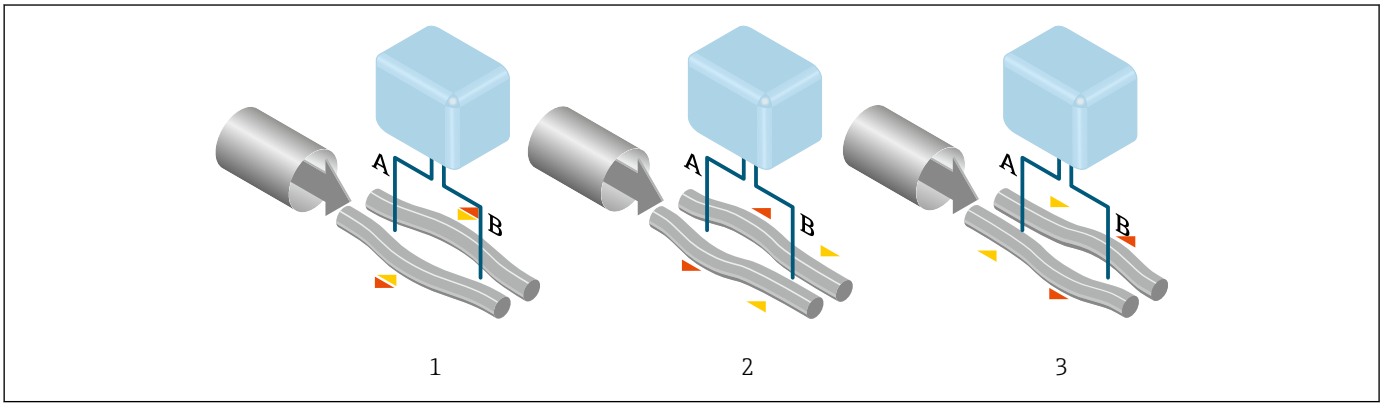
$\omega$ = rotational velocity

$v$ = radial velocity in rotating or oscillating system

The amplitude of the Coriolis force depends on the moving mass $\Delta m$, its velocity v in the system and thus on the mass flow. Instead of a constant rotational velocity $\omega$, the sensor uses oscillation.

In the sensor, two parallel measuring tubes containing flowing medium oscillate in antiphase, acting like a vibrating fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):

- At zero flow (when the medium is at a standstill) the two tubes oscillate in phase (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).




A0028850

The phase shift (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

**Density measurement**
The measuring tube is continuously excited at its resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tube and medium) results in a corresponding, automatic adjustment in the oscillation frequency. The resonance frequency is thus a function of the medium density. The microprocessor utilizes this relationship to obtain a density signal.

**Volume measurement**
Together with the measured mass flow, this is used to calculate the volume flow.

**Temperature measurement**
The temperature of the measuring tube is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output signal.

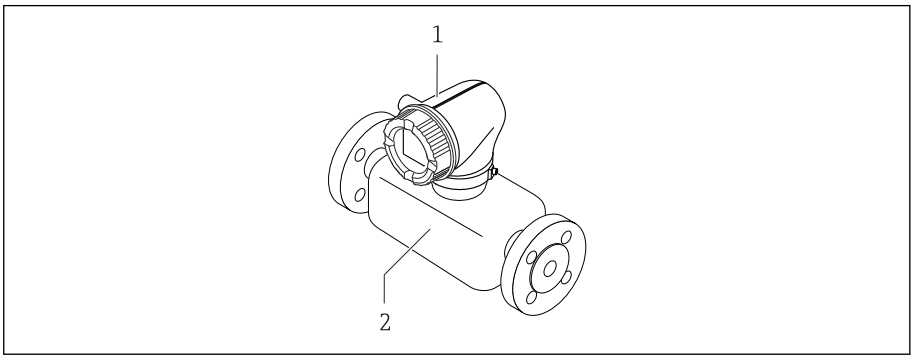
**Gas Fraction Handler (GFH)**
The Gas Fraction Handler is a software function that improves measurement stability and repeatability.
The function continuously checks for the presence of disturbances in single-phase flow, i.e. gas bubbles in liquids.
In the presence of the second phase, flow and density become increasingly unstable.

## Product design

The device consists of a transmitter and a sensor. A compact version of the device is available.

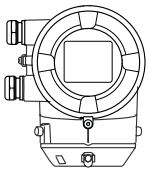
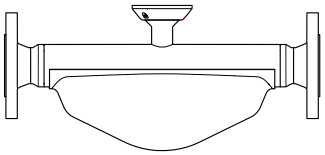
### Compact version

The transmitter and sensor form a mechanical unit.




1 *Transmitter*
2 *Sensor*

### Measuring system

| Proline 10 transmitter | Promass K sensor |
|---|---|
|  Compact version |  A0026712 |

## 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.

Write protection is enabled with the write protection switch on the back of the display module.

# Input

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## Measured variable

| | |
|---|---|
| **Direct measured variables** | ▪ Mass flow<br>▪ Temperature<br>▪ Density*<br>* Visibility depends on order options or device settings |
| **Calculated measured variables** | ▪ Volume flow<br>▪ 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 $\dot{m}_{max(F)}$ |
| $\rho_G$ | 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* , 🖹 94

**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

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## Output versions

| Order code 020: output; input | Output version |
|---|---|
| Option B | ▪ Current output 4 to 20 mA HART<br>▪ Pulse/frequency/switch output |
| Option C | ▪ Current output 4 to 20 mA HART Ex i<br>▪ Pulse/frequency/switch output Ex i |
| Option F | IO-Link |
| Option M | ▪ Modbus RS485<br>▪ Current output 4 to 20 mA |
| Option U | ▪ Modbus RS485 Ex i<br>▪ Current output 4 to 20 mA Ex i |

## Output signal

### Current output 4 to 20 mA HART

| | |
|---|---|
| **Signal mode** | Choose via terminal assignment:<br>▪ Active<br>▪ Passive |
| **Current range** | Can be set to:<br>▪ 4 to 20 mA NAMUR<br>▪ 4 to 20 mA US<br>▪ 4 to 20 mA<br>▪ 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<br>▪ Volume flow<br>▪ Corrected volume flow<br>▪ Temperature<br>▪ Density*<br>▪ Index inhomogeneous medium<br>▪ Exciter current<br>▪ Oscillation frequency<br>▪ Oscillation amplitude*<br>▪ Frequency fluctuation*<br>▪ Oscillation damping<br>▪ Oscillation damping fluctuation*<br>▪ Signal asymmetry<br>▪ HBSI*<br>▪ Electronics temperature<br>* Visibility depends on order options or device settings |

### IO-Link

| | |
|---|---|
| **Physical interface** | Similar to the standard IEC 61131-9 |
| **Signal** | Digital communication signal IO-Link, 3-wire |
| **IO-Link version** | 1.1 |

| | |
|---|---|
| **IO-Link SSP version** | Smart Sensor Profile 2nd Edition V1.2 |
| **IO-Link device port** | IO-Link port class A |

### Modbus RS485

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

### Current output 4 to 20 mA [1)]

| | |
|---|---|
| **Signal mode** | Choose via terminal assignment:<br>▪ Active<br>▪ Passive |
| **Current range** | Can be set to:<br>▪ 4 to 20 mA NAMUR<br>▪ 4 to 20 mA US<br>▪ 4 to 20 mA<br>▪ 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<br>▪ Volume flow<br>▪ Corrected volume flow<br>▪ Temperature<br>▪ Density*<br>▪ Index inhomogeneous medium<br>▪ Exciter current<br>▪ Oscillation frequency<br>▪ Oscillation amplitude*<br>▪ Frequency fluctuation*<br>▪ Oscillation damping<br>▪ Oscillation damping fluctuation*<br>▪ Signal asymmetry<br>▪ HBSI*<br>▪ Electronics temperature<br>* Visibility depends on order options or device settings |

### Pulse/frequency/switch output [2)]

| | |
|---|---|
| **Function** | Can be set to:<br>▪ Pulse output<br>▪ Frequency output<br>▪ Switch output |
| **Version** | Open collector:<br>Passive |

1) Only available with Modbus RS485
2) Only available with 4 to 20 mA HART IO1

| | |
|---|---|
| **Input values** | ▪ DC 10.4 to 30 V<br>▪ Max. 140 mA |
| **Voltage drop** | ▪ ≤ DC 2 V @ 100 mA<br>▪ ≤ DC 2.5 V @ max. input current |

| **Pulse output** | |
|---|---|
| **Pulse width** | Configurable: 0.05 to 2 000 ms |
| **Max. pulse rate** | 10 000 Impulse/s |
| **Pulse value** | Configurable |
| **Assignable measured variables** | ▪ Mass flow<br>▪ Volume flow<br>▪ Corrected volume flow |

| **Frequency output** | |
|---|---|
| **Output frequency** | Configurable: end value frequency 2 to 10 000 Hz ($f_{max}$ = 12 500 Hz) |
| **Damping** | Configurable: 0 to 999.9 s |
| **Pulse/pause ratio** | 1:1 |
| **Assignable measured variables** | ▪ Mass flow<br>▪ Volume flow<br>▪ Corrected volume flow<br>▪ Temperature<br>▪ Density*<br>▪ Index inhomogeneous medium<br>▪ Exciter current<br>▪ Oscillation frequency<br>▪ Oscillation amplitude*<br>▪ Frequency fluctuation*<br>▪ Oscillation damping<br>▪ Oscillation damping fluctuation*<br>▪ Signal asymmetry<br>▪ HBSI*<br>▪ Electronics temperature<br>* Visibility depends on order options or device settings |

| **Switch output** | |
|---|---|
| **Switching behavior** | Binary, conductive or non-conductive |
| **Switching delay** | Configurable: 0 to 100 s |

| | |
|---|---|
| **Number of switching cycles** | Unlimited |
| **Assignable functions** | ▪ Disable<br>▪ On<br>▪ Diagnostic behavior:<br>  ▪ Alarm<br>  ▪ Warning<br>  ▪ Warning and alarm<br>▪ Limit value:<br>  ▪ Mass flow<br>  ▪ Volume flow<br>  ▪ Corrected volume flow<br>  ▪ Temperature<br>  ▪ Density*<br>  ▪ Totalizer 1…3<br>  ▪ Oscillation damping<br>▪ Flow direction monitoring<br>▪ Status<br>  ▪ Partially filled pipe detection<br>  ▪ Low flow cut off<br>* Visibility depends on order options or device settings |

## Signal on alarm

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

### HART

| | |
|---|---|
| **Device diagnostics** | Device condition can be read out via HART Command 48 |

### IO-Link

| | |
|---|---|
| **Operating mode** | Digital transmission of all failure information |
| **Device status** | Readable via cyclic and acyclic data transmission |

### Modbus RS485

| | |
|---|---|
| **Failure mode** | Selectable:<br>▪ NaN value instead of current value<br>▪ Last valid value |

### Current output 4 to 20 mA

| | |
|---|---|
| **4 to 20 mA** | Selectable:<br>▪ Min. value: 3.59 mA<br>▪ Max. value: 21.5 mA<br>▪ Freely definable value between: 3.59 to 21.5 mA<br>▪ Actual value<br>▪ Last valid value |

### Pulse/frequency/switch output

| | |
|---|---|
| **Pulse output** | Selectable:<br>▪ Actual value<br>▪ No pulses |
| **Frequency output** | Selectable:<br>▪ Actual value<br>▪ 0 Hz<br>▪ Defined value: 0 to 12 500 Hz |
| **Switch output** | Selectable:<br>▪ Current status<br>▪ Open<br>▪ Closed |

## 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

### HART

| | |
|---|---|
| **Bus structure** | The HART signal is superimposed on the 4 to 20 mA current output. |
| **Manufacturer ID** | 0x11 |
| **Device type ID** | 0x72 |
| **HART protocol revision** | 7 |
| **Device description files (DTM, DD)** | Information and files under: www.endress.com |
| **HART load** | At least 250 Ω |
| **System integration** | Measured variables via HART protocol |

### IO-Link

| | |
|---|---|
| **IO-Link specification** | Version 1.1.3 |
| **Device ID** | 9728513 |
| **Manufacturer ID** | 17 |
| **Smart Sensor Profile** | Smart Sensor Profile 2nd Edition V1.2; supported<br>▪ Identification and Diagnosis<br>▪ Digital Measuring and Switching Sensor (as per SSP type 4.3.4)<br>▪ Function Class Sensor Control Wide |
| **Smart Sensor Profile Type** | Measuring profile type 4.3.4 Measuring and Switching Sensor, floating point, 4 channel |
| **SIO mode** | No |
| **Speed** | COM2 (38.4 kBaud) |
| **Minimum cycle time** | 12 ms |
| **Process data width** | Input: 18 bytes (as per SSP 4.3.4)<br>Output: 2 bytes (as per SSP 4.3.4) |
| **OnRequestdata** | 8 bytes |
| **Data storage** | Yes |
| **Block configuration** | Yes |
| **Device operational** | The device is operational 6 s after the supply voltage has been applied |
| **System integration** | Cyclic input measured variables:<br>▪ Mass flow [kg/s]<br>▪ Density[ kg/m3], depending on order options or device settings<br>▪ Temperature [°C]<br>▪ Totalizer 1 [kg]<br>Cyclic output measured variables:<br>▪ **Totalizer** submenu – **Totalize** option<br>▪ **Totalizer** submenu – **Reset + hold** option<br>▪ **Totalizer** submenu – **Reset + totalize** option<br>▪ **Totalizer** submenu – **Hold** option<br>▪ Flow override<br>▪ Device search |

#### Device description

In order to integrate field devices into a digital communication system, the IO-Link system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transmission rate.

These data are available in the device description (IODD) which is provided to the IO-Link Master when the communication system is commissioned.

The IODD can be downloaded as follows:
- www.endress.com
- https://ioddfinder.io-link.com

### Modbus RS485

| | |
|---|---|
| **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<br>▪ 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<br>▪ 04: Read input register<br>▪ 06: Write single registers<br>▪ 08: Diagnostics<br>▪ 16: Write multiple registers<br>▪ 23: Read/write multiple registers |
| **Broadcast messages** | Supported by the following function codes:<br>▪ 06: Write single registers<br>▪ 16: Write multiple registers<br>▪ 23: Read/write multiple registers |
| **Supported baud rate** | ▪ 1 200 BAUD<br>▪ 2 400 BAUD<br>▪ 4 800 BAUD<br>▪ 9 600 BAUD<br>▪ 19 200 BAUD<br>▪ 38 400 BAUD<br>▪ 57 600 BAUD<br>▪ 115 200 BAUD |
| **Data transfer mode** | RTU |
| **Data access** | Each parameter can be accessed via Modbus RS485.<br>For Modbus register information |
| **System integration** | Information on system integration .<br>▪ Modbus RS485 information<br>▪ Function codes<br>▪ Register information<br>▪ Response time<br>▪ Modbus data map |

# Power supply


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## Terminal assignment

The terminal assignment is documented on an adhesive label.

The following terminal assignment is available:

*Current output 4 to 20 mA HART (active) and pulse/frequency/switch output*

| Supply voltage | | Output 1 | | | | Output 2 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (–) | 26 (+) | 27 (–) | 24 (+) | 25 (–) | 22 (+) | 23 (–) |
| L/+ | N/– | Current output 4 to 20 mA HART (active) | | – | | Pulse/frequency/switch output (passive) | |

*Current output 4 to 20 mA HART (passive) and pulse/frequency/switch output*

| Supply voltage | | Output 1 | | | | Output 2 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (–) | 26 (+) | 27 (–) | 24 (+) | 25 (–) | 22 (+) | 23 (–) |
| L/+ | N/– | – | | Current output 4 to 20 mA HART (passive) | | Pulse/frequency/switch output (passive) | |

*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 **A** IO-Link port class A | DC 18 to 30 V [1] | | – |
| 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 |

1) These values are absolute minimum and maximum values. No tolerance applies. The DC power unit must be tested to ensure it meets technical safety requirements (e.g. PELV, SELV) with limited power sources (e.g. Class 2).

## Power consumption

- Transmitter:
  - HART, Modbus RS485: Max. 10 W (active power)
  - IO-Link: Max. 6 W (active power)
- Switch-on current:
  - HART, Modbus RS485: Max. 36 A (< 5 ms) as per NAMUR Recommendation NE 21
  - IO-Link: Max. 400 mA

## Current consumption

- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)
- Max 200 mA. (18 to 30 V, IO-Link port class A)

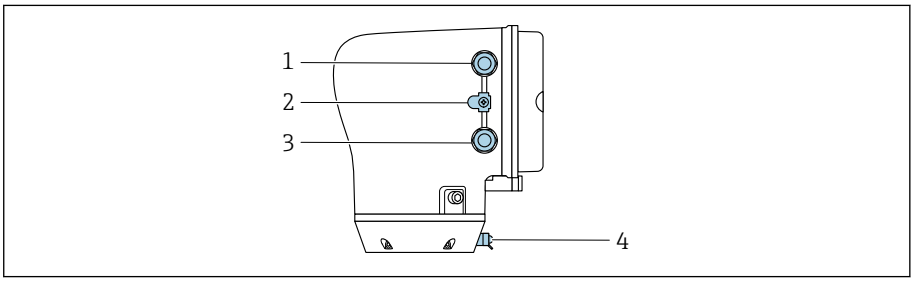
## Power supply failure

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

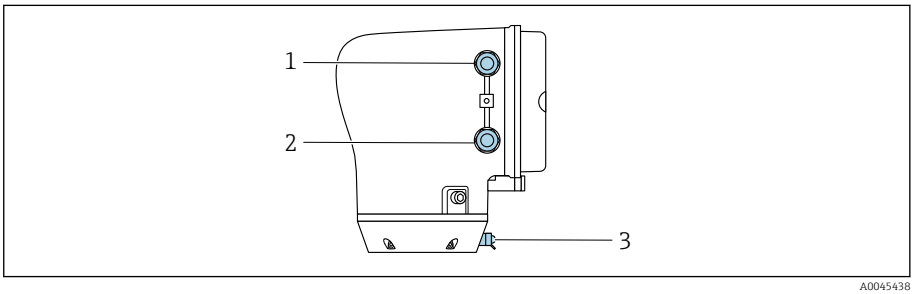
## Electrical connection

### Transmitter terminal connections

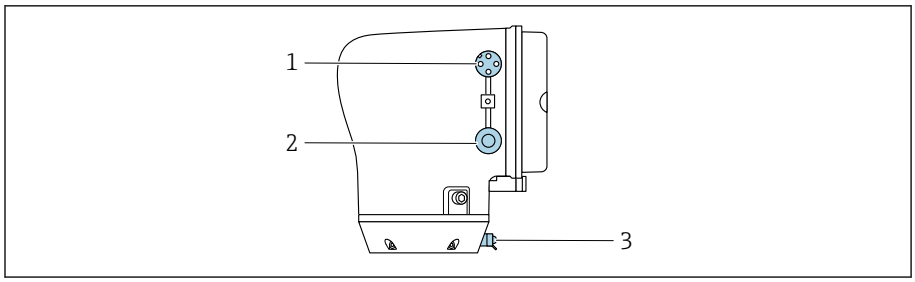
Terminal assignment → *Terminal assignment*, 26




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*



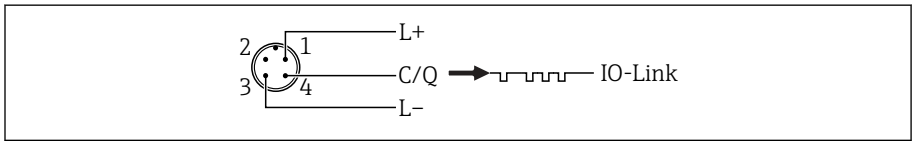

1 *Cable entry for power supply cable: supply voltage*
2 *Cable entry for signal cable*
3 *Outer ground terminal*




A0053767

*1 M12 plug for power supply (supply voltage) and signals (IO-Link)*
*2 Dummy plug*
*3 Outer ground terminal*

### *Pin assignment of IO-Link device plug*



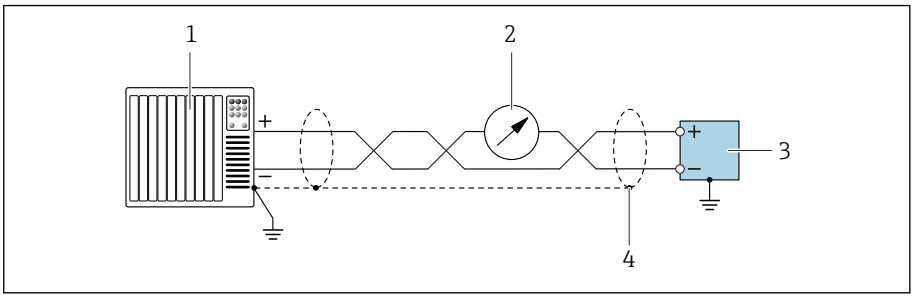

A0053891

*1 M12 A-coded (IEC 61076-2-101)*

*1 PIN 1: power supply*
*2 PIN 2: not used*
*3 PIN 3: reference potential for power supply/output*
*4 PIN 4: output 1 (IO-link)*

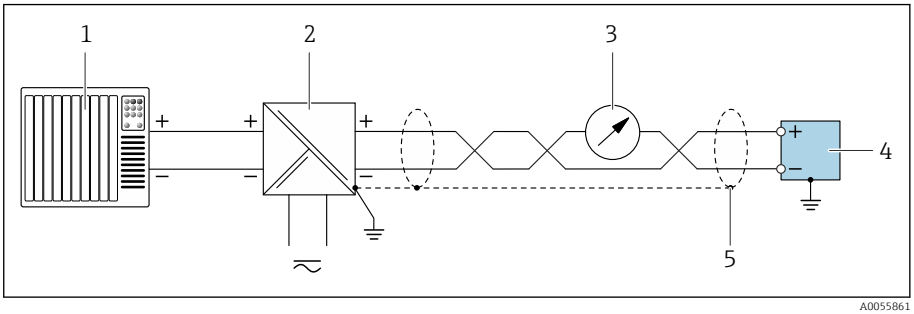
## Examples of electric terminals

### *Current output 4 to 20 mA HART*




2 *Connection example for 4 to 20 mA current output with HART (active)*

1 *Automation system with 4 to 20 mA current input with HART (e.g. PLC)*
2 *Optional display unit: Note maximum load*
3 *Transmitter with 4 to 20 mA current output with HART (active)*
4 *Ground cable shield at one end. For installations in compliance with NAMUR NE 89, grounding of the cable shield on both sides is required.*



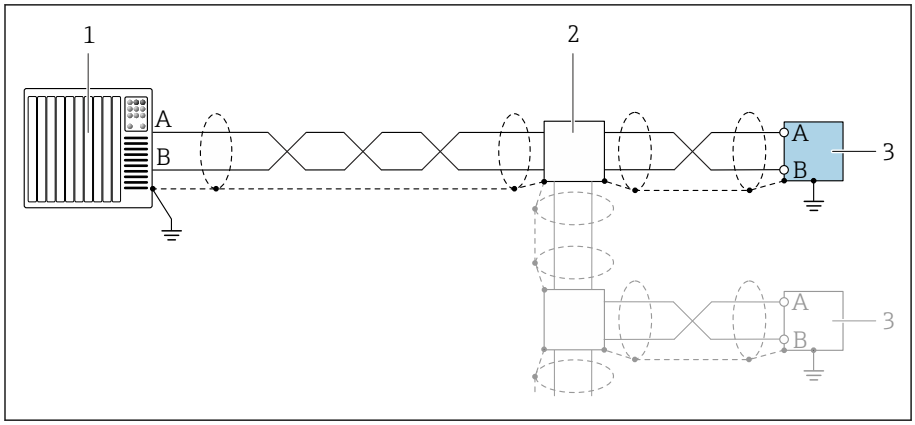

3 *Connection example for 4 to 20 mA current output with HART (passive)*

1 *Automation system with 4 to 20 mA current input with HART (e.g. PLC)*
2 *Power supply*
3 *Optional display unit: Note maximum load*
4 *Transmitter with 4 to 20 mA current output with HART (passive)*
5 *Ground cable shield at one end. For installations in compliance with NAMUR NE 89, grounding of the cable shield on both sides is required.*

### *IO-Link*

See https://io-link.com"IO-Link System Description"

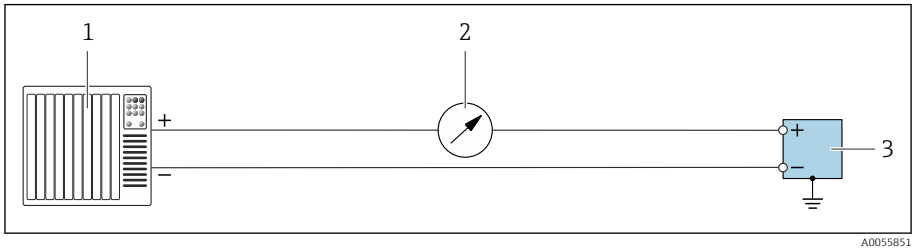
### *Modbus RS485*




4 *Connection example for Modbus RS485*

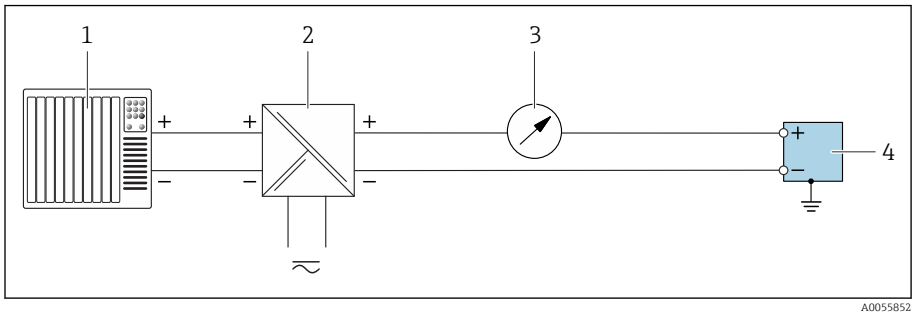
1 *Automation system with Modbus master (e.g. PLC)*
2 *Optional distribution box*
3 *Transmitter with Modbus RS485*

### *Current output 4 to 20 mA (without HART)*




5 *Connection example for 4 to 20 mA current output (active)*

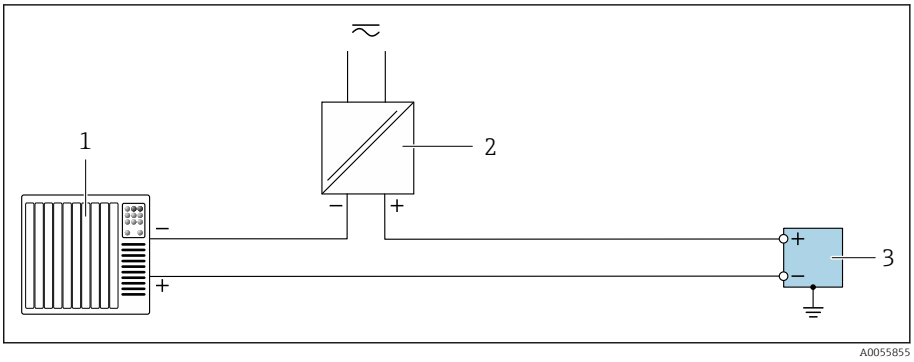
1 *Automation system with current input (e.g. PLC)*
2 *Optional additional display unit: Observe maximum load*
3 *Flowmeter with current output (active)*




6 *Connection example for 4 to 20 mA current output (passive)*

1 *Automation system with current input (e.g. PLC)*
2 *Power supply*
3 *Optional additional display unit: Observe maximum load*
4 *Transmitter with current output (passive)*

*Pulse output/frequency output/switch output*




7 *Connection example for pulse output/frequency output/switch output (passive)*

1 *Automation system with pulse input/frequency input/switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter with pulse output/frequency output/switch output (passive)*

## 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).

## 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
- M12 plug-in connector (IO-Link only)

## Overvoltage protection

| | |
|---|---|
| **Mains voltage fluctuations** | → *Supply voltage*, 26 |
| **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 34

## 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

- Current output 4 to 20 mA HART:
  A shielded cable is recommended, observe the grounding concept of the facility.
- Pulse/frequency/switch output:
  Standard installation cable
- IO-Link:
  Twisted three- or four-core cable M12 A-coded according to IEC 61076-2-101 recommended with
  - Conductor cross-section: 0.34 $mm^2$ (AWG22)
  - Max. cable length: 20 m
- 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 36
Maximum measurement error 36
Repeatability 37
Response time 37
Influence of ambient temperature 37
Influence of medium temperature 37
Influence of medium pressure 38
Design fundamentals 38

## 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* , 94

## Maximum measurement error

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

### Base accuracy

→ *Design fundamentals*, 38

| | |
|---|---|
| **Mass flow and volume flow (liquids)** | ±0.5 % o.r.<br>▪ Order code for "Calibration flow" option G: ±0.2 %<br>▪ 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<br>▪ Under reference operating conditions: ±0.0005 g/cm³<br>▪ Standard density calibration: ±0.003 g/cm³ |
| **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 | 1:1 | 1:10 | 1:20 | 1:50 | 1:100 | 1:500 |
|---|---|---|---|---|---|---|---|
| | [mm] | [kg/h] | [kg/h] | [kg/h] | [kg/h] | [kg/h] | [kg/h] |
| | 8 | 2 000 | 200 | 100 | 40 | 20 | 4 |
| | 15 | 6 500 | 650 | 325 | 130 | 65 | 13 |
| | 25 | 18 000 | 1 800 | 900 | 360 | 180 | 36 |
| | 40 | 45 000 | 4 500 | 2 250 | 900 | 450 | 90 |
| | 50 | 70 000 | 7 000 | 3 500 | 1 400 | 700 | 140 |
| | 80 | 180 000 | 18 000 | 9 000 | 3 600 | 1 800 | 360 |

| US units | DN [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 ppmo. r. (across the entire ambient temperature range) |

## Repeatability

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

→ *Design fundamentals*, 38

| | |
|---|---|
| **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<br>±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

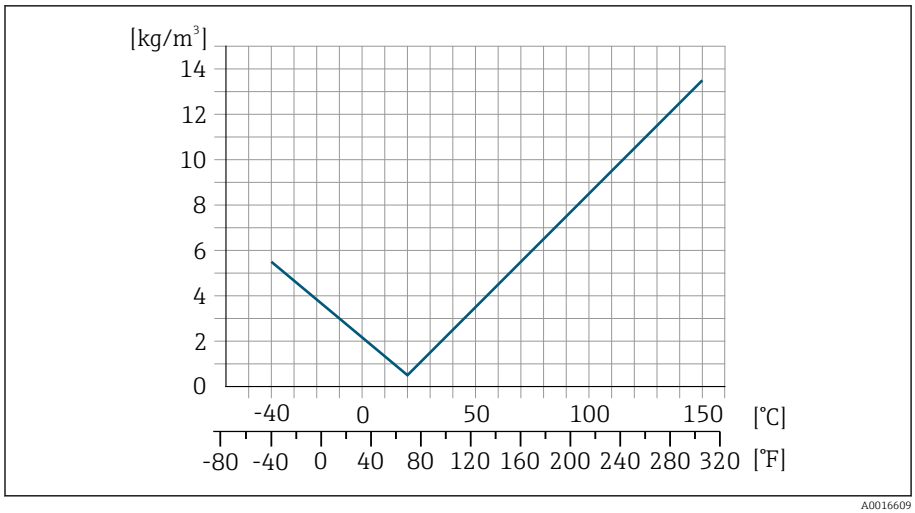
o.f.s. = of full scale value

### 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.




*8 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 following table shows how the pressure (gauge pressure) affects the accuracy of the 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.

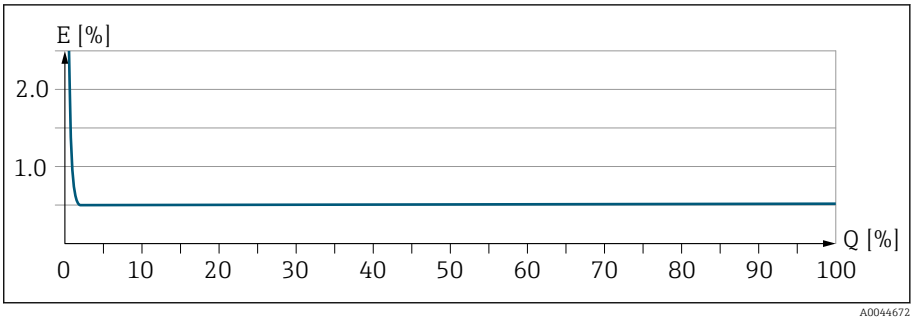
MeasValue = measured value

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

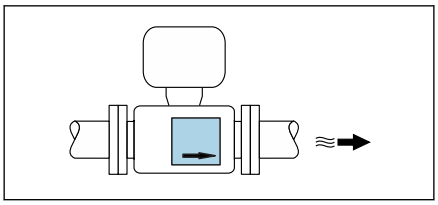
| **Flow rate** | $\geq \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ | $< \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ |
|---|---|---|
| **Maximum measured error in % o.r.** | ± BaseRepeat | $\pm ½ \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ |

# Installation procedure

Installation conditions 42

## Installation conditions

### Flow direction

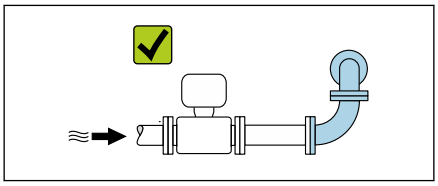


A0041163

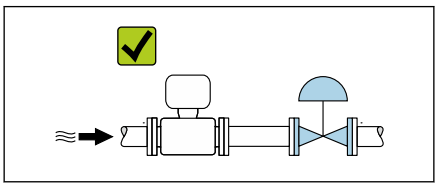
Install the device in the direction of flow.

Note the direction of arrow on the nameplate.

### Inlet runs and outlet runs



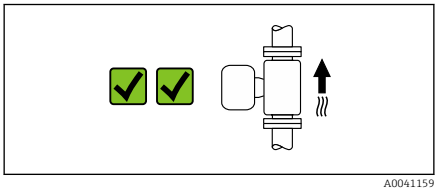
A0029323



A0029322

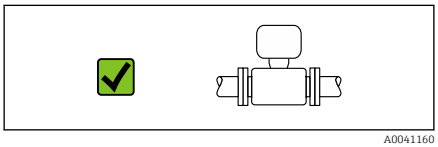
If no cavitation effects occur, requirements regarding inlet and outlet runs do not need to be considered during the installation.
To avoid negative pressure, install the sensor upstream from assemblies that produce turbulence, e.g. valves, T-sections, and downstream from pumps .

### Orientations



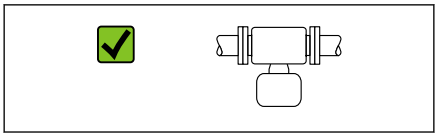
A0041159

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



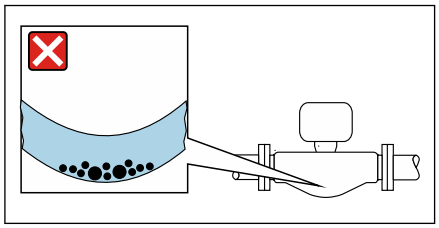
A0041160

**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.

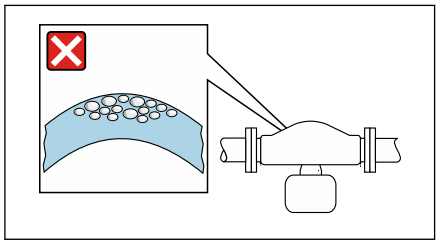


A0041161

**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.

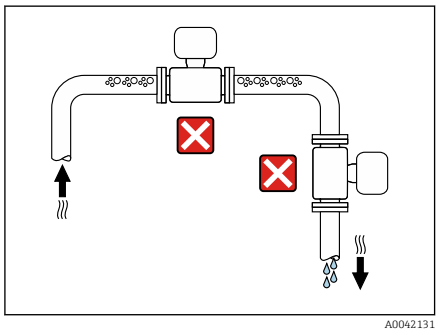

A0044717

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

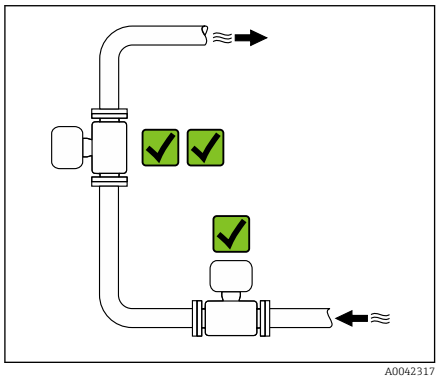
**Special mounting instructions**

- **Drainability**
  When installed vertically, the measuring tubes can be drained completely and protected against buildup.
- **Sanitary compatibility**
  When installing in hygienic applications, please refer to the information in the "Certificates and approvals/sanitary compatibility" section → *Sanitary compatibility* , 📄 86

## Mounting locations

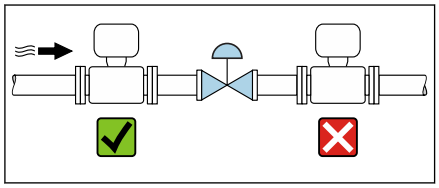

A0042131

- 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.

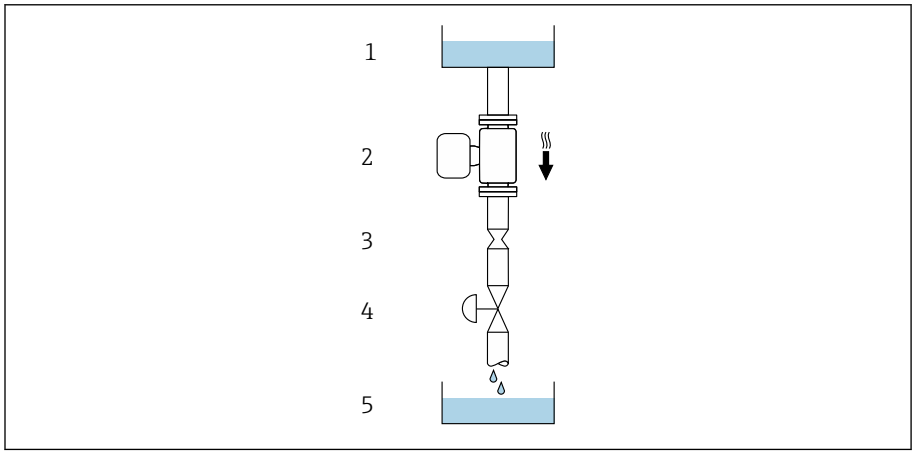
## Installation near control valves


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 *Filling container*

| 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

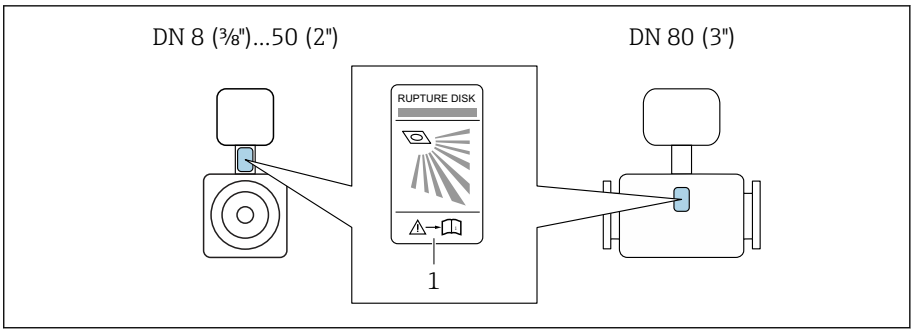
Information that is relevant to the process → *Rupture disk*, 📄 56.

**⚠ 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.

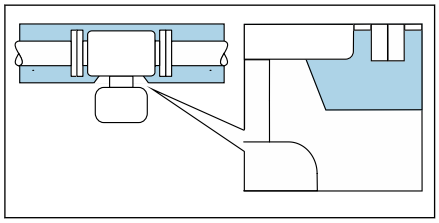
The position of the rupture disk is indicated by a sticker affixed to the device. If the rupture disk is triggered, the sticker is destroyed. The disk can therefore be visually monitored.




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).

- ▶ Fit insulation up as far as the upper edge of the sensor body.

### 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.

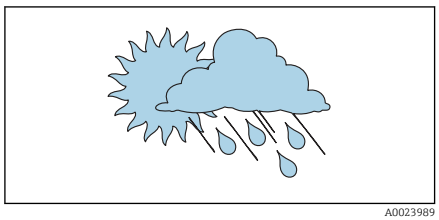
- ▶ Mount the device correctly.

**Heating options**

- Electrical heating, e.g. with electric band heaters [3)]
- Via pipes carrying hot water or steam
- Via heating jackets

Heating jackets for the sensors can be ordered as accessories from Endress+Hauser: → *Sensor*, 92

### 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*, 92.

3) 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" → *Related documentation*, 6

# Environment

Ambient temperature range 48
Storage temperature 48
Relative humidity 48
Operating height 48
Atmosphere 48
Climate class 48
Degree of protection 48
Vibration resistance and shock resistance 48
Electromagnetic compatibility (EMC) 49

## Ambient temperature range

| | |
|---|---|
| **Transmitter and sensor** | −40 to +60 °C (−40 to +140 °F) |
| **Local display** | −20 to +60 °C (−4 to +140 °F)<br>The readability of the display may be impaired at temperatures outside the temperature range. |

Dependency of ambient temperature on medium temperature → *Medium temperature range*, 52

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.

## Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 5 to 95%.

## Operating height

According to EN 61010-1
- Without overvoltage protection: ≤ 2 000 m
- With overvoltage protection: > 2 000 m (e.g. Endress+Hauser HAW series)

## 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<br>▪ 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**<br>Following IEC 60068-2-6 | 2 to 8.4 Hz<br>8.4 to 2 000 Hz | 3.5 mm peak<br>1 g peak |
| **Vibration, broad-band random**<br>Following IEC 60068-2-64 | 10 to 200 Hz<br>200 to 2 000 Hz | 0.003 $g^2$/Hz<br>0.001 $g^2$/Hz (1.54 g rms) |
| **Shocks, half-sine**<br>Following IEC 60068-2-27 | 6 ms 30 g | |

**Shock**
Due to rough handling similar to IEC 60068-2-31.

## Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and
- HART, Modbus RS485: NAMUR Recommendation NE 21
- IO-Link: IO-Link Interface and System Specification


For more information: Declaration of Conformity

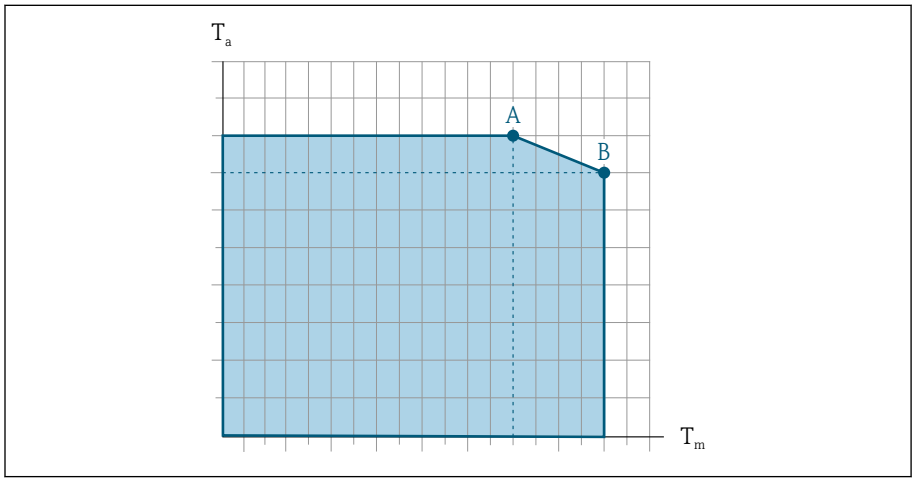
# Process

Medium temperature range 52
Density 52
Flow limit 52
Pressure/temperature ratings 53
Sensor housing 55
Rupture disk 56
Pressure loss 56

## Medium temperature range

−40 to +150 °C (−40 to +302 °F)

### Dependency of ambient temperature on medium temperature




9 *Exemplary representation, values in the table below.*

$T_a$ *Ambient temperature*
$T_m$ *Medium temperature*
A *Maximum permitted medium temperature $T_m$ at $T_{a\,max}$ = 60 °C (140 °F); higher medium temperatures $T_m$ require a reduction in the ambient temperature $T_a$*
B *Maximum permitted ambient temperature $T_a$ for the maximum specified medium temperature $T_m$ of the sensor*

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

| | A | | B | |
|---|---|---|---|---|
| | $T_a$ | $T_m$ | $T_a$ | $T_m$ |
| **Not insulated** | 60 °C (140 °F) | 150 °C (302 °F) | – | – |
| **Insulated** | 60 °C (140 °F) | 110 °C (230 °F) | 55 °C (131 °F) | 150 °C (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*, 14

- 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* , 14

To calculate the flow limit, use the *Applicator* sizing tool → *Service-specific accessory* , 94

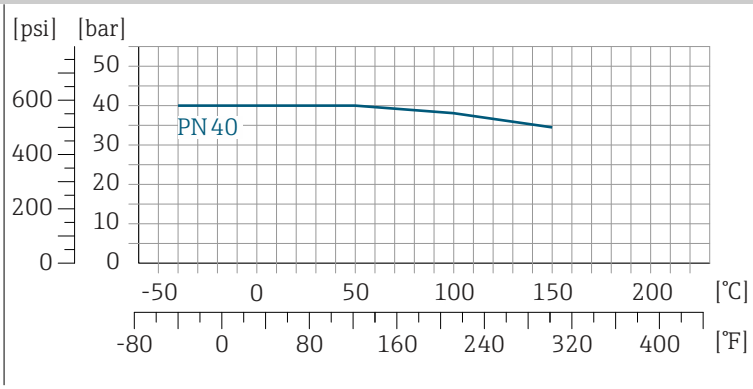
## Pressure/temperature ratings

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

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

### Flange similar to EN 1092-1

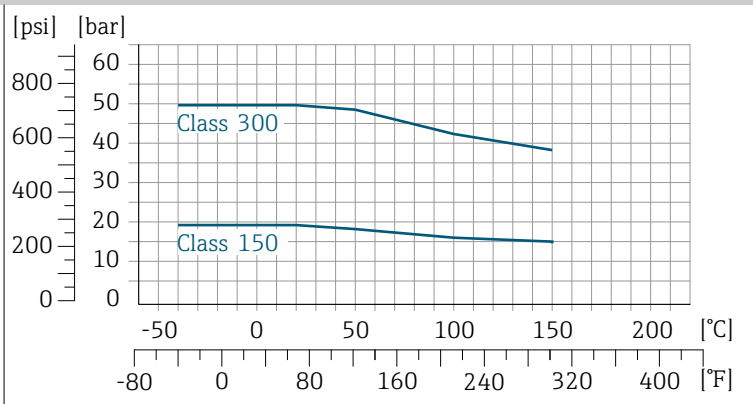
Flange material 1.4404 (F316/F316L)




A0047032-EN

### Flange similar to ASME B16.5

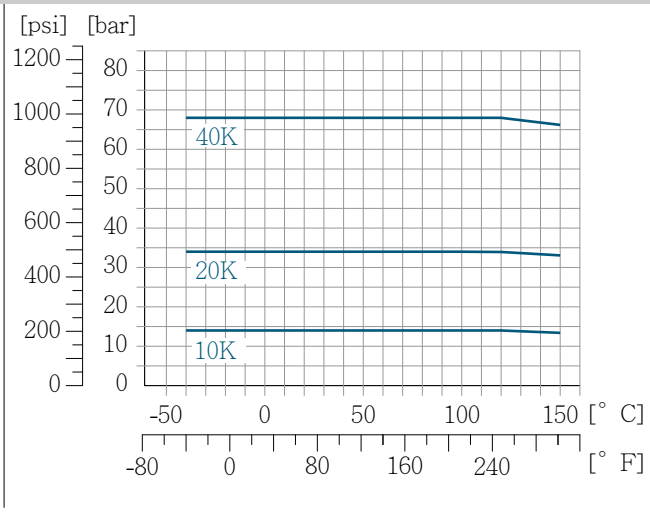
Flange material 1.4404 (F316/F316L)




A0047033-EN

### Fixed flange JIS B2220

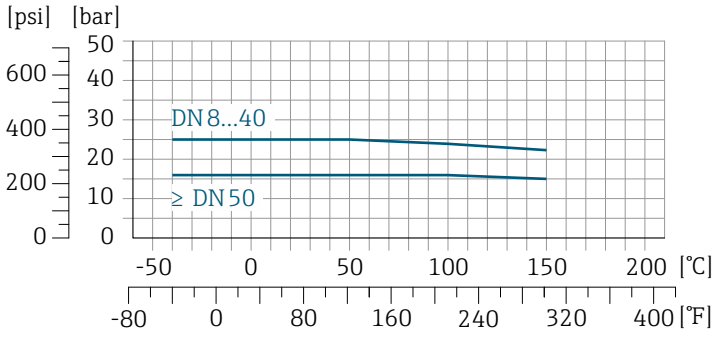
Flange material 1.4404 (F316/F316L)




A0047034-EN

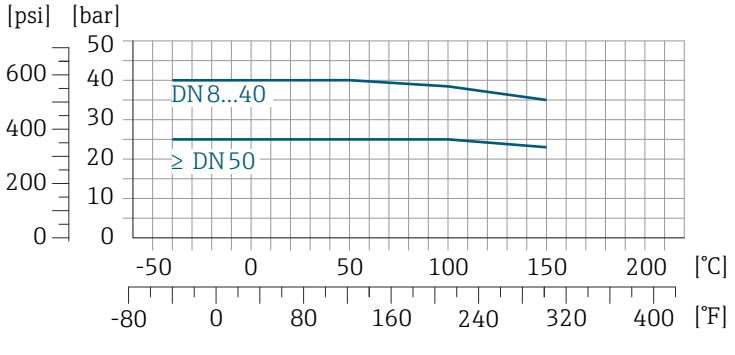
## Flange DIN 11864-2 Form A

Flange material 1.4404 (F316/F316L)



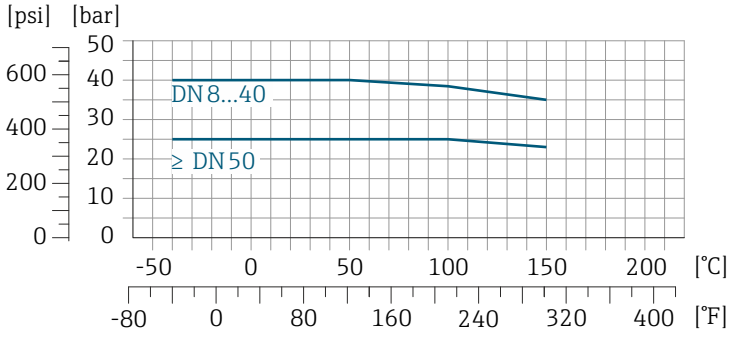

## Thread DIN 11864-1 Form A

Connection material 1.4404 (F316/F316L)




## Thread DIN 11851

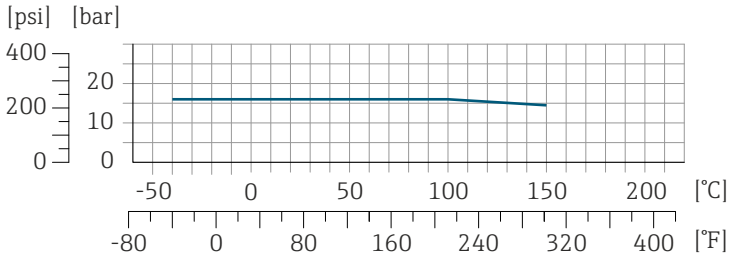
Connection material 1.4404 (F316/F316L)




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.

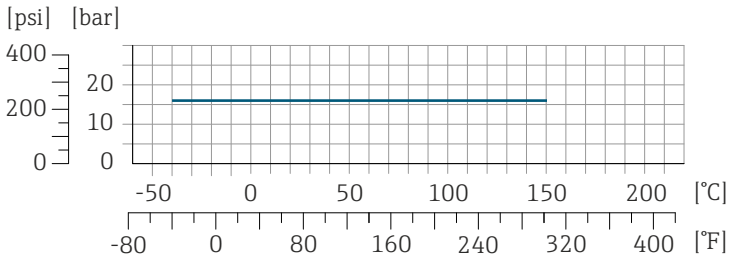
## Thread ISO 2853

Connection material 1.4404 (F316/F316L)

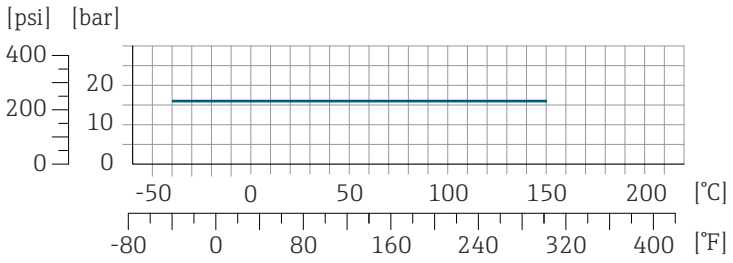


**Thread SMS 1145**

Connection material 1.4404 (F316/F316L)




**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* , 📄 58.

## 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* , 📄 94

# Mechanical construction

Weight 58
Materials 59
Process connections 59
Surface roughness 60

## 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 D "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 |
| 1½ | 26 |
| 2 | 37 |
| 3 | 73 |

## Materials

| | |
|---|---|
| **Transmitter housing** | |
| Order code for "Housing" | ▪ Option A: coated aluminum<br>▪ Option D: polycarbonate<br>▪ Option G: Compact, alu, coated + polycarbonate inspection window |
| Window material | ▪ Order code for "Housing", option A: glass<br>▪ Order code for "Housing", option D: polycarbonate<br>▪ Order code for "Housing", option G: polycarbonate |
| Neck adapter | Order code for "Housing", option A, D and G: coated aluminum |
| **Cable glands and entries** | |
| Cable gland M20 × 1.5 | ▪ Non-hazardous area: plastic<br>▪ Hazardous area: brass |
| Adapter for cable entry with internal thread G ½" or NPT ½" | Nickel-plated brass |
| M12 plug-in connector | Stainless steel 1.4301 (304) |
| **Sensor housing** | |
| | ▪ Acid and alkali-resistant outer surface<br>▪ Stainless steel 1.4301 (304) |
| **Measuring tubes** | |
| | Stainless steel: 1.4539 (904L)<br>Manifold: stainless steel, 1.4404 (316L) |
| **Seals** | |
| | Welded process connections without internal seals |
| **Process connections** | |
| ▪ EN 1092-1 (DIN 2501)<br>▪ ASME B16.5<br>▪ JIS B2220 | Stainless steel, 1.4404 (F316/F316L) |
| Other process connections | Stainless steel, 1.4404 (316/316L) |
| **Accessories** | |
| Weather protection 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

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

| Category | Method | Option(s)/Order code "Measuring tube mat., wetted surface" |
|---|---|---|
| Not polished | – | SA |
| Ra < 0.76 µm (30 µin) [1] | Mechanically polished [2] | BB |
| Ra < 0.76 µm (30 µin) | Mechanically polished, welds in as-welded condition | SJ |

1) Ra according to ISO 21920
2) Inaccessible weld seams between pipe and manifold are excluded

# Dimensions in SI units

**Compact version** 62
Order code for "Housing", option A and G "Aluminum, coated" 62
Order code for "Housing", option A "Aluminum, coated"; Zone 1 63
Order code for "Housing", option D "Polycarbonate" 64

**Fixed flange** 65
Flange according to EN 1092-1 (DIN 2501): PN 40 65
Flange similar to ASME B16.5: Class 150 66
Flange similar to ASME B16.5: Class 300 66
Flange JIS B2220: 20K 67
Flange JIS B2220: 40K 67
Flange DIN 11864-2 Form A, flange with notch 68

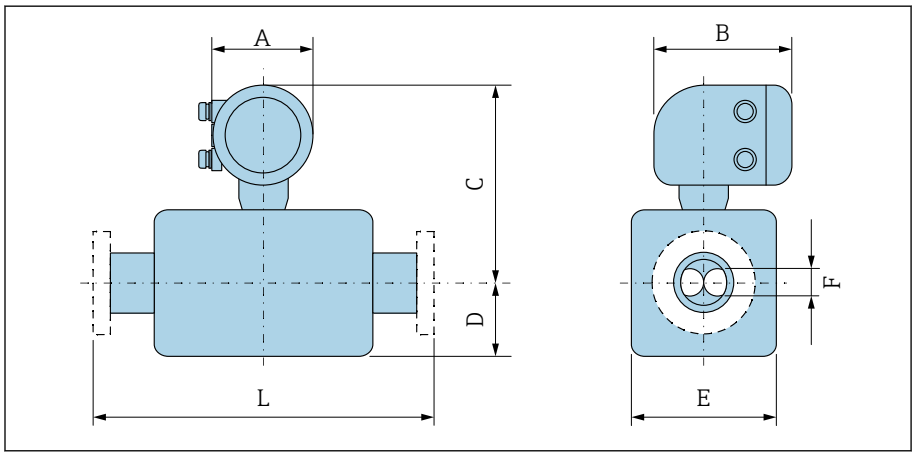
**Clamp connections** 69
Tri-Clamp 69

**Compression fittings** 70
Thread similar to DIN 11851 70
Thread similar to DIN 11864-1 Form A 70
Thread similar to SMS 1145 71
Thread similar to ISO 2853 71

**Accessories** 72
Weather protection cover 72

## Compact version

### Order code for "Housing", option A and G "Aluminum, coated"

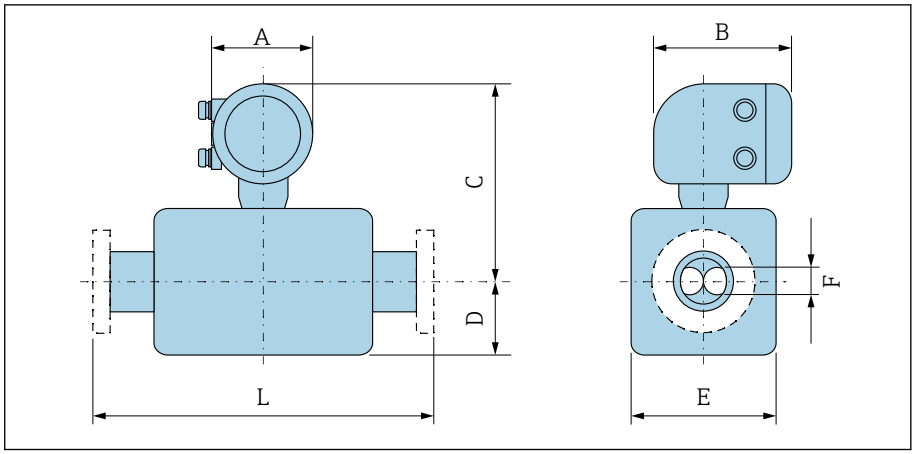



Dimension L depends on the relevant process connection:

| 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

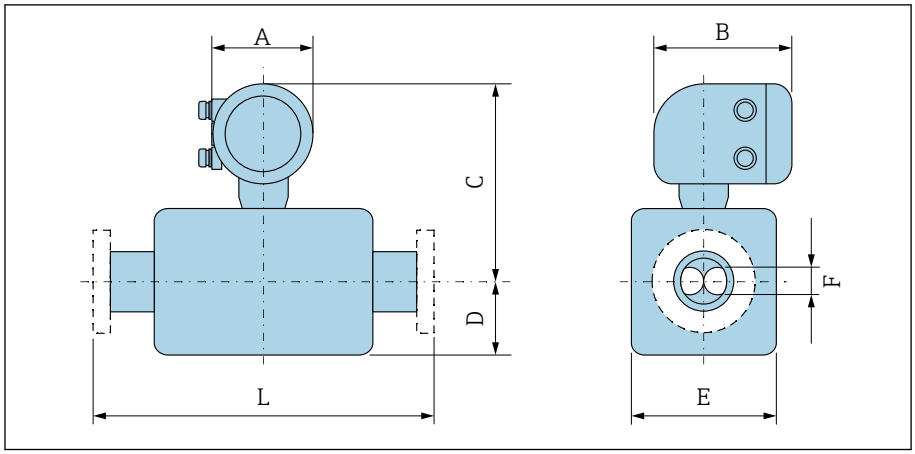



Dimension L depends on the relevant process connection:

| 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 D "Polycarbonate"




Dimension L depends on the relevant 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

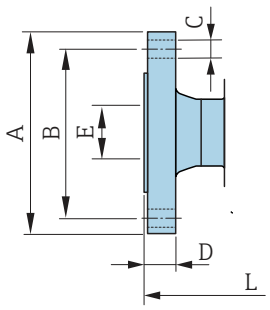
### Flange according to EN 1092-1 (DIN 2501): PN 40

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




A0042813

| 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 |

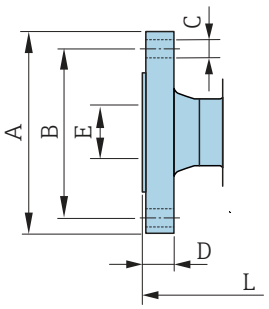
### Flange similar to ASME B16.5: Class 150

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




A0042813

| 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 |

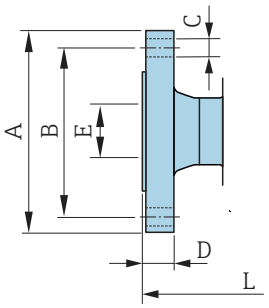
### Flange similar to ASME B16.5: Class 300

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




A0042813

| 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 |

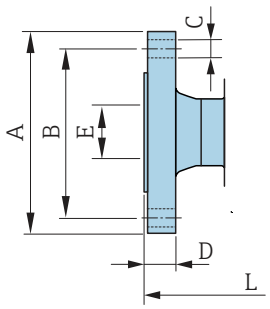
### Flange JIS B2220: 20K

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




A0042813

| 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 |

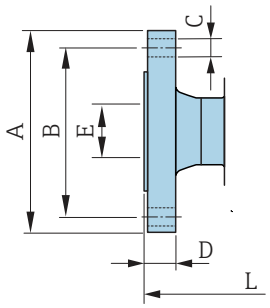
### Flange JIS B2220: 40K

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




A0042813

| 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

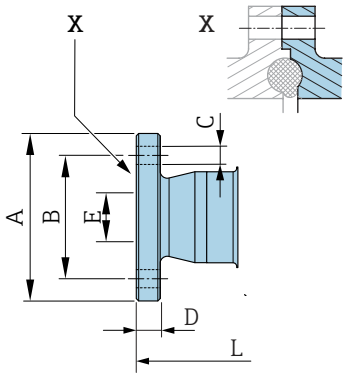
Order code for "Process connection", option KCS

1.4404 (316/316L)

Suitable for pipe similar to DIN 11866 series A, flange with notch

3-A version available: order code for "Additional approval", option LP in conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 0.76 µm)

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




A0042819

| 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

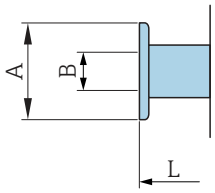
### Tri-Clamp

Order code for "Process connection", option FTS

1.4404 (316/316L)

Suitable for pipe similar to DIN 11866 series C

3-A version available: order code for "Additional approval", option LP in conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 0.76 µm)




A0043179

| 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 |

## Compression fittings

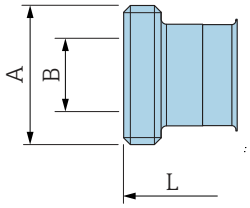
### Thread similar to DIN 11851

Order code for "Process connection", option FMW

1.4404/316L

Suitable for pipe similar to DIN11866, series A

3-A version available: order code for "Additional approval", option LP in conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 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 |

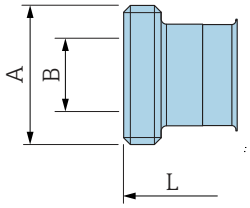
### Thread similar to DIN 11864-1 Form A

Order code for "Process connection", option FLW

1.4404/316L

Suitable for pipe similar to DIN11866, series A

3-A version available: order code for "Additional approval", option LP in conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 0.76 µm)




A0043257

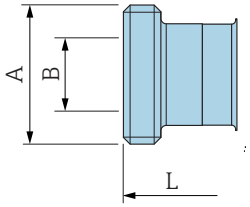
| DN [mm] | A [mm] | B [mm] | L [mm] |
|---|---|---|---|
| 8 | Rd 28 × 1/8 | 10 | 229 |
| 15 | Rd 34 × 1/8 | 16 | 273 |
| 25 | Rd 52 × 1/6 | 26 | 324 |
| 40 | Rd 65 × 1/6 | 38 | 456 |
| 50 | Rd 78 × 1/6 | 50 | 562 |
| 80 | Rd 110 × 1/4 | 81 | 671 |

### Thread similar 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 conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 0.76 µm)



A0043257

| 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 |

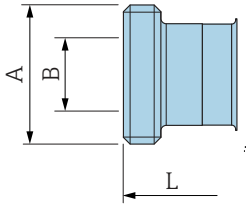
### Thread similar to ISO 2853

Order code for "Process connection", option JSF

1.4404 (316/316L)

Max. thread diameter A similar to ISO 2853 Annex A

3-A version available: order code for "Additional approval", option LP in conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 0.76 µm)

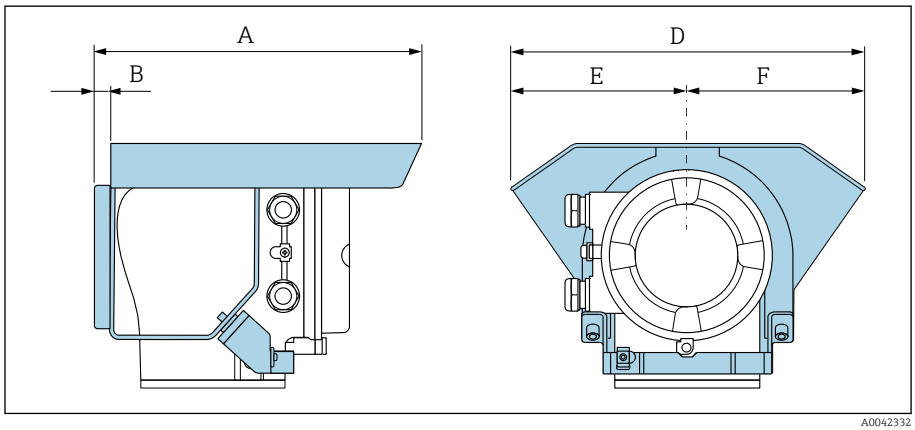


A0043257

| 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

### Weather protection cover




A0042332

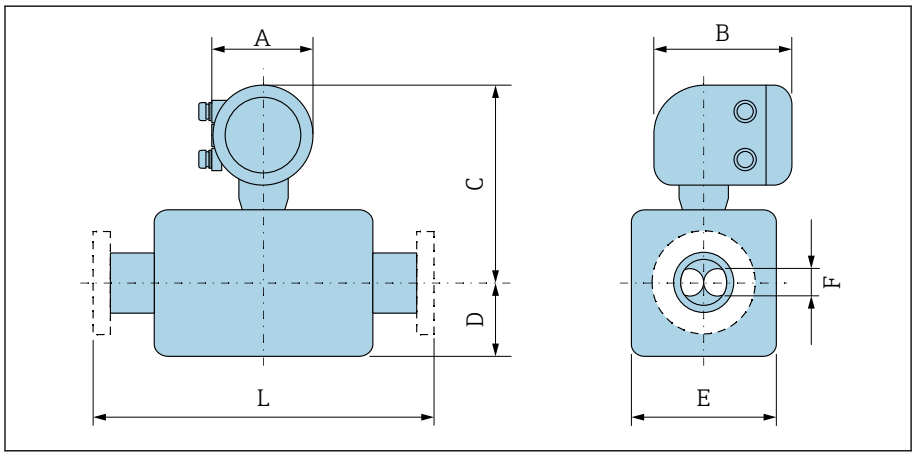
| A [mm] | B [mm] | D [mm] | E [mm] | F [mm] |
|---|---|---|---|---|
| 257 | 12 | 280 | 140 | 140 |

# Dimensions in US units

**Compact version** 74
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## Compact version

### Order code for "Housing", option A and G "Aluminum, coated"

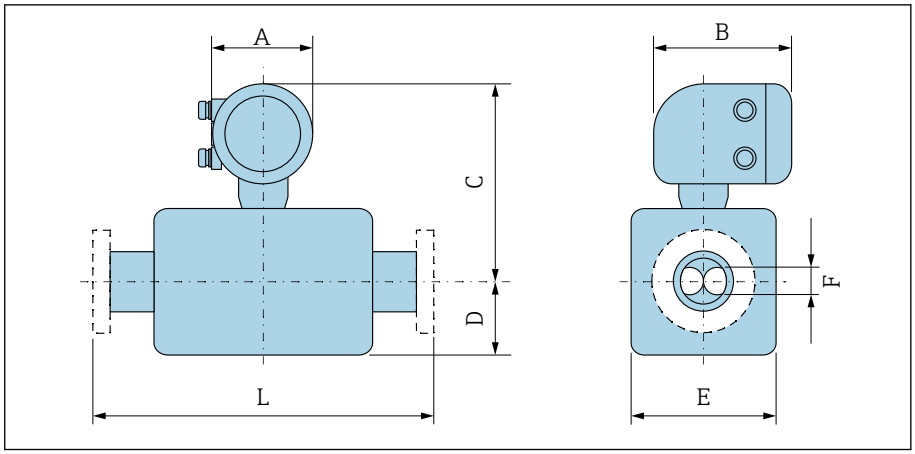



Dimension L depends on the relevant process connection:

| 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

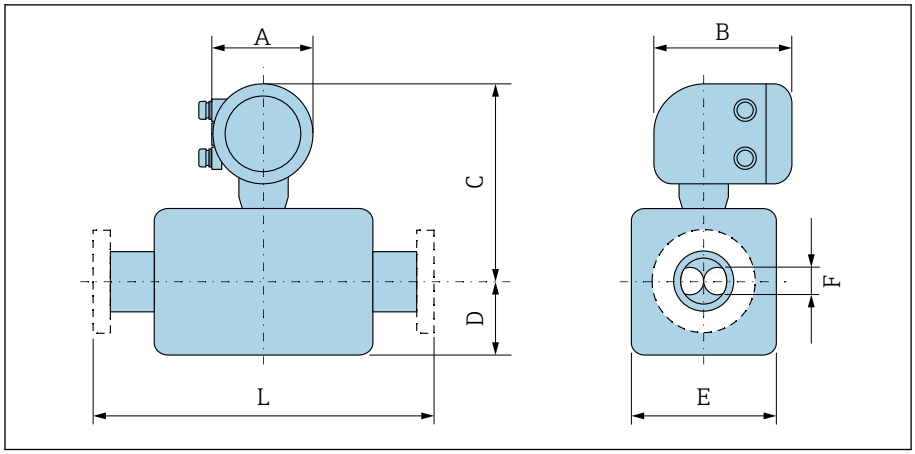



Dimension L depends on the relevant process connection:

| 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 D "Polycarbonate"




Dimension L depends on the relevant 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

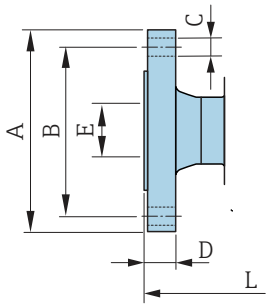
### Flange similar to ASME B16.5: Class 150

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 |

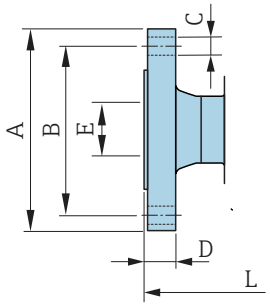
### Flange similar to ASME B16.5: Class 300

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

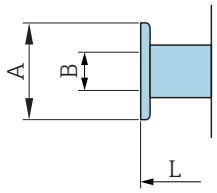
### Tri-Clamp

Order code for "Process connection", option FTS

1.4404 (316/316L)

Suitable for pipe similar to DIN 11866 series C

3-A version available: order code for "Additional approval", option LP in conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 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 |

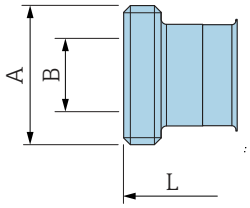
## Compression fittings

### Thread similar 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 conjunction with order code for "Measuring tube mat., wetted surface", option BB, SJ (Ra ≤ 30 µin)

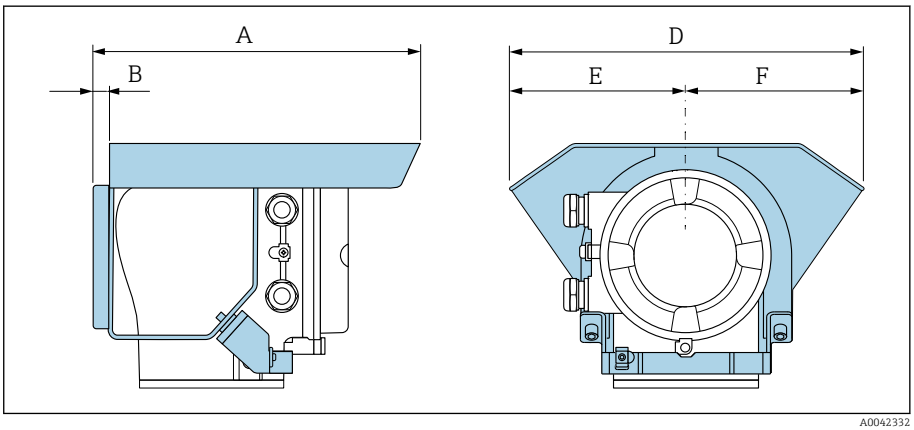



A0043257

| 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

### Weather protection cover




A0042332

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

# Local display

Operation concept 82
Operation options 83
Operating tools 83

## Operation concept

| | |
|---|---|
| Operation method | Operation via local display with touchscreen [1]<br>Operation via:<br>▪ SmartBlue app [2]<br>▪ Commubox FXA291 |
| Reliable operation | ▪ Operation in local language<br>▪ Uniform operating philosophy in device and in the SmartBlue App<br>▪ Write protection<br>▪ 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:<br>▪ Open remedial actions via local display and SmartBlue app<br>▪ Diverse simulation options<br>▪ Logbook of events that have occurred |

1) Only for HART and Modbus RS485 communication protocols
2) Optional via order code "Display; operation", options H, J or K

### IO-Link

The device-specific parameters are configured via IO-Link. There are specific configuration or operating programs from different manufacturers available to the user for this purpose. The device description file (IODD) is provided for the device.

**IO-Link operating concept**
Operator-oriented menu structure for user-specific tasks. Efficient diagnostic behavior increases measurement availability:
- Diagnostic messages
- Remedial action
- Simulation options

**IODD download**
Two options to download the IODD :
- www.endress.com/download
- https://ioddfinder.io-link.com/

#### www.endress.com/download

1. Select "Device Drivers".
2. Select the "IO Device Description (IODD)" entry under "Type".
3. Select "Product root".
4. Click "Search".
   ↳ A list of search results is displayed.

Select the appropriate version and download.

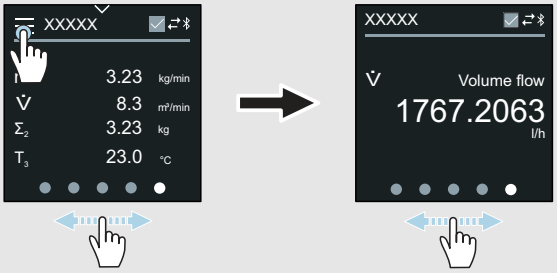
#### https://ioddfinder.io-link.com/

1. Enter "Endress" as the manufacturer and select.
2. Select product name.
   ↳ A list of search results is displayed.

Select the appropriate version and download.

For detailed IO-Link information, see "IO-Link" Special Documentation for the device
→ *Related documentation*, 🖹 6

## Operation options

| | |
|---|---|
| Local display | <br>A0042957<br>10 *Only for HART and Modbus RS485 communication protocols*<br><br>Display elements:<br>▪ LCD touch screen [1)]<br>▪ Depends on the orientation, automatic alignment of the local display<br>▪ Configuration of display format for measured variables and status variables<br><br>Operating elements:<br>▪ Touch screen [1)]<br>▪ 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.<br>▪ Based on Bluetooth<br>▪ No separate driver required<br>▪ Available for mobile handheld terminals, tablets and smartphones<br>▪ Suitable for convenient and secure access to devices in hard-to-reach locations or in hazardous areas<br>▪ Can be used within a 20 m (65.6 ft) radius of the device<br>▪ Encrypted and secure data transmission<br>▪ No data loss during commissioning and maintenance<br>▪ Diagnostic information and process information in real time |

1) Only for HART and Modbus RS485 communication protocols

## Operating tools

| Operating tools | Operating unit | Interface | Additional information |
|---|---|---|---|
| DeviceCare SFE100 | ▪ Notebook<br>▪ PC<br>▪ Tablet with Microsoft Windows system | ▪ CDI service interface<br>▪ Fieldbus protocol | Innovation brochure IN01047S |
| FieldCare SFE500 | ▪ Notebook<br>▪ PC<br>▪ Tablet with Microsoft Windows system | ▪ CDI service interface<br>▪ Fieldbus protocol | Operating Instructions BA00027S and BA00059S |
| SmartBlue app | ▪ Devices with iOS: iOS9.0 or higher<br>▪ Devices with Android: Android 4.4 KitKat or higher | Bluetooth | Endress+HauserSmartBlue App:<br>▪ Google Playstore (Android)<br>▪ iTunes Apple Shop (iOS devices) |
| Device Xpert | Field Xpert SFX 100/350/370 | HART fieldbus protocol | Operating Instructions BA01202S |

# Certificates and approvals

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Non-Ex approval 86
Pressure Equipment Directive 86
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Radio approval 87
Additional certification 87
External standards and guidelines 87

## Ex approval (not IO-Link)

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

## Non-Ex approval

- cCSAus
- EAC
- UKCA

## Pressure Equipment Directive

- CRN
- PED Cat. III
- PESR Cat. III

## Sanitary compatibility

- 3-A approval
  - Only measuring instruments with the order code for "Additional approval", option LP "3A" have 3-A approval.
  - The 3-A approval refers to the measuring instrument.
  - When installing the measuring instrument, ensure that no liquid can accumulate on the outside of the measuring instrument. 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.
- EHEDG-certified (Type EL Class I)
  - Only measuring instruments with the order code for "Additional approval", option LT "EHEDG" have been tested and meet the requirements of the EHEDG.
  - To meet the requirements for EHEDG certification, the device must be used with process connections in accordance with the EHEDG position paper entitled "Easy cleanable Pipe couplings and Process connections" (www.ehedg.org).
  - To meet the requirements for EHEDG certification, the orientation of the device must ensure drainability→ *Special mounting instructions*, 🖹 43.
  - The EHEDG cleanability test requires a flow velocity of 1.5 m/s in the process line. This velocity must be ensured for EHEDG-compliant cleaning.
- 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 instruments with the order code for "Test, certificate", option J1 "EU Food Contact Materials (EC) 1935/2004.
- FDA CFR 21
  A declaration for a specific serial number that confirms compliance with FDA requirements is only generated for measuring instruments 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 instruments 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.

## HART certification

The device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified according to HART 7
- The device can also be operated with certified devices of other manufacturers (interoperability).

## Radio approval

The device has radio approvals.

## Additional certification

- IO-Link
  Self-certification with Manufacturer Declaration
- CRN approval
  Some device versions have a CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device.
- EN10204-3.1 material certificate, wetted parts and sensor housing (order code for "Test, certificate", option JA)
- Pressure test, internal process, test report (order code for "Test, certificate", option JB)
- Surface roughness test ISO4287/Ra, (wetted parts), test report (option JE)
- Compliance with requirements derived from cGMP, Declaration (option JG)

## External standards and guidelines

- IEC/EN 60529
  Degrees of protection provided by enclosure (IP code)
- IEC/EN 60068-2-6
  Environmental influences: Test procedure - Test Fc: vibration (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.
- GB 30439.5
  Safety requirements for industrial automation products - Part 5: Flowmeter safety requirements
- IEC 61131-9
  Interface for communication with small sensors and actuators via a point-to -point connection
- 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

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## 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 according to DIN ISO 9001:2008 Clause 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 report.
- Simple testing process with local operation or other operating interfaces
- Clear measuring point assessment (pass/fail) with high total test coverage within the framework of manufacturer specifications.
- Extension of calibration intervals according to operator's risk evaluation

### Heartbeat Monitoring

Availability depends on the product structure.

Heartbeat Monitoring continuously provides data characteristic of the measuring principle to an external condition monitoring system, facilitating 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.

# Accessories

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## Device-specific accessories

### Transmitter

| Accessory | Description | Order code |
|---|---|---|
| Proline 10 transmitter | Installation Instructions EA01350D | 8XBBXX-*...* |
| Weather protection cover | Protects the device from weather exposure:<br>Installation Instructions EA01351D | 71502730 |

### Sensor

| Accessory | 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.<br>If using oil as a heating medium, please consult with an Endress+Hauser service organization.<br>Heating jackets cannot be used with sensors fitted with a rupture disk.<br>▪ If ordering with the device: order code for "Accessory enclosed"<br>▪ If ordering subsequently: use the order code with the product root DK8003.<br>Special Documentation SD02695D |

## Communication-specific accessories

| Accessory | Description |
|---|---|
| Commubox FXA195 USB/HART modem | Intrinsically safe HART communication with FieldCare and FieldXpert<br>Technical Information TI00404F |
| 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.<br>Technical Information TI405C/07 |
| 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.<br>Technical Information TI405C/07 |
| HART loop converter HMX50 | Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.<br>▪ Technical Information TI00429F<br>▪ Operating Instructions BA00371F |
| Fieldgate FXA42 | Transmission of measured values from connected 4 to 20 mA analog and digital devices.<br>▪ Technical Information TI01297S<br>▪ Operating Instructions BA01778S<br>▪ Product page: www.endress.com/fxa42 |
| Field Xpert SMT50 | The Field Xpert SMT50 table PC for device configuration enables mobile plant asset management. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress.<br>This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.<br>▪ Technical Information TI01555S<br>▪ Operating Instructions BA02053S<br>▪ Product page: www.endress.com/smt50 |
| 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.<br>▪ Technical Information TI01342S<br>▪ Operating Instructions BA01709S<br>▪ 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.<br>▪ Technical Information TI01418S<br>▪ Operating Instructions BA01923S<br>▪ Product page: www.endress.com/smt77 |
| FieldPort SFP20 | The FieldPort SFP20 is a USB interface for the configuration of Endress+Hauser IO-Link devices, and also of devices from other vendors. Combined with the IO-Link CommDTM (DeviceCare, FieldCare, Field Xpert) and the IODD Interpreter, the FieldPort complies with the FDT/DTM standards. |
| IO-Link master BL20 | IO-Link master from Turck for DIN rails supports PROFINET, EtherNet/IP and Modbus TCP. With web server for easy configuration. |

## Service-specific accessory

| Accessory | Description | Order code |
|---|---|---|
| Applicator | Software for selecting and sizing Endress+Hauser devices. | https://portal.endress.com/webapp/applicator |
| Netilion | IIoT ecosystem: Unlock knowledge<br>With the Netilion IIoT ecosystem, Endress+Hauser allows you to optimize your plant performance, digitize workflows, share knowledge, and enhance collaboration.<br>Based on decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem that enables you to gain useful insights from data. These insights can be used to optimize processes, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant. | www.netilion.endress.com |
| FieldCare | FDT-based plant asset management software from Endress+Hauser. Management and configuration of Endress+Hauser devices.<br>Operating Instructions BA00027S and BA00059S | ▪ Device driver: www.endress.com → Download Area<br>▪ CD-ROM (contact Endress+Hauser)<br>▪ DVD (contact Endress+Hauser) |
| DeviceCare | Software for connecting and configuring Endress+Hauser devices.<br>▪ Technical Information: TI01134S<br>▪ Innovation brochure: IN01047S | ▪ Device driver: www.endress.com → Download Area<br>▪ CD-ROM (contact Endress+Hauser)<br>▪ DVD (contact Endress+Hauser) |

## System components

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




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