# Technical Information
# Proline Promass E 300

## Coriolis flowmeter



# Mid-range Coriolis flowmeter with a compact, easily accessible transmitter

### Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Accurate measurement of liquids and gases for a wide range of standard applications

*Device properties*

- Compact dual-tube sensor
- Medium temperature up to +150 °C (+302 °F)
- Process pressure up to 100 bar (1450 psi)
- Compact dual-compartment housing with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Remote display available

### Your benefits

- Cost-effective – multipurpose device; an alternative to conventional volumetric flowmeters
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no in-/outlet run needs
- Full access to process and diagnostic information – numerous, freely combinable I/Os and Ethernet
- Reduced complexity and variety – freely configurable I/O functionality
- Integrated verification – Heartbeat Technology

Endress+Hauser [EH]

People for Process Automation

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# About this document

**Symbols**

**Electrical symbols**

| Symbol | Meaning |
|---|---|
| ⎓ | Direct current |
| ∼ | Alternating current |
| ⏦ | Direct current and alternating current |
| ⏚ | **Ground connection**<br>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |
| ⏛ | **Potential equalization connection (PE: protective earth)**<br>Ground terminals that must be connected to ground prior to establishing any other connections.<br><br>The ground terminals are located on the interior and exterior of the device:<br>• Interior ground terminal: potential equalization is connected to the supply network.<br>• Exterior ground terminal: device is connected to the plant grounding system. |

**Communication-specific symbols**

| Symbol | Meaning |
|---|---|
| 📶 | **Wireless Local Area Network (WLAN)**<br>Communication via a wireless, local network. |
| ▣ | **LED**<br>Light emitting diode is off. |
| ☀ | **LED**<br>Light emitting diode is on. |
| ☀ | **LED**<br>Light emitting diode is flashing. |

**Symbols for certain types of information**

| Symbol | Meaning |
|---|---|
| ✓ | **Permitted**<br>Procedures, processes or actions that are permitted. |
| ✓✓ | **Preferred**<br>Procedures, processes or actions that are preferred. |
| ✗ | **Forbidden**<br>Procedures, processes or actions that are forbidden. |
| ℹ | **Tip**<br>Indicates additional information. |
| 📖 | Reference to documentation |
| 📄 | Reference to page |
| 🖼 | Reference to graphic |
| 👁 | Visual inspection |

**Symbols in graphics**

| Symbol | Meaning |
|---|---|
| **1, 2, 3, …** | Item numbers |
| 1. , 2. , 3. , … | Series of steps |
| **A, B, C, …** | Views |
| **A-A, B-B, C-C, …** | Sections |
| $\triangle\!\!\!/ _{EX}$ | Hazardous area |
| $\triangle\!\!\!\!\!\!/ _{EX}$ | Safe area (non-hazardous area) |
| $\approx\!\!\blacktriangleright$ | Flow direction |

# Function and system design

**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 fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):
• At zero flow (when the fluid 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).
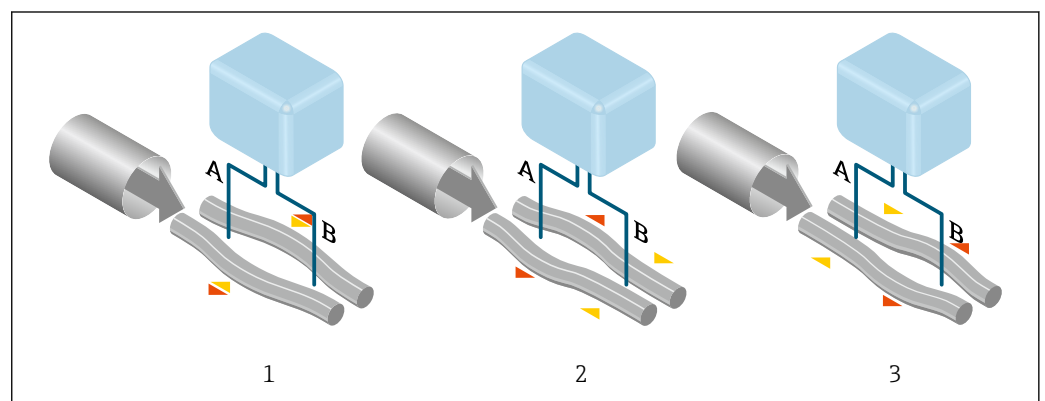


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The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle 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 fluid) 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 Promass 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 or droplets in gas. In the presence of the second phase, flow and density become increasingly unstable. The Gas Fraction Handler function improves measurement stability with respect to the severity of the disturbances, without any effect under single-phase flow conditions.

ℹ️ The Gas Fraction Handler is only available in device versions with HART, Modbus RS485, PROFINET and PROFINET with Ethernet-APL.

📖 For detailed information on the Gas Fraction Handler, see the Special Documentation for "Gas Fraction Handler" → 🕮 113
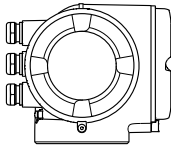
| | |
|---|---|
| **Measuring system** | The device consists of a transmitter and a sensor.<br><br>The device is available as a compact version:<br>The transmitter and sensor form a mechanical unit.<br><br>**Transmitter** |

| Proline 300 | Device versions and materials: |
|---|---|
| | • Transmitter housing<br>  • Aluminum, coated: aluminum, AlSi10Mg, coated<br>  • Stainless, hygienic: stainless steel, 1.4404<br>• Material of window in transmitter housing:<br>  • Aluminum, coated: glass<br>  • Stainless, hygienic: polycarbonate<br>Configuration:<br>• External operation via 4-line, illuminated graphic local display (LCD) with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning.<br>• Via service interface or WLAN interface:<br>  • Operating tools (e.g. FieldCare, DeviceCare)<br>  • Web server (access via Web browser, e.g. Microsoft Internet Explorer, Microsoft Edge) |
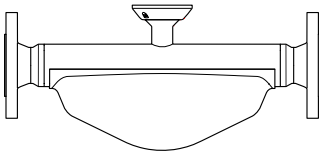
**Sensor**

| Promass E | |
|---|---|
| | • Bent dual-tube system<br>• For standard applications where stable and reliable measurements are required<br>• Simultaneous measurement of flow, volume flow, density and temperature (multivariable)<br>• Immune to process influences<br>• Nominal diameter range: DN 8 to 80 ($\frac{3}{8}$ to 3")<br>• Materials:<br>  • Sensor: stainless steel, 1.4301 (304)<br>  • Measuring tubes: stainless steel, 1.4539 (904L)<br>  • Process connections: stainless steel, 1.4404 (316/316L) |

**Equipment architecture**
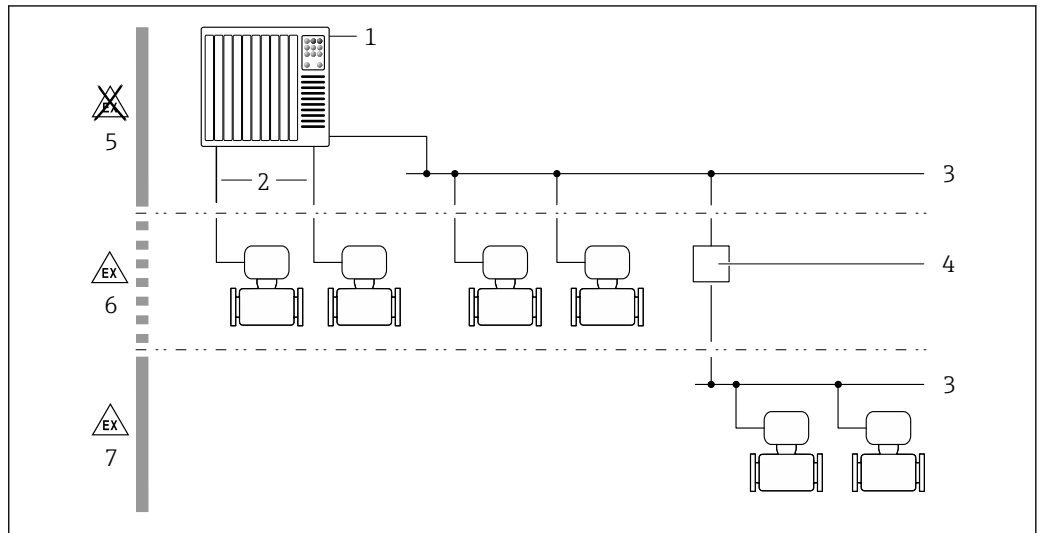


⊞ *1  Possibilities for integrating measuring devices into a system*

*1  Control system (e.g. PLC)*
*2  Connecting cable (0/4 to 20 mA HART etc.)*
*3  Fieldbus*
*4  Coupler*
*5  Non-hazardous area*
*6  Hazardous area: Zone 2; Class I, Division 2*
*7  Hazardous area: Zone 1; Class I, Division 1*

**Security**

**IT security**

Our warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

**Device-specific IT security**

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section:

| Function/interface | Factory setting | Recommendation |
|---|---|---|
| Write protection via hardware write protection switch → 🖹 8 | Not enabled | On an individual basis following risk assessment |
| Access code (also applies for Web server login or FieldCare connection) → 🖹 8 | Not enabled (0000) | Assign a customized access code during commissioning |
| WLAN (order option in display module) | Enabled | On an individual basis following risk assessment |
| WLAN security mode | Enabled (WPA2-PSK) | Do not change |
| WLAN passphrase (password) → 🖹 8 | Serial number | Assign a customized WLAN passphrase during commissioning |
| WLAN mode | Access point | On an individual basis following risk assessment |
| Web server → 🖹 8 | Enabled | On an individual basis following risk assessment |
| CDI-RJ45 service interface → 🖹 9 | – | On an individual basis following risk assessment |

*Protecting access via hardware write protection*

Write access to the parameters of the device via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the main electronics module). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered.

*Protecting access via a password*

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- User-specific access code
  Protect write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- WLAN passphrase
  The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.
- Infrastructure mode
  When the device is operated in infrastructure mode, the WLAN passphrase corresponds to the WLAN passphrase configured on the operator side.

*User-specific access code*

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code.

*WLAN passphrase: Operation as WLAN access point*

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface, which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter.

*Infrastructure mode*

A connection between the device and WLAN access point is protected by means of an SSID and passphrase on the system side. Please contact the relevant system administrator for access.

*General notes on the use of passwords*

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.

*Access via Web server*

The device can be operated and configured via a Web browser with the integrated Web server. The connection is via the service interface (CDI-RJ45) or the WLAN interface. For device versions with the EtherNet/IP and PROFINET communication protocols, the connection can also be established via the terminal connection for signal transmission with EtherNet/IP, PROFINET (RJ45 plug) or PROFINET with Ethernet-APL (two-wire).

The Web server is enabled when the device is delivered. The Web server can be disabled if necessary (e.g. after commissioning) via the **Web server functionality** parameter.

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.

For detailed information on device parameters, see:
The "Description of Device Parameters" document → 🗐 113

*Access via OPC-UA*

The "OPC UA Server" application package is available in the device version with the HART communication protocol → 🕮 109.

The device can communicate with OPC UA clients using the "OPC UA Server" application package.

The OPC UA server integrated in the device can be accessed via the WLAN access point using the WLAN interface - which can be ordered as an optional extra - or the service interface (CDI- RJ45) via Ethernet network. Access rights and authorization as per separate configuration.

The following Security Modes are supported as per the OPC UA Specification (IEC 62541):
- None
- Basic128Rsa15 – signed
- Basic128Rsa15 – signed and encrypted

*Access via service interface (CDI-RJ45)*

The device can be connected to a network via the service interface (CDI-RJ45). Device-specific functions guarantee the secure operation of the device in a network.

The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures such as network segmentation.

Transmitters with an Ex de approval may not be connected via the service interface (CDI-RJ45)!

Order code for "Approval transmitter + sensor", options (Ex de): BA, BB, C1, C2, GA, GB, MA, MB, NA, NB

The device can be incorporated into a ring topology. The device is integrated via the terminal connection for signal transmission (output 1) and the connection to the service interface (CDI-RJ45) .

# Input

| Measured variable | **Direct measured variables** |
| | |

**Direct measured variables**

- Mass flow
- Density
- Temperature

**Calculated measured variables**

- Volume flow
- Corrected volume flow
- Reference density

**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. The full scale value can be calculated with the following formulas:

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

$(\rho_G \cdot (c_G/2) \cdot d_i^2 \cdot (\pi/4) \cdot 3600 \cdot n)$

| $\dot{m}_{max(G)}$ | 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] |
| $c_G$ | Sound velocity (gas) [m/s] |
| $d_i$ | Measuring tube internal diameter [m] |
| $\pi$ | Pi |
| n = 2 | Number of measuring tubes |

| DN | | x |
|---|---|---|
| [mm] | [in] | [kg/m³] |
| 8 | ⅜ | 85 |
| 15 | ½ | 110 |
| 25 | 1 | 125 |
| 40 | 1½ | 125 |

| DN | | x |
|---|---|---|
| [mm] | [in] | [kg/m³] |
| 50 | 2 | 125 |
| 80 | 3 | 155 |

To calculate the measuring range, use the *Applicator* sizing tool → 🗏 111

If calculating the full scale value using the two formulas:

1. Calculate the full scale value with both formulas.
2. The smaller value is the value that must be used.

### Recommended measuring range

Flow limit → 🗏 64

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**Operable flow range**

Over 1000 : 1.

Flow rates above the preset full scale value do not override the electronics unit, with the result that the totalizer values are registered correctly.

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**Input signal**

### Output and input variants

→ 🗏 13

### External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow for gases, the automation system can continuously write different measured values to the measuring device:
• Operating pressure to increase accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure, e.g. Cerabar M or Cerabar S)
• Medium temperature to increase accuracy (e.g. iTEMP)
• Reference density for calculating the corrected volume flow for gases

Various pressure and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 🗏 112

It is recommended to read in external measured values to calculate the corrected volume flow.

*HART protocol*

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:
• HART protocol
• Burst mode

*Current input*

The measured values are written from the automation system to the measuring device via the current input → 🗏 12.

*Digital communication*

The measured values can be written by the automation system via:
• FOUNDATION Fieldbus
• PROFIBUS DP
• PROFIBUS PA
• Modbus RS485
• EtherNet/IP
• PROFINET
• PROFINET with Ethernet-APL

**Current input 0/4 to 20 mA**

| Current input | 0/4 to 20 mA (active/passive) |
|---|---|
| Current span | • 4 to 20 mA (active)<br>• 0/4 to 20 mA (passive) |
| Resolution | 1 µA |
| Voltage drop | Typically: 0.6 to 2 V for 3.6 to 22 mA (passive) |
| Maximum input voltage | ≤ 30 V (passive) |
| Open-circuit voltage | ≤ 28.8 V (active) |
| Possible input variables | • Pressure<br>• Temperature<br>• Density |

**Status input**

| Maximum input values | • DC −3 to 30 V<br>• If status input is active (ON): $R_i$ >3 kΩ |
|---|---|
| Response time | Configurable: 5 to 200 ms |
| Input signal level | • Low signal: DC −3 to +5 V<br>• High signal: DC 12 to 30 V |
| Assignable functions | • Off<br>• Reset the individual totalizers separately<br>• Reset all totalizers<br>• Flow override |

# Output

**Output and input variants**

Depending on the option selected for output/input 1, different options are available for the other outputs and inputs. Only one option can be selected for each output/input 1 to 3. The following tables must be read vertically (↓).

Example: If the option BA "4–20 mA HART" was selected for output/input 1, one of the options A, B, D, E, F, H, I or J is available for output 2 and one of the options A, B, D, E, F, H, I or J is available for output 3.

**Output/input 1 and options for output/input 2**

Options for output/input 3 → 🖹 14

| Order code for "Output; input 1" (020) → | Possible options | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Current output 4 to 20 mA HART | BA | | | | | | | | | | | | |
| Current output 4 to 20 mA HART Ex i passive | ↓ | CA | | | | | | | | | | | |
| Current output 4 to 20 mA HART Ex i active | | ↓ | CC | | | | | | | | | | |
| FOUNDATION Fieldbus | | | ↓ | SA | | | | | | | | | |
| FOUNDATION Fieldbus Ex i | | | | ↓ | TA | | | | | | | | |
| PROFIBUS DP | | | | | ↓ | LA | | | | | | | |
| PROFIBUS PA | | | | | | ↓ | GA | | | | | | |
| PROFIBUS PA Ex i | | | | | | | ↓ | HA | | | | | |
| Modbus RS485 | | | | | | | | ↓ | MA | | | | |
| EtherNet/IP 2-port switch integrated | | | | | | | | | ↓ | NA | | | |
| PROFINET 2-port switch integrated | | | | | | | | | | ↓ | RA | | |
| PROFINET with Ethernet-APL | | | | | | | | | | | ↓ | RB | |
| PROFINET with Ethernet-APL Ex i | | | | | | | | | | | | ↓ | RC |
| **Order code for "Output; input 2" (021) →** | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Not assigned | A | A | A | A | A | A | A | A | A | A | A | A | A |
| Current output 4 to 20 mA | B | | | B | | B | B | | B | B | B | B | |
| Current output 4 to 20 mA Ex i passive | | C | C | | C | | | C | | | | | C |
| User-configurable input/output [1] | D | | | D | | D | D | | D | D | D | D | |
| Pulse/frequency/switch output | E | | | E | | E | E | | E | E | E | E | |
| Double pulse output [2] | F | | | | | | | | F | | | | |
| Pulse/frequency/switch output Ex i passive | | G | G | | G | | | G | | | | | G |
| Relay output | H | | | H | | H | H | | H | H | H | H | |
| Current input 0/4 to 20 mA | I | | | I | | I | I | | I | I | I | I | |
| Status input | J | | | J | | J | J | | J | J | J | J | |

1) A specific input or output can be assigned to a user-configurable input/output → 🖹 20.
2) If double pulse output (F) is selected for output/input 2 (021), only the double pulse output (F) option is available for selection for output/input 3 (022).

**Output/input 1 and options for output/input 3**

ℹ Options for output/input 2 → 🖺 13

| Order code for "Output; input 1" (020) → | Possible options | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Current output 4 to 20 mA HART | BA | | | | | | | | | | | | |
| Current output 4 to 20 mA HART Ex i passive | ↓ | CA | | | | | | | | | | | |
| Current output 4 to 20 mA HART Ex i active | | ↓ | CC | | | | | | | | | | |
| FOUNDATION Fieldbus | | | ↓ | SA | | | | | | | | | |
| FOUNDATION Fieldbus Ex i | | | | ↓ | TA | | | | | | | | |
| PROFIBUS DP | | | | | ↓ | LA | | | | | | | |
| PROFIBUS PA | | | | | | ↓ | GA | | | | | | |
| PROFIBUS PA Ex i | | | | | | | ↓ | HA | | | | | |
| Modbus RS485 | | | | | | | | ↓ | MA | | | | |
| EtherNet/IP 2-port switch integrated | | | | | | | | | ↓ | NA | | | |
| PROFINET 2-port switch integrated | | | | | | | | | | ↓ | RA | | |
| PROFINET with Ethernet-APL | | | | | | | | | | | ↓ | RB | |
| PROFINET with Ethernet-APL Ex i | | | | | | | | | | | | ↓ | RC |
| **Order code for "Output; input 3" (022) →** | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Not assigned | A | A | A | A | A | A | A | A | A | A | A | A | A |
| Current output 4 to 20 mA | B | | | | | B | | | B | B | B | B | |
| Current output 4 to 20 mA Ex i passive | | C | C | | | | | | | | | | |
| User-configurable input/output | D | | | | | D | | | D | D | D | D | |
| Pulse/frequency/switch output | E | | | | | E | | | E | E | E | E | |
| Double pulse output (slave) [1] | F | | | | | | | | F | F | | | |
| Pulse/frequency/switch output Ex i passive | | G | G | | | | | | | | | | |
| Relay output | H | | | | | H | | | H | H | H | H | |
| Current input 0/4 to 20 mA | I | | | | | I | | | I | I | I | I | |
| Status input | J | | | | | J | | | J | J | J | J | |

[1] If double pulse output (F) is selected for output/input 2 (021), only the double pulse output (F) option is available for output/input 3 (022).

| Output signal | **Current output 4 to 20 mA HART** |
|---|---|

| Order code | "Output; input 1" (20):<br>Option BA: current output 4 to 20 mA HART |
|---|---|
| **Signal mode** | Can be set to:<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>• 0 to 20 mA (only if the signal mode is active)<br>• Fixed current |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Maximum input voltage** | DC 30 V (passive) |
| **Load** | 250 to 700 Ω |
| **Resolution** | 0.38 µA |
| **Damping** | Configurable: 0 to 999.9 s |
| **Assignable measured variables** | • Mass flow<br>• Volume flow<br>• Corrected volume flow<br>• Density<br>• Reference density<br>• Temperature<br>• Electronics temperature<br>• Oscillation frequency 0<br>• Oscillation damping 0<br>• Signal asymmetry<br>• Exciter current 0<br><br>The range of options increases if the measuring device has one or more application packages. |

**Current output 4 to 20 mA HART Ex i**

| Order code | "Output; input 1" (20) choose from:<br>• Option CA: current output 4 to 20 mA HART Ex i passive<br>• Option CC: current output 4 to 20 mA HART Ex i active |
|---|---|
| **Signal mode** | Depends on the selected order version. |
| **Current range** | Can be set to:<br>• 4 to 20 mA NAMUR<br>• 4 to 20 mA US<br>• 4 to 20 mA<br>• 0 to 20 mA (only if the signal mode is active)<br>• Fixed current |
| **Open-circuit voltage** | DC 21.8 V (active) |
| **Maximum input voltage** | DC 30 V (passive) |
| **Load** | • 250 to 400 Ω (active)<br>• 250 to 700 Ω (passive) |
| **Resolution** | 0.38 µA |

| Damping | Configurable: 0 to 999.9 s |
|---|---|
| Assignable measured variables | • Mass flow<br>• Volume flow<br>• Corrected volume flow<br>• Density<br>• Reference density<br>• Temperature<br>• Electronics temperature<br>• Oscillation frequency 0<br>• Oscillation damping 0<br>• Signal asymmetry<br>• Exciter current 0<br><br>ℹ The range of options increases if the measuring device has one or more application packages. |

**FOUNDATION Fieldbus**

| FOUNDATION Fieldbus | H1, IEC 61158-2, galvanically isolated |
|---|---|
| Data transfer | 31.25 kbit/s |
| Current consumption | 10 mA |
| Permitted supply voltage | 9 to 32 V |
| Bus connection | With integrated reverse polarity protection |

**PROFIBUS DP**

| Signal encoding | NRZ code |
|---|---|
| Data transfer | 9.6 kBaud...12 MBaud |
| Terminating resistor | Integrated, can be activated via DIP switches |

**PROFIBUS PA**

| PROFIBUS PA | In accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated |
|---|---|
| Data transmission | 31.25 kbit/s |
| Current consumption | 10 mA |
| Permitted supply voltage | 9 to 32 V |
| Bus connection | With integrated reverse polarity protection |

**Modbus RS485**

| Physical interface | RS485 in accordance with EIA/TIA-485 standard |
|---|---|
| Terminating resistor | Integrated, can be activated via DIP switches |

**EtherNet/IP**

| Standards | In accordance with IEEE 802.3 |
|---|---|

**PROFINET**

| Standards | In accordance with IEEE 802.3 |
|---|---|

**PROFINET with Ethernet-APL**

| | |
|---|---|
| Device use | **Device connection to an APL field switch**<br>The device may only be operated according to the following APL port classifications:<br>• If used in hazardous areas: SLAA or SLAC [1]<br>• If used in non-hazardous areas: SLAX<br><br>Connection values of APL field switch (corresponds to APL port classification SPCC or SPAA, for instance):<br>• Maximum input voltage: 15 $V_{DC}$<br>• Minimum output values: 0.54 W<br><br>**Device connection to an SPE switch**<br>The device may only be operated according to the following PoDL power class: If used in the non-hazardous area: PoDL power class 10<br><br>Connection values of SPE switch (corresponds to PoDL power class 10, 11 or 12):<br>• Maximum input voltage: 30 $V_{DC}$<br>• Minimum output values: 1.85 W |
| PROFINET | According to IEC 61158 and IEC 61784 |
| Ethernet-APL | According to IEEE 802.3cg, APL port profile specification v1.0, galvanically isolated |
| Data transfer | 10 Mbit/s |
| Current consumption | **Transmitter**<br>• Max. 400 mA(24 V)<br>• Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz) |
| Permitted supply voltage | 9 to 30 V |
| Network connection | With integrated reverse polarity protection |

[1] For more information on using the device in the hazardous area, see the Ex-specific Safety Instructions

**Current output 4 to 20 mA**

| | |
|---|---|
| Order code | "Output; input 2" (21), "Output; input 3" (022):<br>Option B: current output 4 to 20 mA |
| Signal mode | Can be set to:<br>• Active<br>• Passive |
| Current span | Can be set to:<br>• 4 to 20 mA NAMUR<br>• 4 to 20 mA US<br>• 4 to 20 mA<br>• 0 to 20 mA (only if the signal mode is active)<br>• Fixed current |
| Maximum output values | 22.5 mA |
| Open-circuit voltage | DC 28.8 V (active) |
| Maximum input voltage | DC 30 V (passive) |
| Load | 0 to 700 Ω |
| Resolution | 0.38 µA |

| Damping | Configurable: 0 to 999.9 s |
|---|---|
| Assignable measured variables | • Mass flow<br>• Volume flow<br>• Corrected volume flow<br>• Density<br>• Reference density<br>• Temperature<br>• Electronics temperature<br>• Oscillation frequency 0<br>• Oscillation damping 0<br>• Signal asymmetry<br>• Exciter current 0<br><br>ℹ The range of options increases if the measuring device has one or more application packages. |

**Current output 4 to 20 mA Ex i passive**

| Order code | "Output; input 2" (21), "Output; input 3" (022):<br>Option C: current output 4 to 20 mA Ex i passive |
|---|---|
| Signal mode | Passive |
| Current span | Can be set to:<br>• 4 to 20 mA NAMUR<br>• 4 to 20 mA US<br>• 4 to 20 mA<br>• Fixed current |
| Maximum output values | 22.5 mA |
| Maximum input voltage | DC 30 V |
| Load | 0 to 700 Ω |
| Resolution | 0.38 µA |
| Damping | Configurable: 0 to 999 s |
| Assignable measured variables | • Mass flow<br>• Volume flow<br>• Corrected volume flow<br>• Density<br>• Reference density<br>• Temperature<br>• Electronics temperature<br>• Oscillation frequency 0<br>• Oscillation damping 0<br>• Signal asymmetry<br>• Exciter current 0<br><br>ℹ The range of options increases if the measuring device has one or more application packages. |

**Pulse/frequency/switch output**

| Function | Can be configured as pulse, frequency or switch output |
|---|---|
| Version | Open collector<br><br>Can be set to:<br>• Active<br>• Passive<br>• Passive NAMUR<br><br>ℹ Ex-i, passive |
| Maximum input values | DC 30 V, 250 mA (passive) |
| Open-circuit voltage | DC 28.8 V (active) |
| Voltage drop | For 22.5 mA: ≤ DC 2 V |

| Pulse output | |
|---|---|
| Maximum input values | DC 30 V, 250 mA (passive) |
| Maximum output current | 22.5 mA (active) |
| Open-circuit voltage | DC 28.8 V (active) |
| Pulse width | Configurable: 0.05 to 2 000 ms |
| Maximum pulse rate | 10 000 Impulse/s |
| Pulse value | Configurable |
| Assignable measured variables | • Mass flow<br>• Volume flow<br>• Corrected volume flow |

| Frequency output | |
|---|---|
| Maximum input values | DC 30 V, 250 mA (passive) |
| Maximum output current | 22.5 mA (active) |
| Open-circuit voltage | DC 28.8 V (active) |
| 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>• Density<br>• Reference density<br>• Temperature<br>• Electronics temperature<br>• Oscillation frequency 0<br>• Oscillation damping 0<br>• Signal asymmetry<br>• Exciter current 0<br><br>ℹ The range of options increases if the measuring device has one or more application packages. |

| Switch output | |
|---|---|
| Maximum input values | DC 30 V, 250 mA (passive) |
| Open-circuit voltage | DC 28.8 V (active) |
| Switching behavior | Binary, conductive or non-conductive |
| Switching delay | Configurable: 0 to 100 s |
| Number of switching cycles | Unlimited |
| Assignable functions | • Off<br>• On<br>• Diagnostic behavior<br>• Limit value<br>  • Mass flow<br>  • Volume flow<br>  • Corrected volume flow<br>  • Density<br>  • Reference density<br>  • Temperature<br>  • Totalizer 1-3<br>• Flow direction monitoring<br>• Status<br>  • Partially filled pipe detection<br>  • Low flow cut off<br><br>ℹ The range of options increases if the measuring device has one or more application packages. |

**Double pulse output**

| Function | Double pulse |
|---|---|
| Version | Open collector<br>Can be set to:<br>• Active<br>• Passive<br>• Passive NAMUR |
| Maximum input values | DC 30 V, 250 mA (passive) |
| Open-circuit voltage | DC 28.8 V (active) |
| Voltage drop | For 22.5 mA: ≤ DC 2 V |
| Output frequency | Configurable: 0 to 1 000 Hz |
| Damping | Configurable: 0 to 999 s |
| Pulse/pause ratio | 1:1 |
| Assignable measured variables | • Mass flow<br>• Volume flow<br>• Corrected volume flow<br>• Density<br>• Reference density<br>• Temperature<br><br>ⓘ The range of options increases if the measuring device has one or more application packages. |

**Relay output**

| Function | Switch output |
|---|---|
| Version | Relay output, galvanically isolated |
| Switching behavior | Can be set to:<br>• NO (normally open), factory setting<br>• NC (normally closed) |
| Maximum switching capacity (passive) | • DC 30 V, 0.1 A<br>• AC 30 V, 0.5 A |
| Assignable functions | • Off<br>• On<br>• Diagnostic behavior<br>• Limit value<br>  • Mass flow<br>  • Volume flow<br>  • Corrected volume flow<br>  • Density<br>  • Reference density<br>  • Temperature<br>  • Totalizer 1-3<br>• Flow direction monitoring<br>• Status<br>  • Partially filled pipe detection<br>  • Low flow cut off<br><br>ⓘ The range of options increases if the measuring device has one or more application packages. |

**User-configurable input/output**

**One** specific input or output is assigned to a user-configurable input/output (configurable I/O) during device commissioning.

The following inputs and outputs are available for assignment:
- Choice of current output: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Pulse/frequency/switch output
- Choice of current input: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Status input

The technical values correspond to those of the inputs and outputs described in this section.

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

### HART current output

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

### PROFIBUS PA

| Status and alarm messages | Diagnostics in accordance with PROFIBUS PA Profile 3.02 |
|---|---|
| Failure current FDE (Fault Disconnection Electronic) | 0 mA |

### PROFIBUS DP

| Status and alarm messages | Diagnostics in accordance with PROFIBUS PA Profile 3.02 |
|---|---|

### EtherNet/IP

| Device diagnostics | Device condition can be read out in Input Assembly |
|---|---|

### PROFINET

| Device diagnostics | According to "Application Layer protocol for decentralized periphery", Version 2.3 |
|---|---|

### PROFINET with Ethernet-APL

| Device diagnostics | Diagnostics according to PROFINET PA Profile 4 |
|---|---|

### FOUNDATION Fieldbus

| Status and alarm messages | Diagnostics in accordance with FF-891 |
|---|---|
| Failure current FDE (Fault Disconnection Electronic) | 0 mA |

### Modbus RS485

| Failure mode | Choose from:<br>• NaN value instead of current value<br>• Last valid value |
|---|---|

**Current output 0/4 to 20 mA**

*4 to 20 mA*

| Failure mode | Choose from:<br>• 4 to 20 mA in accordance with NAMUR recommendation NE 43<br>• 4 to 20 mA in accordance with US<br>• Min. value: 3.59 mA<br>• Max. value: 22.5 mA<br>• Freely definable value between: 3.59 to 22.5 mA<br>• Actual value<br>• Last valid value |
|---|---|

*0 to 20 mA*

| Failure mode | Choose from:<br>• Maximum alarm: 22 mA<br>• Freely definable value between: 0 to 20.5 mA |
|---|---|

**Pulse/frequency/switch output**

| Pulse output | |
|---|---|
| **Failure mode** | Choose from:<br>• Actual value<br>• No pulses |
| **Frequency output** | |
| **Failure mode** | Choose from:<br>• Actual value<br>• 0 Hz<br>• Defined value ($f_{max}$ 2 to 12 500 Hz) |
| **Switch output** | |
| **Failure mode** | Choose from:<br>• Current status<br>• Open<br>• Closed |

**Relay output**

| Failure mode | Choose from:<br>• Current status<br>• Open<br>• Closed |
|---|---|

**Local display**

| Plain text display | With information on cause and remedial measures |
|---|---|
| **Backlight** | Red backlighting indicates a device error. |

Status signal as per NAMUR recommendation NE 107

**Interface/protocol**

- Via digital communication:
  - HART protocol
  - FOUNDATION Fieldbus
  - PROFIBUS PA
  - PROFIBUS DP
  - Modbus RS485
  - EtherNet/IP
  - PROFINET
  - PROFINET with Ethernet-APL
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

| Plain text display | With information on cause and remedial measures |
|---|---|

Additional information on remote operation → 🗎 92

**Web browser**

| Plain text display | With information on cause and remedial measures |
|---|---|

**Light emitting diodes (LED)**

| Status information | Status indicated by various light emitting diodes |
|---|---|
| | The following information is displayed depending on the device version:<br>• Supply voltage active<br>• Data transmission active<br>• Device alarm/error has occurred<br>• EtherNet/IP network available<br>• EtherNet/IP connection established<br>• PROFINET network available<br>• PROFINET connection established<br>• PROFINET blinking feature |

**Load**  Output signal → 🗎 15

**Ex connection data**  Safety-related values

| Order code for "Output; input 1" | Output type | Safety-related values "Output; input 1" | |
|---|---|---|---|
| | | 26 (+) | 27 (−) |
| Option **BA** | Current output 4 to 20 mA HART | $U_N = 30\ V_{DC}$<br>$U_M = 250\ V_{AC}$ | |
| Option **GA** | PROFIBUS PA | $U_N = 32\ V_{DC}$<br>$U_M = 250\ V_{AC}$ | |
| Option **LA** | PROFIBUS DP | $U_N = 32\ V_{DC}$<br>$U_M = 250\ V_{AC}$ | |
| Option **MA** | Modbus RS485 | $U_N = 30\ V_{DC}$<br>$U_M = 250\ V_{AC}$ | |
| Option **SA** | FOUNDATION Fieldbus | $U_N = 32\ V_{DC}$<br>$U_M = 250\ V_{AC}$ | |
| Option **NA** | EtherNet/IP | $U_N = 30\ V_{DC}$<br>$U_M = 250\ V_{AC}$ | |

| Order code for "Output; input 1" | Output type | Safety-related values "Output; input 1" | |
|---|---|---|---|
| | | 26 (+) | 27 (−) |
| Option **RA** | PROFINET | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | |
| Option **RB** | PROFINET with Ethernet-APL | APL port profile SLAX<br>SPE PoDL classes 10, 11, 12<br>$U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | |

| Order code for "Output; input 2"; "Output; input 3" | Output type | Safety-related values | | | |
|---|---|---|---|---|---|
| | | Output; input 2 | | Output; input 3 | |
| | | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| Option **B** | Current output 4 to 20 mA | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | | | |
| Option **D** | User-configurable input/output | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | | | |
| Option **E** | Pulse/frequency/switch output | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | | | |
| Option **F** | Double pulse output | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | | | |
| Option **H** | Relay output | $U_N$ = 30 $V_{DC}$<br>$I_N$ = 100 $mA_{DC}$/500 $mA_{AC}$<br>$U_M$ = 250 $V_{AC}$ | | | |
| Option **I** | Current input 4 to 20 mA | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | | | |
| Option **J** | Status input | $U_N$ = 30 $V_{DC}$<br>$U_M$ = 250 $V_{AC}$ | | | |

**Intrinsically safe values**

| Order code "Output; input 1" | Output type | Intrinsically safe values "Output; input 1" | |
|---|---|---|---|
| | | 26 (+) | 27 (−) |
| Option **CA** | Current output 4 to 20 mA HART Ex i passive | $U_i$ = 30 V<br>$I_i$ = 100 mA<br>$P_i$ = 1.25 W<br>$L_i$ = 0 μH<br>$C_i$ = 6 nF | |
| Option **CC** | Current output 4 to 20 mA HART Ex i active | **Ex ia** [1]<br>$U_0$ = 21.8 V<br>$I_0$ = 90 mA<br>$P_0$ = 491 mW<br>$L_0$ = 4.1 mH (IIC)/15 mH (IIB)<br>$C_0$ = 160 nF (IIC)/1 160 nF (IIB)<br><br>$U_i$ = 30 V<br>$I_i$ = 10 mA<br>$P_i$ = 0.3 W<br>$L_i$ = 5 μH<br>$C_i$ = 6 nF | **Ex ic** [2]<br>$U_0$ = 21.8 V<br>$I_0$ = 90 mA<br>$P_0$ = 491 mW<br>$L_0$ = 9 mH (IIC)/39 mH (IIB)<br>$C_0$ = 600 nF (IIC)/4 000 nF (IIB) |

| Order code "Output; input 1" | Output type | Intrinsically safe values "Output; input 1" | |
| --- | --- | --- | --- |
| | | 26 (+) | 27 (−) |
| Option **HA** | PROFIBUS PA Ex i (FISCO Field Device) | **Ex ia** [1] $U_i$ = 30 V $l_i$ = 570 mA $P_i$ = 8.5 W $L_i$ = 10 µH $C_i$ = 5 nF | **Ex ic** [2] $U_i$ = 32 V $l_i$ = 570 mA $P_i$ = 8.5 W $L_i$ = 10 µH $C_i$ = 5 nF |
| Option **TA** | FOUNDATION Fieldbus Ex i | **Ex ia** [1] $U_i$ = 30 V $l_i$ = 570 mA $P_i$ = 8.5 W $L_i$ = 10 µH $C_i$ = 5 nF | **Ex ic** [2] $U_i$ = 32 V $l_i$ = 570 mA $P_i$ = 8.5 W $L_i$ = 10 µH $C_i$ = 5 nF |
| Option **RC** | PROFINET with Ethernet-APL Ex i | **Ex ia** [1] 2-WISE power load APL port profile SLAA | **Ex ic** [2] 2-WISE power load APL port profile SLAC |

1) Only available for Proline 500 transmitter Zone 1; Class I, Division 1.
2) Only available for transmitter Zone 2; Class I, Division 2.

| Order code for "Output; input 2"; "Output; input 3" | Output type | Intrinsically safe values or NIFW values | | | |
| --- | --- | --- | --- | --- | --- |
| | | Output; input 2 | | Output; input 3 | |
| | | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| Option **C** | Current output 4 to 20 mA Ex i passive | $U_i$ = 30 V $l_i$ = 100 mA $P_i$ = 1.25 W $L_i$ = 0 $C_i$ = 0 | | | |
| Option **G** | Pulse/frequency/switch output Ex i passive | $U_i$ = 30 V $l_i$ = 100 mA $P_i$ = 1.25 W $L_i$ = 0 $C_i$ = 0 | | | |

**Low flow cut off**

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

**Galvanic isolation**

The outputs are galvanically isolated:
• from the power supply
• from one another
• from the potential equalization (PE) terminal

**Protocol-specific data**

HART

| Manufacturer ID | 0x11 |
| --- | --- |
| Device type ID | 0x3B |
| HART protocol revision | 7 |
| Device description files (DTM, DD) | Information and files under: www.endress.com |
| HART load | Min. 250 Ω |
| System integration | Information on system integration: Operating Instructions → 🖺 112. • Measured variables via HART protocol • Burst Mode functionality |

**FOUNDATION Fieldbus**

| | |
|---|---|
| **Manufacturer ID** | 0x452B48 (hex) |
| **Ident number** | 0x103B (hex) |
| **Device revision** | 1 |
| **DD revision** | Information and files under: |
| **CFF revision** | ▪ [www.endress.com](www.endress.com)<br>▪ [www.fieldcommgroup.org](www.fieldcommgroup.org) |
| **Interoperability Test Kit (ITK)** | Version 6.2.0 |
| **ITK Test Campaign Number** | Information:<br>▪ [www.endress.com](www.endress.com)<br>▪ [www.fieldcommgroup.org](www.fieldcommgroup.org) |
| **Link Master capability (LAS)** | Yes |
| **Choice of "Link Master" and "Basic Device"** | Yes<br>Factory setting: Basic Device |
| **Node address** | Factory setting: 247 (0xF7) |
| **Supported functions** | The following methods are supported:<br>▪ Restart<br>▪ ENP Restart<br>▪ Diagnostic<br>▪ Set to OOS<br>▪ Set to AUTO<br>▪ Read trend data<br>▪ Read event logbook |
| **Virtual Communication Relationships (VCRs)** | |
| **Number of VCRs** | 44 |
| **Number of link objects in VFD** | 50 |
| **Permanent entries** | 1 |
| **Client VCRs** | 0 |
| **Server VCRs** | 10 |
| **Source VCRs** | 43 |
| **Sink VCRs** | 0 |
| **Subscriber VCRs** | 43 |
| **Publisher VCRs** | 43 |
| **Device Link Capabilities** | |
| **Slot time** | 4 |
| **Min. delay between PDU** | 8 |
| **Max. response delay** | 16 |
| **System integration** | Information regarding system integration: Operating Instructions → 🕮 112.<br><br>▪ Cyclic data transmission<br>▪ Description of the modules<br>▪ Execution times<br>▪ Methods |

**PROFIBUS DP**

| | |
|---|---|
| **Manufacturer ID** | 0x11 |
| **Ident number** | 0x156F |
| **Profile version** | 3.02 |

| Device description files (GSD, DTM, DD) | Information and files under:<br>• https://www.endress.com/download<br>  On the device product page: PRODUCTS → Product Finder → Links<br>• https://www.profibus.com |
|---|---|
| Supported functions | • Identification & Maintenance<br>  Simplest device identification on the part of the control system and nameplate<br>• PROFIBUS upload/download<br>  Reading and writing parameters is up to ten times faster with PROFIBUS upload/download<br>• Condensed status<br>  Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur |
| Configuration of the device address | • DIP switches on the I/O electronics module<br>• Via operating tools (e.g. FieldCare) |
| Compatibility with earlier model | If the device is replaced, the measuring device Promass 300 supports the compatibility of the cyclic data with previous models. It is not necessary to adjust the engineering parameters of the PROFIBUS network with the Promass 300 GSD file.<br><br>Previous model:<br>Promass 83 PROFIBUS DP<br>• ID No.: 1529 (hex)<br>• Extended GSD file: EH3x1529.gsd<br>• Standard GSD file: EH3_1529.gsd<br><br>   Description of the function scope of compatibility:<br>   Operating Instructions → 🖩 112. |
| System integration | Information regarding system integration: Operating Instructions → 🖺 112.<br><br>• Cyclic data transmission<br>• Block model<br>• Description of the modules |

**PROFIBUS PA**

| Manufacturer ID | 0x11 |
|---|---|
| Ident number | 0x156D |
| Profile version | 3.02 |
| Device description files (GSD, DTM, DD) | Information and files under:<br>• https://www.endress.com/download<br>  On the device product page: PRODUCTS → Product Finder → Links<br>• https://www.profibus.com |
| Supported functions | • Identification & Maintenance<br>  Simplest device identification on the part of the control system and nameplate<br>• PROFIBUS upload/download<br>  Reading and writing parameters is up to ten times faster with PROFIBUS upload/download<br>• Condensed status<br>  Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur |
| Configuration of the device address | • DIP switches on the I/O electronics module<br>• Local display<br>• Via operating tools (e.g. FieldCare) |

| Compatibility with earlier model | If the device is replaced, the measuring device Promass 300 supports the compatibility of the cyclic data with previous models. It is not necessary to adjust the engineering parameters of the PROFIBUS network with the Promass 300 GSD file. |
|---|---|
| | Earlier models:<br>• Promass 80 PROFIBUS PA<br>  • ID No.: 1528 (hex)<br>  • Extended GSD file: EH3x1528.gsd<br>  • Standard GSD file: EH3_1528.gsd<br>• Promass 83 PROFIBUS PA<br>  • ID No.: 152A (hex)<br>  • Extended GSD file: EH3x152A.gsd<br>  • Standard GSD file: EH3_152A.gsd |
| | 📖 Description of the function scope of compatibility: Operating Instructions → 🖺 112. |
| System integration | Information regarding system integration: Operating Instructions → 🖺 112.<br><br>• Cyclic data transmission<br>• Block model<br>• Description of the modules |

**Modbus RS485**

| 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 | • ASCII<br>• RTU |
| Data access | Each device parameter can be accessed via Modbus RS485.<br><br>📖 For Modbus register information |

| Compatibility with earlier model | If the device is replaced, the measuring device Promass 300 supports the compatibility of the Modbus registers for the process variables and the diagnostic information with the previous model Promass 83. It is not necessary to change the engineering parameters in the automation system. |
|---|---|
| | Description of the function scope of compatibility: Operating Instructions → 🖹 112. |
| System integration | Information on system integration: Operating Instructions → 🖹 112. |
| | • Modbus RS485 information<br>• Function codes<br>• Register information<br>• Response time<br>• Modbus data map |

**EtherNet/IP**

| Protocol | • The CIP Networks Library Volume 1: Common Industrial Protocol<br>• The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP |
|---|---|
| Communication type | • 10Base-T<br>• 100Base-TX |
| Device profile | Generic device (product type: 0x2B) |
| Manufacturer ID | 0x000049E |
| Device type ID | 0x103B |
| Baud rates | Automatic $^{10}/_{100}$ Mbit with half-duplex and full-duplex detection |
| Polarity | Auto-polarity for automatic correction of crossed TxD and RxD pairs |
| Supported CIP connections | Max. 3 connections |
| Explicit connections | Max. 6 connections |
| I/O connections | Max. 6 connections (scanner) |
| Configuration options for measuring device | • DIP switches on the electronics module for IP addressing<br>• Manufacturer-specific software (FieldCare)<br>• Add-on Profile Level 3 for Rockwell Automation control systems<br>• Web browser<br>• Electronic Data Sheet (EDS) integrated in the measuring device |
| Configuration of the EtherNet interface | • Speed: 10 MBit, 100 MBit, auto (factory setting)<br>• Duplex: half-duplex, full-duplex, auto (factory setting) |
| Configuration of the device address | • DIP switches on the electronics module for IP addressing (last octet)<br>• DHCP<br>• Manufacturer-specific software (FieldCare)<br>• Add-on Profile Level 3 for Rockwell Automation control systems<br>• Web browser<br>• EtherNet/IP tools, e.g. RSLinx (Rockwell Automation) |
| Device Level Ring (DLR) | Yes |
| System integration | Information regarding system integration: Operating Instructions → 🖹 112.<br><br>• Cyclic data transmission<br>• Block model<br>• Input and output groups |

**PROFINET**

| Protocol | Application layer protocol for decentral device periphery and distributed automation, Version 2.3 |
|---|---|
| Communication type | 100 MBit/s |
| Conformance Class | Conformance Class B |
| Netload Class | Netload Class 2 0 Mbps |

| Baud rates | Automatic 100 Mbit/s with full-duplex detection |
|---|---|
| Cycle times | From 8 ms |
| Polarity | Auto-polarity for automatic correction of crossed TxD and RxD pairs |
| Media Redundancy Protocol (MRP) | Yes |
| System redundancy support | System redundancy S2 (2 AR with 1 NAP) |
| Device profile | Application interface identifier 0xF600<br>Generic device |
| Manufacturer ID | 0x11 |
| Device type ID | 0x843B |
| Device description files (GSD, DTM, DD) | Information and files under:<br>• www.endress.com<br>  On the product page for the device: Documents/Software → Device drivers<br>• www.profibus.com |
| Supported connections | • 2 x AR (IO Controller AR)<br>• 1 x AR (IO-Supervisor Device AR connection allowed)<br>• 1 x Input CR (Communication Relation)<br>• 1 x Output CR (Communication Relation)<br>• 1 x Alarm CR (Communication Relation) |
| Configuration options for measuring device | • DIP switches on the electronics module, for device name assignment (last part)<br>• Asset management software (FieldCare, DeviceCare, Field Xpert)<br>• Integrated Web server via Web browser and IP address<br>• Device master file (GSD), can be read out via the integrated Web server of the measuring device.<br>• Onsite operation |
| Configuration of the device name | • DIP switches on the electronics module, for device name assignment (last part)<br>• DCP protocol<br>• Asset management software (FieldCare, DeviceCare, Field Xpert)<br>• Integrated Web server |
| Supported functions | • Identification & Maintenance, simple device identifier via:<br>  • Control system<br>  • Nameplate<br>• Measured value status<br>  The process variables are communicated with a measured value status<br>• Blinking feature via the local display for simple device identification and assignment<br>• Device operation via asset management software (e.g. FieldCare, DeviceCare, SIMATIC PDM) |
| System integration | Information regarding system integration: Operating Instructions → 🕮 112.<br><br>• Cyclic data transmission<br>• Overview and description of the modules<br>• Status coding<br>• Startup configuration<br>• Factory setting |

**PROFINET with Ethernet-APL**

| Protocol | Application layer protocol for decentral device periphery and distributed automation, Version 2.4 |
|---|---|
| Communication type | Ethernet Advanced Physical Layer 10BASE-T1L |
| Conformance Class | Conformance Class B (PA) |
| Netload Class | Netload Class 2 0 Mbps |
| Baud rates | 10 Mbit/s Full-duplex |
| Cycle times | 64 ms |

| Polarity | Automatic correction of crossed "APL signal +" and "APL signal -" signal lines |
|---|---|
| Media Redundancy Protocol (MRP) | Not possible (point-to-point connection to APL field switch) |
| System redundancy support | System redundancy S2 (2 AR with 1 NAP) |
| Device profile | PROFINET PA profile 4 (Application interface identifier API: 0x9700) |
| Manufacturer ID | 0x11 |
| Device type ID | 0xA43B |
| Device description files (GSD, DTM, FDI) | Information and files under:<br>• www.endress.com/download<br>On the device product page: PRODUCTS → Product Finder → Links<br>• www.profibus.com |
| Supported connections | • 2x AR (IO Controller AR)<br>• 2x AR (IO Supervisor Device AR connection allowed) |
| Configuration options for measuring device | • DIP switches on the electronics module, for device name assignment (last part)<br>• Asset management software (FieldCare, DeviceCare, Field Xpert)<br>• Integrated Web server via Web browser and IP address<br>• Device master file (GSD), can be read out via the integrated Web server of the measuring device.<br>• Onsite operation |
| Configuration of the device name | • DIP switches on the electronics module, for device name assignment (last part)<br>• DCP protocol<br>• Asset management software (FieldCare, DeviceCare, Field Xpert)<br>• Integrated Web server |
| Supported functions | • Identification & Maintenance, simple device identifier via:<br>  • Control system<br>  • Nameplate<br>• Measured value status<br>The process variables are communicated with a measured value status<br>• Blinking feature via the local display for simple device identification and assignment<br>• Device operation via asset management software (e.g. FieldCare, DeviceCare, SIMATIC PDM with FDI package) |
| System integration | Information regarding system integration: Operating Instructions → 🗎 112.<br><br>• Cyclic data transmission<br>• Overview and description of the modules<br>• Status coding<br>• Startup configuration<br>• Factory setting |

# Power supply

**Terminal assignment**     Transmitter: supply voltage, input/outputs

*HART*

| Supply voltage | | Input/output 1 | | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | 26 (+) | 27 (−) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | | | |

*FOUNDATION Fieldbus*

| Supply voltage | | Input/output 1 | | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | 26 (A) | 27 (B) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | | | |

*PROFIBUS DP*

| Supply voltage | | Input/output 1 | | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | 26 (B) | 27 (A) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | | | |

*PROFIBUS PA*

| Supply voltage | | Input/output 1 | | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | 26 (B) | 27 (A) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | | | |

*Modbus RS485*

| Supply voltage | | Input/output 1 | | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | 26 (B) | 27 (A) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | | | |

*PROFINET*

| Supply voltage | | Input/output 1 | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | PROFINET (RJ45 connector) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | |

*PROFINET with Ethernet-APL*

| Supply voltage | | Input/output 1 | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | PROFINET (RJ45 connector) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | | The terminal assignment depends on the specific device version ordered → 🖺 13. | | | |

*EtherNet/IP*

| Supply voltage | | Input/output 1 | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|
| 1 (+) | 2 (−) | EtherNet/IP (RJ45 connector) | 24 (+) | 25 (−) | 22 (+) | 23 (−) |
| | | | The terminal assignment depends on the specific device version ordered → 🗏 13. | | | |

ℹ️ Terminal assignment of the remote display and operating module → 🗏 36.

Available device plugs

ℹ️ Device plugs may not be used in hazardous areas!

**Device plugs for fieldbus systems:**
Order code for "Input; output 1"
- Option **SA** "FOUNDATION Fieldbus" → 🗏 33
- Option **GA** "PROFIBUS PA" → 🗏 33
- Option **NA** "EtherNet/IP" → 🗏 33
- Option **RA** "PROFINET" → 🗏 34
- Option **RB** "PROFINET with Ethernet-APL" → 🗏 34

**Device plug for connecting to the service interface:**
Order code for "Accessory mounted"
Option **NB**, adapter RJ45 M12 (service interface) → 🗏 47

**Order code for "Input; output 1", option SA "FOUNDATION Fieldbus"**

| Order code for | Cable entry/connection → 🗏 35 | |
|---|---|---|
| "Electrical connection" | 2 | 3 |
| M, 3, 4, 5 | 7/8" connector | – |

**Order code for "Input; output 1", option GA "PROFIBUS PA"**

| Order code for | Cable entry/connection → 🗏 35 | |
|---|---|---|
| "Electrical connection" | 2 | 3 |
| L, N, P, U | Connector M12 × 1 | – |

**Order code for "Input; output 1", option NA "EtherNet/IP"**

| Order code for | Cable entry/connection → 🗏 35 | |
|---|---|---|
| "Electrical connection" | 2 | 3 |
| L, N, P, U | Connector M12 × 1 | – |
| R [1) 2)], S [1) 2)], T [1) 2)], V [1) 2)] | Connector M12 × 1 | Connector M12 × 1 |

1) Cannot be combined with an external WLAN antenna (order code for "Enclosed accessories", option P8) of an RJ45 M12 adapter for the service interface (order code for "Accessories mounted", option NB) or of the remote display and operating module DKX001
2) Suitable for integrating the device in a ring topology.

Order code for "Input; output 1", option RA "PROFINET"

| Order code for | Cable entry/connection → 🖹 35 | |
|---|---|---|
| "Electrical connection" | 2 | 3 |
| L, N, P, U | Connector M12 × 1 | – |
| R [1) 2)], S [1) 2)], T [1) 2)], V [1) 2)] | Connector M12 × 1 | Connector M12 × 1 |

1)   Cannot be combined with an external WLAN antenna (order code for "Enclosed accessories", option P8) of an RJ45 M12 adapter for the service interface (order code for "Accessories mounted", option NB) or of the remote display and operating module DKX001.
2)   Suitable for integrating the device in a ring topology.

Order code for "Input; output 1", option RB "PROFINET with Ethernet-APL"

| Order code | Cable entry/connection → 🖹 35 | |
|---|---|---|
| "Electrical connection" | 2 | 3 |
| L, N, P, U | M12 plug × 1 | – |

Order code for "Accessory mounted", option NB "Adapter RJ45 M12 (service interface)"

| Order code | Cable entry/coupling → 🖹 35 | |
|---|---|---|
| "Accessory mounted" | Cable entry 2 | Cable entry 3 |
| NB | Plug M12 × 1 | – |

| | | |
|---|---|---|
| **Supply voltage** | | |

| Order code for "Power supply" | Terminal voltage | | Frequency range |
|---|---|---|---|
| Option **D** | DC 24 V | ±20% | – |
| Option **E** | AC 100 to 240 V | −15 to +10% | 50/60 Hz |
| Option **I** | DC 24 V | ±20% | – |
| | AC 100 to 240 V | −15 to +10% | 50/60 Hz |

**Power consumption**

Transmitter

Max. 10 W (active power)

| switch-on current | Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21 |
|---|---|

**Current consumption**

Transmitter

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

**Power supply failure**

- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memoryor in the pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

**Overcurrent protection element**

The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own.
- The circuit breaker must be easy to reach and labeled accordingly.
- Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.

**Electrical connection**

**Transmitter connection**

ℹ️
- Terminal assignment→ 🖺 32
- Device plugs available→ 🖺 33
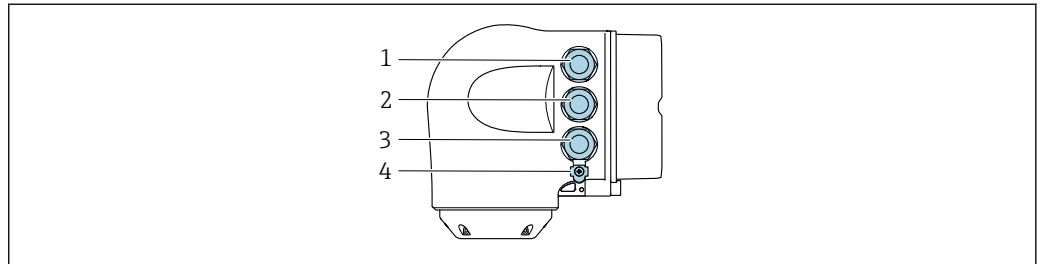


A0026781

*1 Terminal connection for supply voltage*
*2 Terminal connection for signal transmission, input/output*
*3 Terminal connection for signal transmission, input/output or terminal for network connection via service interface (CDI-RJ45); Optional: terminal connection for external WLAN antenna or connection for remote display and operating module DKX001*
*4 Terminal connection for potential equalization (PE)*

ℹ️ An adapter for the RJ45 to the M12 plug is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 plug mounted in the cable entry. The connection to the service interface can therefore be established via an M12 plug without opening the device.

ℹ️ Network connection via service interface (CDI-RJ45) → 🖺 98

*Connecting in a ring topology*

Device versions with EtherNet/IP and PROFINET communication protocols can be integrated into a ring topology. The device is integrated via the terminal connection for signal transmission (output 1) and the connection to the service interface (CDI-RJ45).

ℹ️ Integrate the transmitter into a ring topology:
- EtherNet/IP
- PROFINET
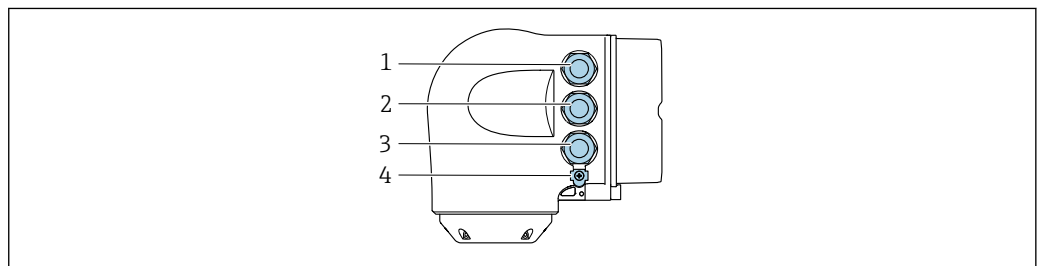


A0026781

*1 Terminal connection for supply voltage*
*2 Terminal connection for signal transmission: PROFINET or EtherNet/IP (RJ45 connector)*
*3 Terminal connection to service interface (CDI-RJ45)*
*4 Terminal connection for potential equalization (PE)*

ℹ️ If the device has additional inputs/outputs, these are routed in parallel via the cable entry for connection to the service interface (CDI-RJ45).

**Connecting the remote display and operating module DKX001**

The remote display and operating module DKX001 is available as an optional extra → 🖺 109.

- The remote display and operating module DKX001 is only available for the following housing version: order code for "Housing": option A "Aluminum, coated"
- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



A0027518

*1    Remote display and operating module DKX001*
*2    Terminal connection for potential equalization (PE)*
*3    Connecting cable*
*4    Measuring device*
*5    Terminal connection for potential equalization (PE)*

**Connection examples**

*Current output 4 to 20 mA HART*
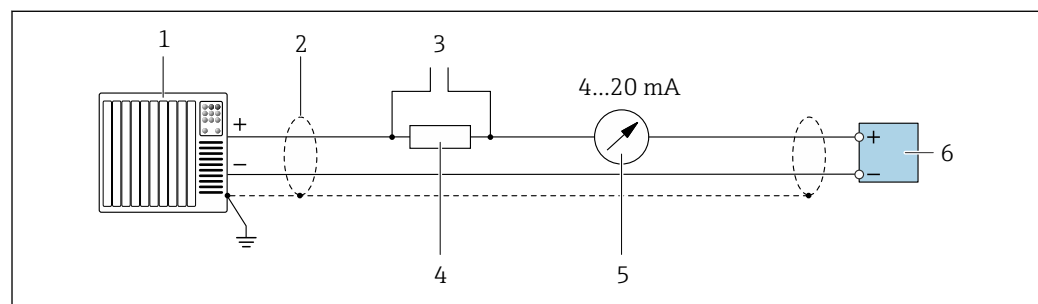


A0029055

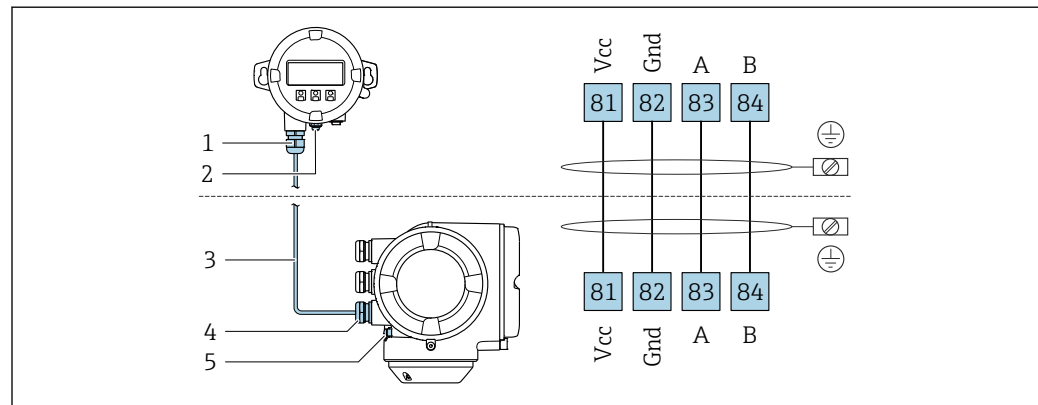🖸 *2    Connection example for 4 to 20 mA HART current output (active)*

*1    Automation system with current input (e.g. PLC)*
*2    Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 🖺 47*
*3    Connection for HART operating devices → 🖺 92*
*4    Resistor for HART communication (≥ 250 Ω): observe maximum load → 🖺 15*
*5    Analog display unit: observe maximum load → 🖺 15*
*6    Transmitter*
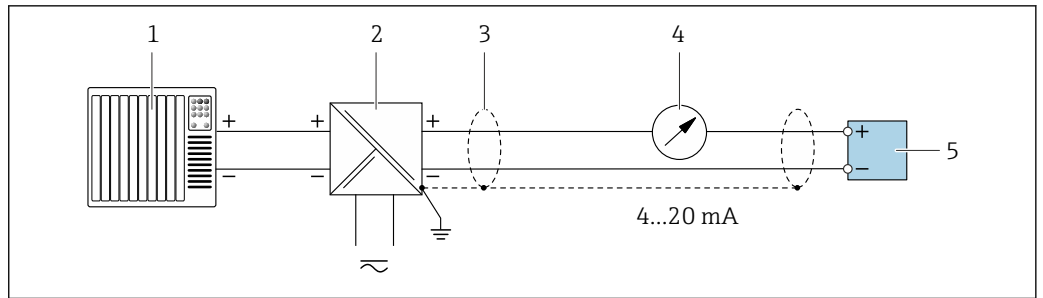
*3    Connection example for 4 to 20 mA HART current output (passive)*

*1    Automation system with current input (e.g. PLC)*
*2    Power supply*
*3    Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 🖿 47*
*4    Analog display unit: observe maximum load → 🖿 15*
*5    Transmitter*

*HART input*
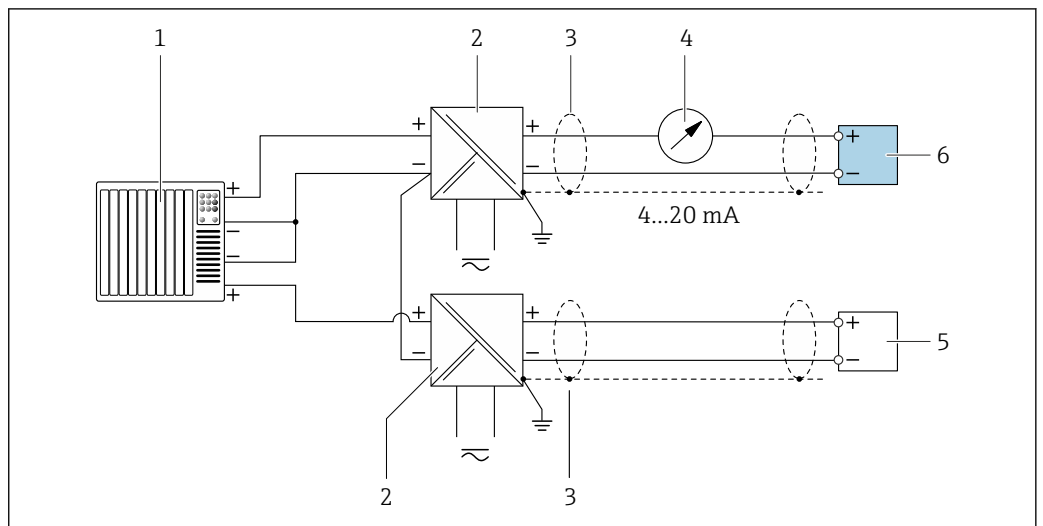


*4    Connection example for HART input with a common negative (passive)*

*1    Automation system with HART output (e.g. PLC)*
*2    Active barrier for power supply (e.g. RN221N)*
*3    Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
*4    Analog display unit: observe maximum load → 🖿 15*
*5    Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements*
*6    Transmitter*

*PROFIBUS PA*
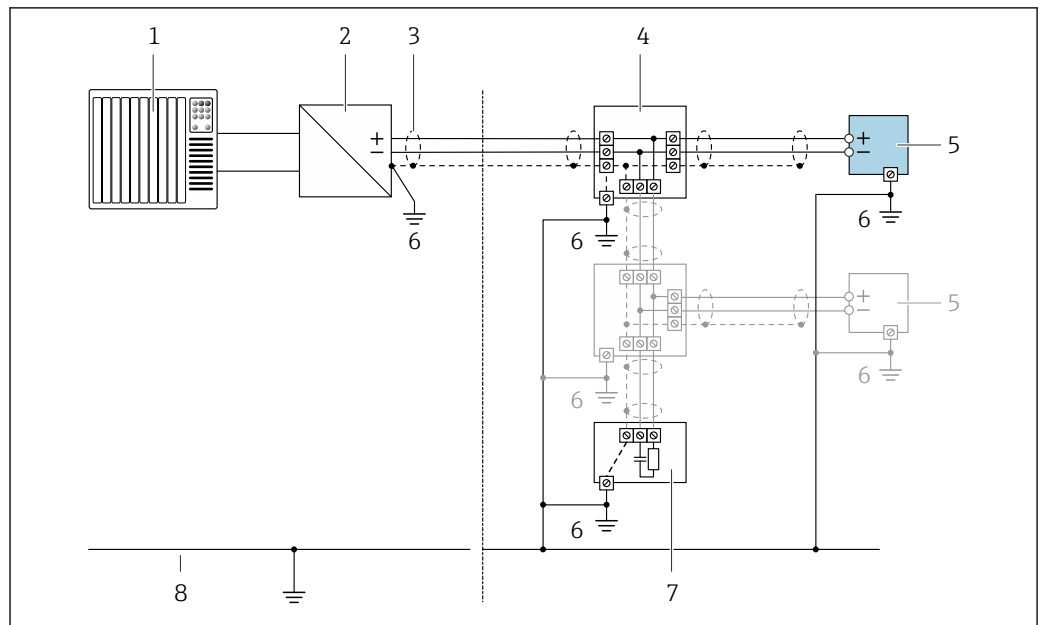


**⊠ 5**     *Connection example for PROFIBUS PA*

*1     Control system (e.g. PLC)*
*2     PROFIBUS PA segment coupler*
*3     Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC*
      *requirements; observe cable specifications*
*4     T-box*
*5     Measuring device*
*6     Local grounding*
*7     Bus terminator*
*8     Potential matching line*

*PROFIBUS DP*
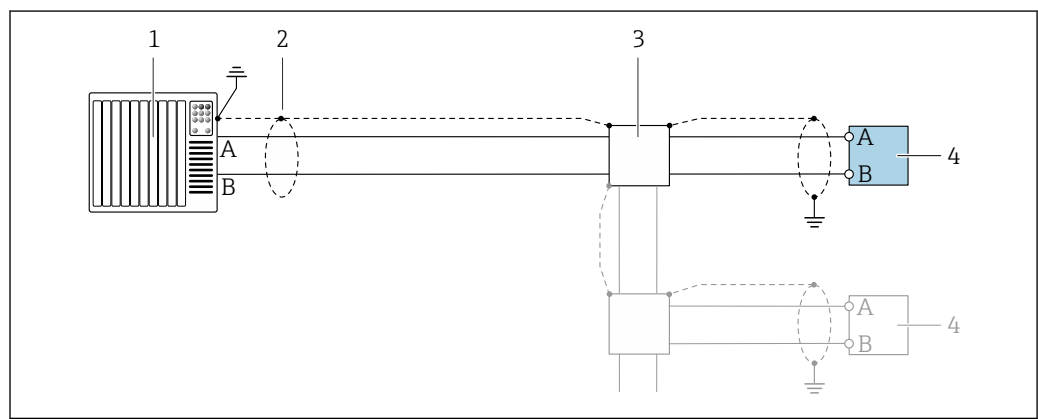


**⊠ 6**     *Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2*

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

If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

*EtherNet/IP*
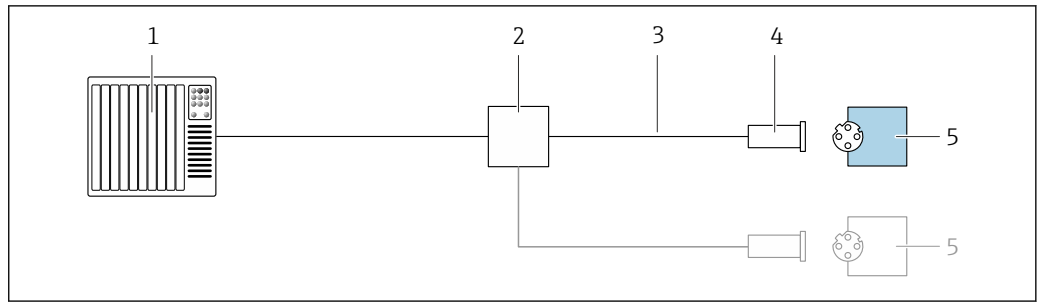


🖾 *7    Connection example for EtherNet/IP*

*1    Control system (e.g. PLC)*
*2    Ethernet switch*
*3    Observe cable specifications*
*4    Device plug*
*5    Transmitter*

*EtherNet/IP: DLR (Device Level Ring)*



*1    Control system (e.g. PLC)*
*2    Ethernet switch*
*3    Observe cable specifications → 🖹 47*
*4    Transmitter*
*5    Connecting cable between the two transmitters*

*PROFINET*



🖾 *8    Connection example for PROFINET*

*1    Control system (e.g. PLC)*
*2    Ethernet switch*
*3    Observe cable specifications*
*4    Device plug*
*5    Transmitter*

*PROFINET with Ethernet-APL*



A0047536
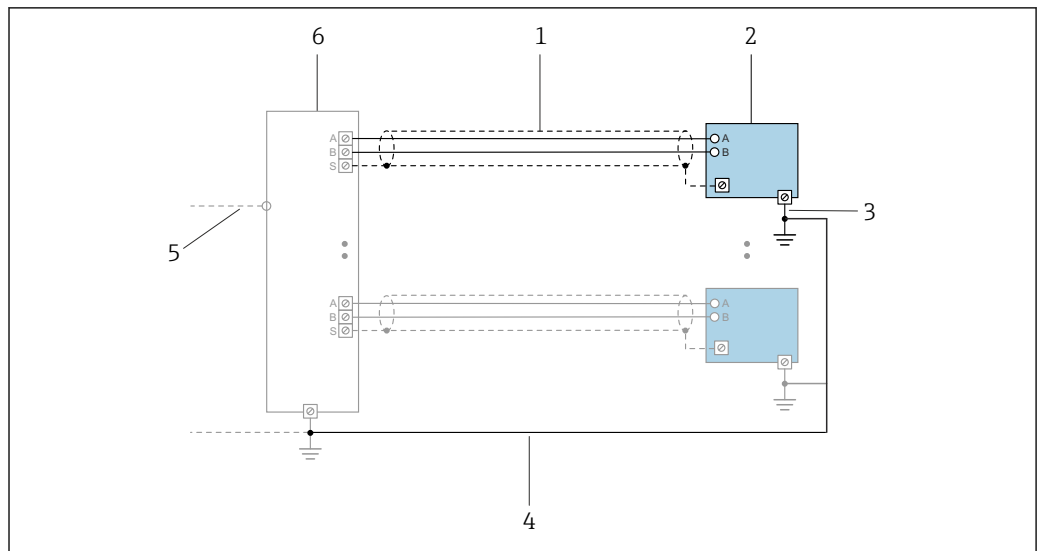
🖼 *9     Connection example for PROFINET with Ethernet-APL*

*1     Cable shield*
*2     Measuring device*
*3     Local grounding*
*4     Potential equalization*
*5     Trunk or TCP*
*6     Field switch*

*PROFINET: MRP (Media Redundancy Protocol)*
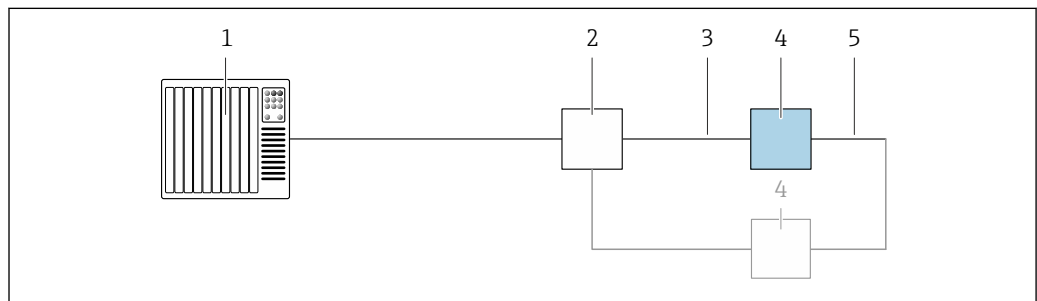


A0027544

*1     Control system (e.g. PLC)*
*2     Ethernet switch*
*3     Observe cable specifications → 🖻 47*
*4     Transmitter*
*5     Connecting cable between the two transmitters*

*PROFINET: system redundancy S2*
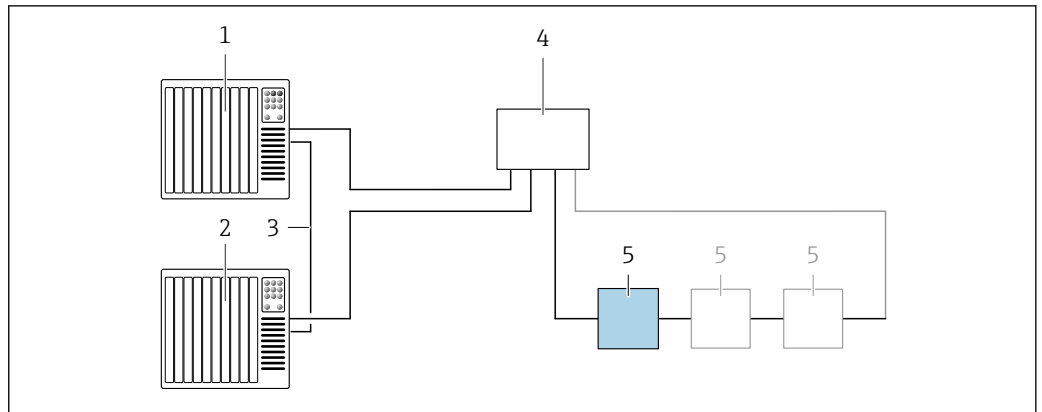


A0039553

🖼 *10    Connection example for system redundancy S2*

*1    Control system 1 (e.g. PLC)*
*2    Synchronization of control systems*
*3    Control system 2 (e.g. PLC)*
*4    Industrial Ethernet Managed Switch*
*5    Transmitter*

*FOUNDATION Fieldbus*
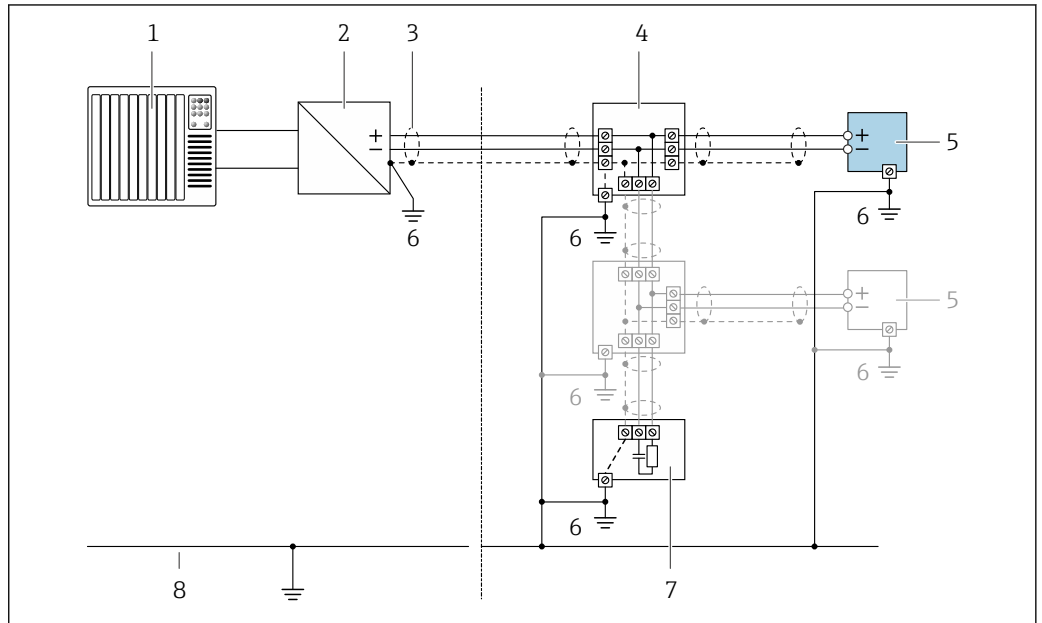


A0028768

🖼 *11    Connection example for FOUNDATION Fieldbus*

*1    Control system (e.g. PLC)*
*2    Power Conditioner (FOUNDATION Fieldbus)*
*3    Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
*4    T-box*
*5    Measuring device*
*6    Local grounding*
*7    Bus terminator*
*8    Potential matching line*

*Modbus RS485*
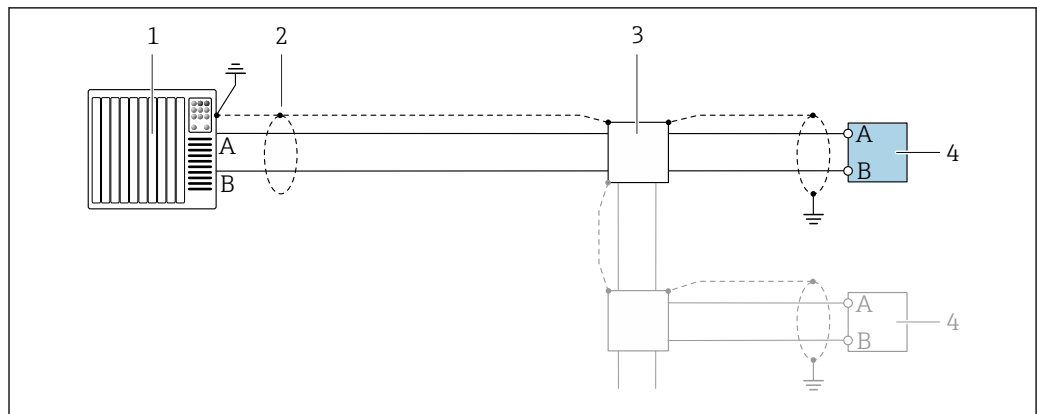


A0028765

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

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

*Current output 4-20 mA*
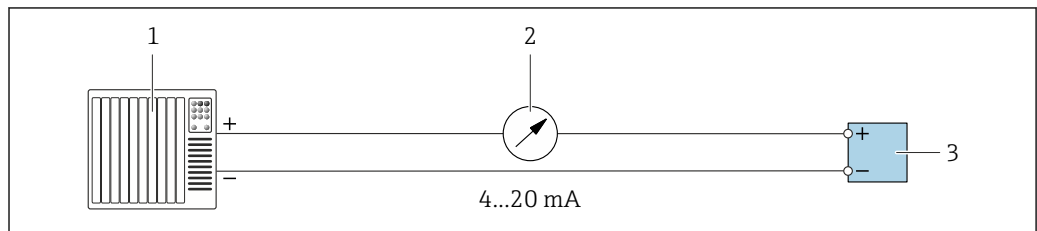


A0028758

🖾 *13   Connection example for 4-20 mA current output (active)*

*1   Automation system with current input (e.g. PLC)*
*2   Analog display unit: observe maximum load → 🖴 15*
*3   Transmitter*
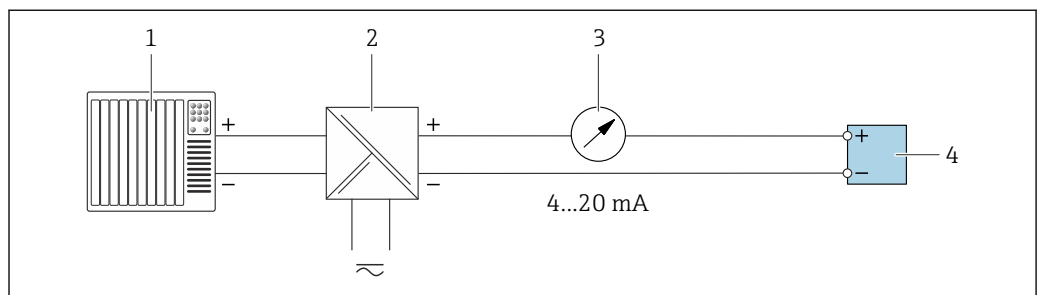


A0028759

🖾 *14   Connection example for 4-20 mA current output (passive)*

*1   Automation system with current input (e.g. PLC)*
*2   Active barrier for power supply (e.g. RN221N)*
*3   Analog display unit: observe maximum load → 🖴 15*
*4   Transmitter*

*Pulse/frequency output*
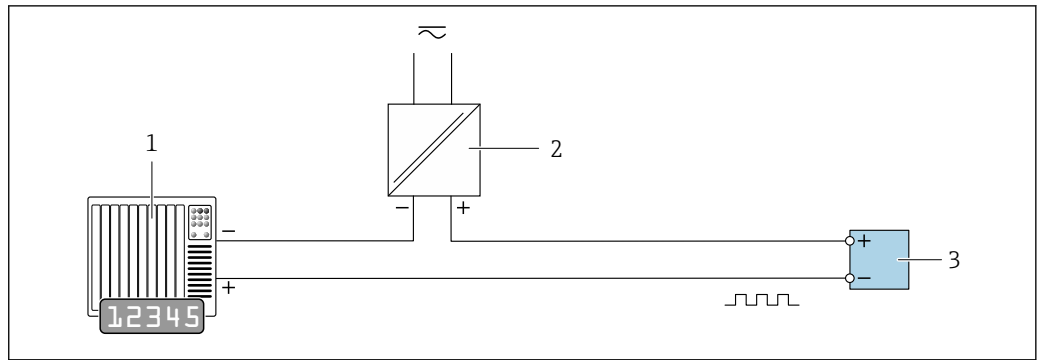


A0028761

*🖼 15   Connection example for pulse/frequency output (passive)*

*1   Automation system with pulse/frequency input (e.g. PLC with 10 kΩ pull-up or pull-down resistor)*
*2   Power supply*
*3   Transmitter: observe input values → 🕮 18*

*Switch output*
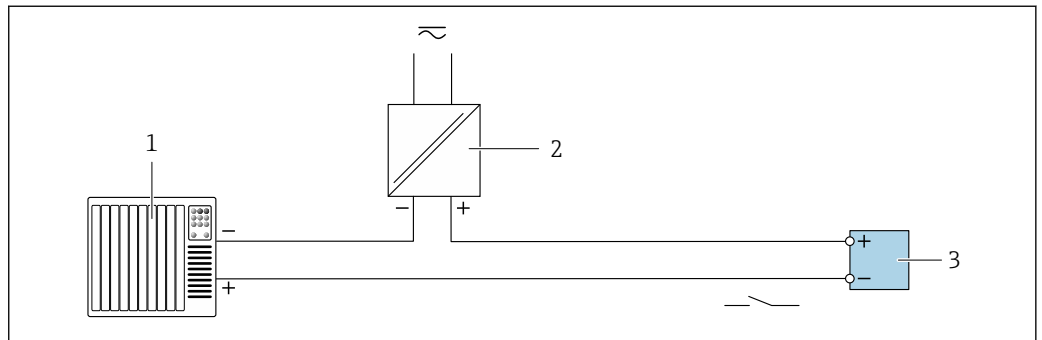


A0028760

*🖼 16   Connection example for switch output (passive)*

*1   Automation system with switch input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)*
*2   Power supply*
*3   Transmitter: observe input values → 🕮 18*

*Double pulse output*
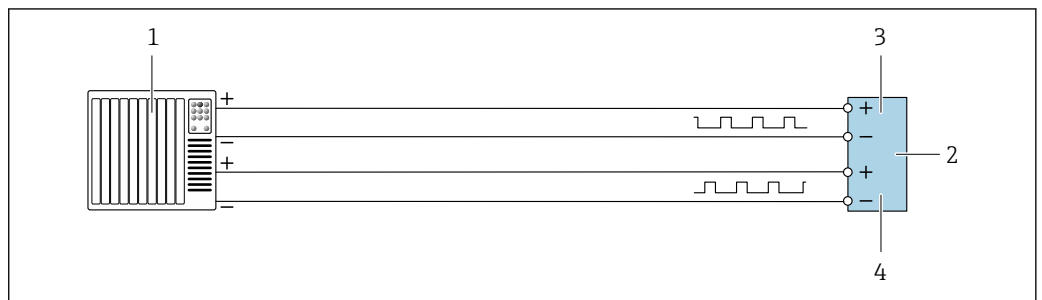


A0029280

*🖼 17   Connection example for double pulse output (active)*

*1   Automation system with double pulse input (e.g. PLC)*
*2   Transmitter: observe input values → 🕮 20*
*3   Double pulse output*
*4   Double pulse output (slave), phase-shifted*
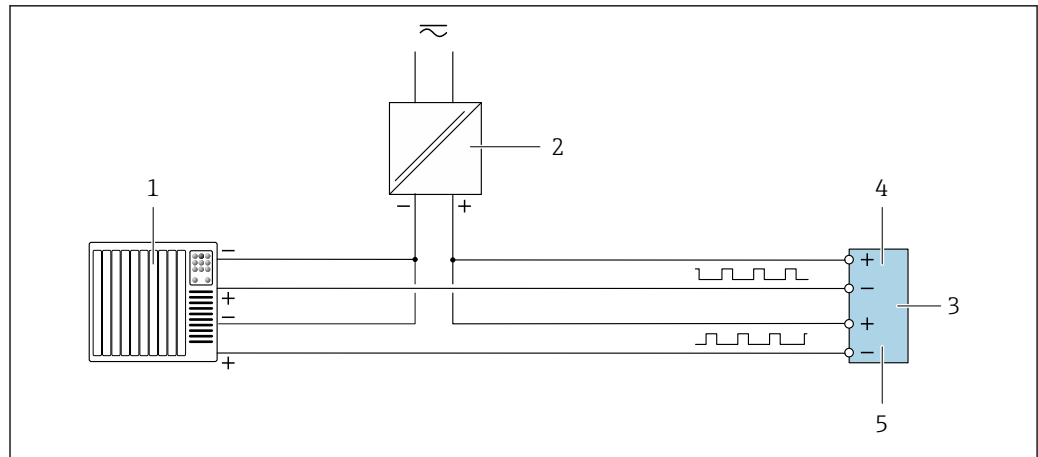
*18  Connection example for double pulse output (passive)*

*1    Automation system with double pulse input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)*
*2    Power supply*
*3    Transmitter: observe input values → 🖹 20*
*4    Double pulse output*
*5    Double pulse output (slave), phase-shifted*

*Relay output*
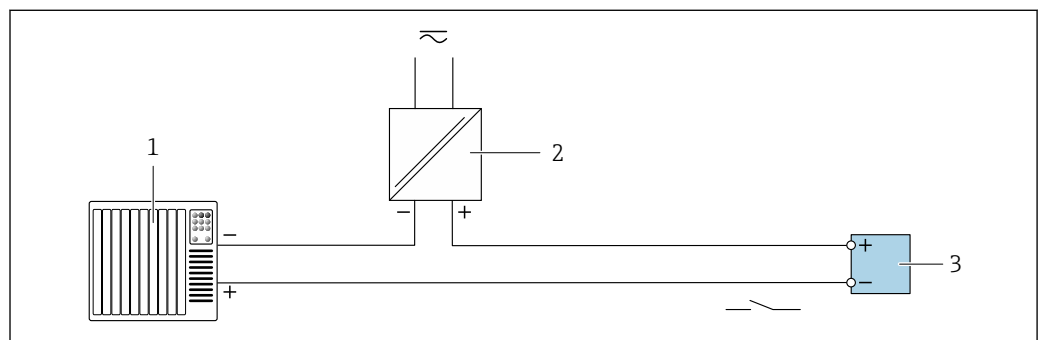


*19  Connection example for relay output (passive)*

*1    Automation system with relay input (e.g. PLC)*
*2    Power supply*
*3    Transmitter: observe input values → 🖹 20*

*Current input*
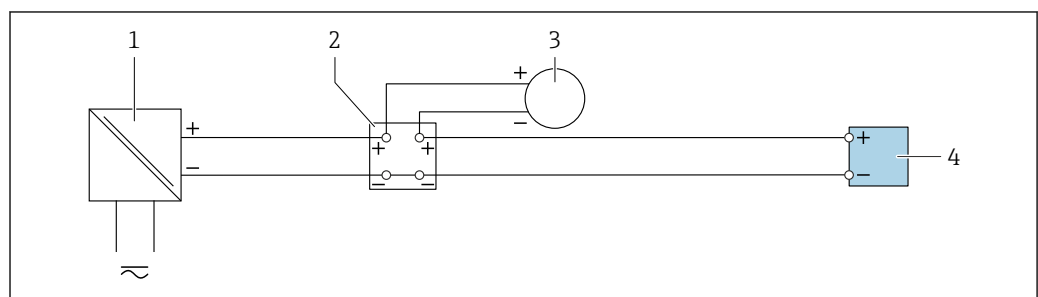


*20  Connection example for 4 to 20 mA current input*

*1    Power supply*
*2    Terminal box*
*3    External measuring device (to read in pressure or temperature, for instance)*
*4    Transmitter*

*Status input*
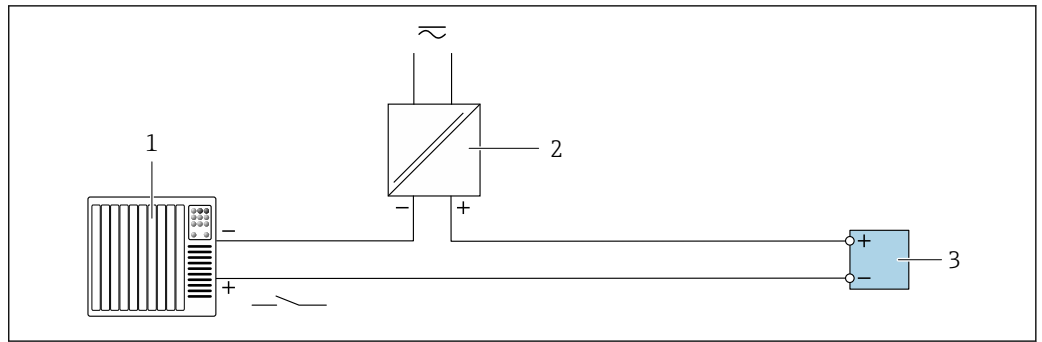


▣ *21   Connection example for status input*

*1   Automation system with status output (e.g. PLC)*
*2   Power supply*
*3   Transmitter*

| Potential equalization | **Requirements** |
|---|---|

For potential equalization:
• Pay attention to in-house grounding concepts
• Take account of operating conditions like the pipe material and grounding
• Connect the medium, sensor and transmitter to the same electrical potential
• Use a ground cable with a minimum cross-section of 6 mm² (0.0093 in²) and a cable lug for potential equalization connections

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

| Terminals | Spring-loaded terminals: Suitable for strands and strands with ferrules.<br>Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG). |
|---|---|

| Cable entries | • Cable gland: M20 × 1.5 with cable ∅ 6 to 12 mm (0.24 to 0.47 in)<br>• Thread for cable entry:<br>  • NPT ½"<br>  • G ½"<br>  • M20<br>• Device plug for digital communication: M12<br>  Only available for certain device versions → 🖹 33. |
|---|---|

**Pin assignment, device plug**   **FOUNDATION Fieldbus**
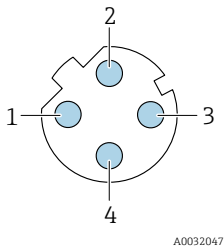
| Pin | | Assignment | Coding | Plug/socket |
|---|---|---|---|---|
| 1 | + | Signal + | A | Plug |
| 2 | - | Signal – | | |
| 3 | | Grounding | | |
| 4 | | Not assigned | | |

**PROFIBUS PA**

| Pin | | Assignment | Coding | Plug/socket |
|---|---|---|---|---|
| 1 | + | PROFIBUS PA + | A | Plug |
| 2 | | Grounding | | |
| 3 | - | PROFIBUS PA – | | |
| 4 | | Not assigned | | |
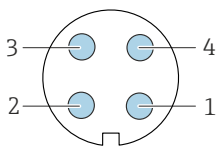
ℹ️ Recommended plug:
- Binder, series 713, part no. 99 1430 814 04
- Phoenix, part no. 1413934 SACC-FS-4QO SH PBPA SCO

**PROFINET**

| Pin | | Assignment |
|-----|---|---|
| 1 | + | TD + |
| 2 | + | RD + |
| 3 | - | TD − |
| 4 | - | RD − |
| **Coding** | | **Plug/socket** |
| D | | Socket |
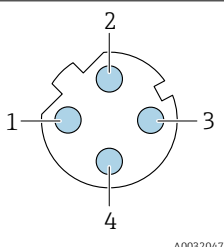
ℹ️ Recommended plug:
- Binder, series 825, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

**PROFINET with Ethernet-APL**

| Pin | | Assignment | Coding | Plug/socket |
|-----|---|---|---|---|
| 1 | - | APL signal - | A | Socket |
| 2 | + | APL signal + | | |
| 3 | | Cable shield[1] | | |
| 4 | | Not assigned | | |
| Metal plug housing | | Cable shield | | |
| [1]If a cable shield is used | | | | |

ℹ️ Recommended plug:
- Binder, series 713, part no. 99 1430 814 04
- Phoenix, part no. 1413934 SACC-FS-4QO SH PBPA SCO
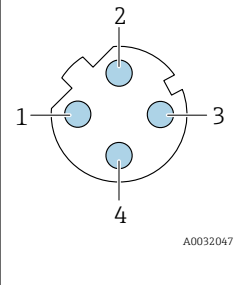
**EtherNet/IP**

| Pin | | Assignment |
|-----|---|---|
| 1 | + | Tx |
| 2 | + | Rx |
| 3 | - | Tx |
| 4 | - | Rx |
| **Coding** | | **Plug/socket** |
| D | | Socket |

ℹ️ Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

### Service interface

Order code for "Accessories mounted", option **NB**: Adapter RJ45 M12 (service interface)

| | Pin | | Assignment |
|---|---|---|---|
| | 1 | + | Tx |
| | 2 | + | Rx |
| | 3 | - | Tx |
| | 4 | - | Rx |
| | Coding | | Plug/socket |
| | D | | Socket |

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

---

**Cable specification**

### Permitted temperature range

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

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

Standard installation cable is sufficient.

### Protective grounding cable for the outer ground terminal

Conductor cross-section < 2.1 mm$^2$ (14 AWG)

The use of a cable lug enables the connection of larger cross-sections.

The grounding impedance must be less than 2 Ω.

### Signal cable

*Current output 4 to 20 mA HART*

A shielded cable is recommended. Observe grounding concept of the plant.

*PROFIBUS PA*

Twisted, shielded two-wire cable. Cable type A is recommended .

For further information on planning and installing PROFIBUS networks see:
- Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)
- PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline"
- IEC 61158-2 (MBP)

*PROFIBUS DP*

The IEC 61158 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

| Cable type | A |
|---|---|
| Characteristic impedance | 135 to 165 Ω at a measuring frequency of 3 to 20 MHz |
| Cable capacitance | < 30 pF/m |
| Wire cross-section | > 0.34 mm$^2$ (22 AWG) |
| Cable type | Twisted pairs |
| Loop resistance | ≤110 Ω/km |

| Signal damping | Max. 9 dB over the entire length of the cable cross-section |
|---|---|
| Shield | Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant. |

For further information on planning and installing PROFIBUS networks see:
- Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)
- PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline"
- IEC 61158-2 (MBP)

*EtherNet/IP*

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of ODVA Organization

*PROFINET*

Standard IEC 61156-6 specifies CAT 5 as the minimum category for a cable used for PROFINET. CAT 5e and CAT 6 are recommended.

For more information on planning and installing PROFINET networks, see: "PROFINET Cabling and Interconnection Technology", Guideline for PROFINET

*PROFINET with Ethernet-APL*

The reference cable type for APL segments is fieldbus cable type A, MAU type 1 and 3 (specified in IEC 61158-2). This cable meets the requirements for intrinsically safe applications according to IEC TS 60079-47 and can also be used in non-intrinsically safe applications.

| Cable type | A |
|---|---|
| Cable capacitance | 45 to 200 nF/km |
| Loop resistance | 15 to 150 Ω/km |
| Cable inductance | 0.4 to 1 mH/km |

Further details are provided in the Ethernet-APL Engineering Guideline (https://www.ethernet-apl.org).

*FOUNDATION Fieldbus*

Twisted, shielded two-wire cable.

For further information on planning and installing FOUNDATION Fieldbus networks see:
- Operating Instructions for "FOUNDATION Fieldbus Overview" (BA00013S)
- FOUNDATION Fieldbus Guideline
- IEC 61158-2 (MBP)

*Modbus RS485*

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

| Cable type | A |
|---|---|
| Characteristic impedance | 135 to 165 Ω at a measuring frequency of 3 to 20 MHz |
| Cable capacitance | < 30 pF/m |
| Wire cross-section | > 0.34 mm$^2$ (22 AWG) |
| Cable type | Twisted pairs |
| Loop resistance | ≤110 Ω/km |

| Signal damping | Max. 9 dB over the entire length of the cable cross-section |
|---|---|
| Shield | Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant. |

*Current output 0/4 to 20 mA*

Standard installation cable is sufficient

*Pulse /frequency /switch output*

Standard installation cable is sufficient

*Double pulse output*

Standard installation cable is sufficient

*Relay output*

Standard installation cable is sufficient.

*Current input 0/4 to 20 mA*

Standard installation cable is sufficient

*Status input*

Standard installation cable is sufficient

**Connecting cable for transmitter - remote display and operating module DKX001**

*Standard cable*

A standard cable can be used as the connecting cable.

| Standard cable | 4 cores (2 pairs); pair-stranded with common shield |
|---|---|
| Shielding | Tin-plated copper-braid, optical cover ≥ 85 % |
| Capacitance: core/shield | Maximum 1 000 nF for Zone 1; Class I, Division 1 |
| L/R | Maximum 24 µH/Ω for Zone 1; Class I, Division 1 |
| Cable length | Maximum 300 m (1 000 ft), see the following table |

| Cross-section | Cable length for use in:<br>• Non-hazardous area<br>• Hazardous area: Zone 2; Class I, Division 2<br>• Hazardous area: Zone 1; Class I, Division 1 |
|---|---|
| 0.34 mm² (22 AWG) | 80 m (270 ft) |
| 0.50 mm² (20 AWG) | 120 m (400 ft) |
| 0.75 mm² (18 AWG) | 180 m (600 ft) |
| 1.00 mm² (17 AWG) | 240 m (800 ft) |
| 1.50 mm² (15 AWG) | 300 m (1 000 ft) |

*Optionally available connecting cable*

| Standard cable | 2 × 2 × 0.34 mm² (22 AWG) PVC cable [1] with common shield (2 pairs, pair-stranded) |
|---|---|
| Flame resistance | According to DIN EN 60332-1-2 |
| Oil-resistance | According to DIN EN 60811-2-1 |
| Shielding | Tin-plated copper-braid, optical cover ≥ 85 % |
| Capacitance: core/shield | ≤200 pF/m |

| L/R | ≤24 µH/Ω |
|---|---|
| Available cable length | 10 m (35 ft) |
| Operating temperature | When mounted in a fixed position: –50 to +105 ℃ (–58 to +221 ℉); when cable can move freely: –25 to +105 ℃ (–13 to +221 ℉) |

1) UV radiation can impair the cable outer sheath. Protect the cable from direct sunshine where possible.

**Overvoltage protection**

| Mains voltage fluctuations | → 🗎 34 |
|---|---|
| Overvoltage category | Overvoltage category II |
| Short-term, temporary overvoltage | Up to 1200 V between cable and ground, for max. 5 s |
| Long-term, temporary overvoltage | Up to 500 V between cable and ground |

# Performance characteristics

**Reference operating conditions**
- Error limits based on ISO 11631
- Water with +15 to +45 ℃ (+59 to +113 ℉) at 2 to 6 bar (29 to 87 psi)
- Specifications as per calibration protocol
- Accuracy based on accredited calibration rigs that are traced to ISO 17025.

ℹ️ To obtain measured errors, use the *Applicator* sizing tool → 🗎 111

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

**Base accuracy**

ℹ️ Design fundamentals → 🗎 53

*Mass flow and volume flow (liquids)*

±0.15 % o.r.
±0.10 % o.r. (order code for "Calibration flow", option A, B, C, for mass flow)

*Mass flow (gases)*

±0.50 % o.r.

*Density (liquids)*

| Under reference conditions [g/cm³] | Standard density calibration [g/cm³] |
|---|---|
| ±0.0005 | ±0.002 |

*Temperature*

±0.5 ℃ ± 0.005 · T ℃ (±0.9 ℉ ± 0.003 · (T – 32) ℉)

**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 |

| DN | | Zero point stability | |
|---|---|---|---|
| [mm] | [in] | [kg/h] | [lb/min] |
| 50 | 2 | 7.0 | 0.257 |
| 80 | 3 | 18.0 | 0.6615 |

**Flow values**

Flow values as turndown parameters depending on the nominal diameter.

*SI units*

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

*US units*

| DN | 1:1 | 1:10 | 1:20 | 1:50 | 1:100 | 1:500 |
|---|---|---|---|---|---|---|
| [inch] | [lb/min] | [lb/min] | [lb/min] | [lb/min] | [lb/min] | [lb/min] |
| 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 | 1 654 | 165.4 | 82.70 | 33.08 | 16.54 | 3.308 |
| 2 | 2 573 | 257.3 | 128.7 | 51.46 | 25.73 | 5.146 |
| 3 | 6 615 | 661.5 | 330.8 | 132.3 | 66.15 | 13.23 |

**Accuracy of outputs**

The outputs have the following base accuracy specifications.

*Current output*

| Accuracy | ±5 µA |
|---|---|

*Pulse/frequency output*

o.r. = of reading

| Accuracy | Max. ±50 ppm o.r. (over the entire ambient temperature range) |
|---|---|

**Repeatability**

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

**Base repeatability**

Design fundamentals → 🖹 53

*Mass flow and volume flow (liquids)*

±0.075 % o.r.
±0.05 % o.r. (calibration option, for mass flow)

*Mass flow (gases)*

±0.25 % o.r. (up to a Mach number of 0.2)

*Density (liquids)*

±0.00025 g/cm³

*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**

| Temperature coefficient | No additional effect. Included in accuracy. |
|---|---|

**Influence of medium temperature**

**Mass flow and volume flow**

o.f.s. = of full scale value

If there is a difference between the temperature during zero adjustment and the process temperature, the additional measured error of the sensors is typically ±0.0002 %o.f.s./°C (±0.0001 % o.f.s./°F).

The influence is reduced when the zero adjustment is performed at process temperature.

**Density**
If there is a difference between the density calibration temperature and the process temperature, the measured error of the sensors is typically ±0.0001 g/cm³/°C (±0.00005 g/cm³/°F). Field density adjustment is possible.
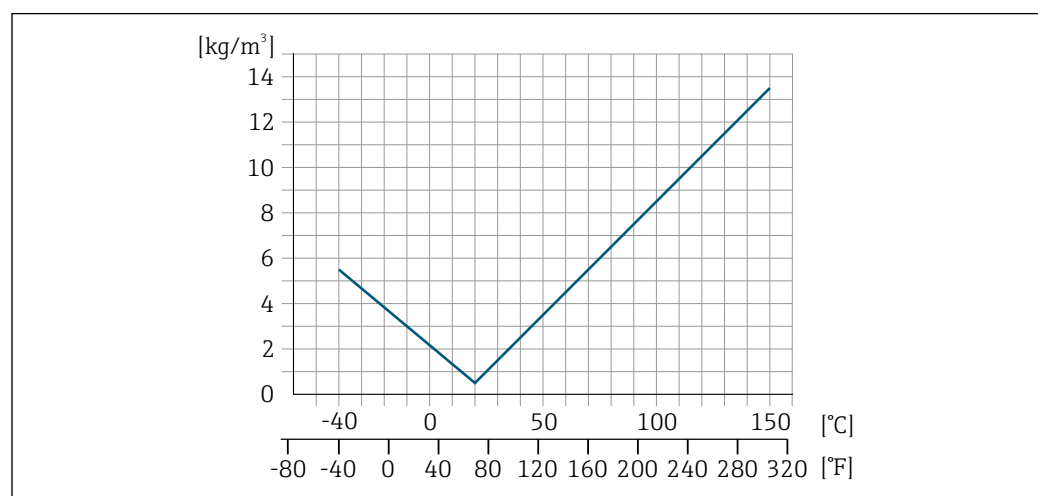


 *22   Field density adjustment, for example at +20 °C (+68 °F)*

**Temperature**
±0.005 · T °C (± 0.005 · (T − 32) °F)

| **Influence of medium pressure** | The tables below show the effect that a difference in pressure between the calibration pressure and the process pressure has on the accuracy in the case of the mass flow and density. |
|---|---|

o.r. = of reading

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

Operating Instructions → 🗎 112.

| DN | | [% o.r./bar] | [% o.r./psi] |
|---|---|---|---|
| [mm] | [in] | | |
| 8 | ⅜ | no influence | |
| 15 | ½ | no influence | |
| 25 | 1 | no influence | |
| 40 | 1½ | no influence | |
| 50 | 2 | −0.009 | −0.0006 |
| 80 | 3 | −0.020 | −0.0014 |

**Design fundamentals**

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

BaseAccu = base accuracy in % o.r., BaseRepeat = base repeatability in % o.r.

MeasValue = measured value; ZeroPoint = zero point stability

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

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

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

| Flow rate | Maximum repeatability in % o.r. |
|---|---|
| $\geq \dfrac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ | $\pm \text{BaseRepeat}$ |
| $< \dfrac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ | $\pm ½ \cdot \dfrac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ |

**Example of maximum measured error**
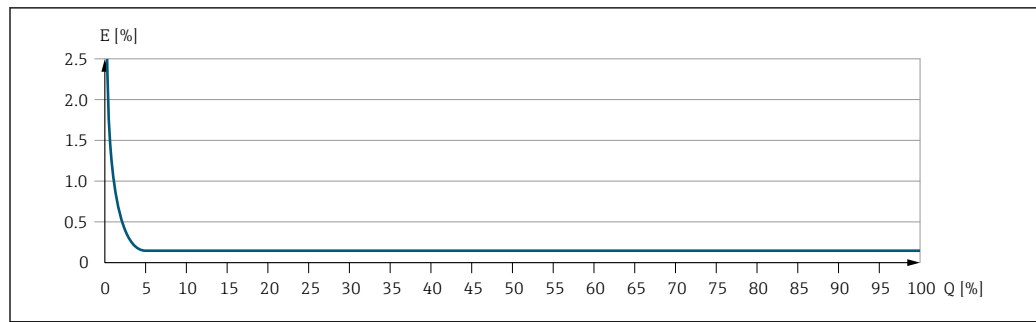


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*E*   *Maximum measured error in % o.r. (example)*
*Q*   *Flow rate in % of maximum full scale value*

# Installation

**Mounting location**
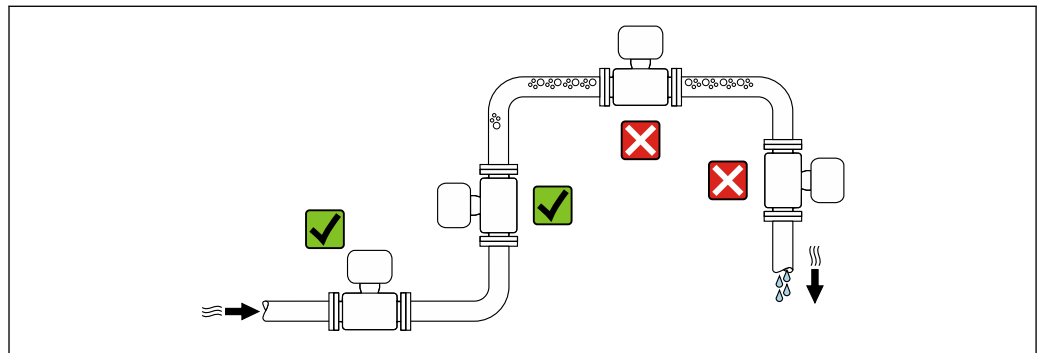


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To prevent measuring errors arising from accumulation of gas bubbles in the measuring pipe, avoid the following mounting locations in the piping:
• Highest point of a pipeline.
• Directly upstream of a free pipe outlet in a down pipe.

**Installation in down pipes**

However, the following installation suggestion allows for installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.
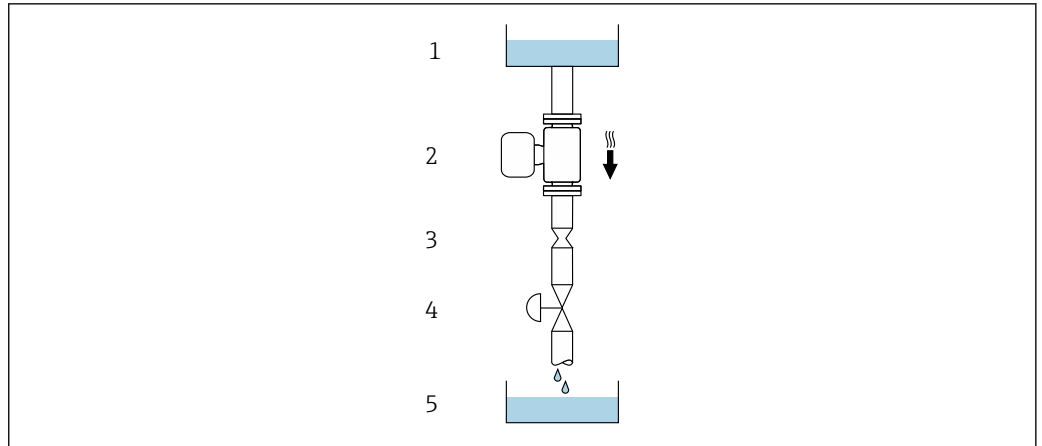
*■ 23 Installation in a down pipe (e.g. for batching applications)*

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

| DN | | Ø orifice plate, pipe restriction | |
|---|---|---|---|
| [mm] | [in] | [mm] | [in] |
| 8 | 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 |

**Orientation**

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

| | Orientation | | Recommendation |
|---|---|---|---|
| A | Vertical orientation |  | ☑☑ [1] |
| B | Horizontal orientation, transmitter at top |  | ☑☑ [2] Exception: → ■ 24, 🕮 56 |
| C | Horizontal orientation, transmitter at bottom |  | ☑☑ [3] Exception: → ■ 24, 🕮 56 |
| D | Horizontal orientation, transmitter at side |  | ☒ |

1) This orientation is recommended to ensure self-draining.
2) Applications with low process temperatures may reduce the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
3) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

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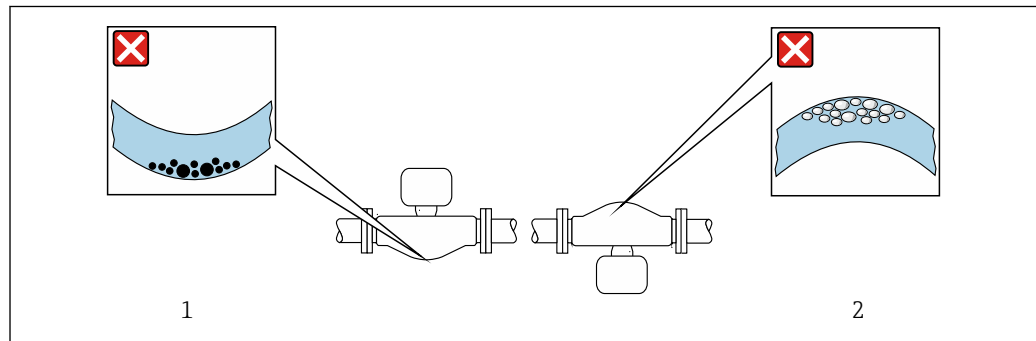


*⊠ 24    Orientation of sensor with curved measuring tube*

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

**Inlet and outlet runs**    No special precautions need to be taken for fittings which create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs → 🖹 64.

**Special mounting instructions**

**Drainability**

When installed vertically, the measuring tubes can be drained completely and protected against buildup.

**Hygienic compatibility**

> 🛈 • When installing in hygienic applications, please refer to the information in the "Certificates and approvals/hygienic compatibility" section → 🖹 105
> • In the case of measuring devices with the order code for "Housing", option B "Stainless, hygienic", to seal the connection compartment cover, screw it closed finger-tight and tighten it by another 45° (corresponds to 15 Nm).

**Rupture disk**

Process-related information: → 🖹 64.

> ⚠️ **WARNING**
> **Danger from medium escaping!**
> Medium escaping under pressure can cause injury or material damage.
> ▸ Take precautions to prevent danger to persons and damage if the rupture disk is actuated.
> ▸ Observe the information on the rupture disk sticker.
> ▸ Make sure that the function and operation of the rupture disk is not impeded through the installation of the device.
> ▸ Do not use a heating jacket.
> ▸ Do not remove or damage the rupture disk.

The position of the rupture disk is indicated on a sticker applied over it. If the rupture disk is triggered, the sticker is destroyed. The disk can therefore be visually monitored.
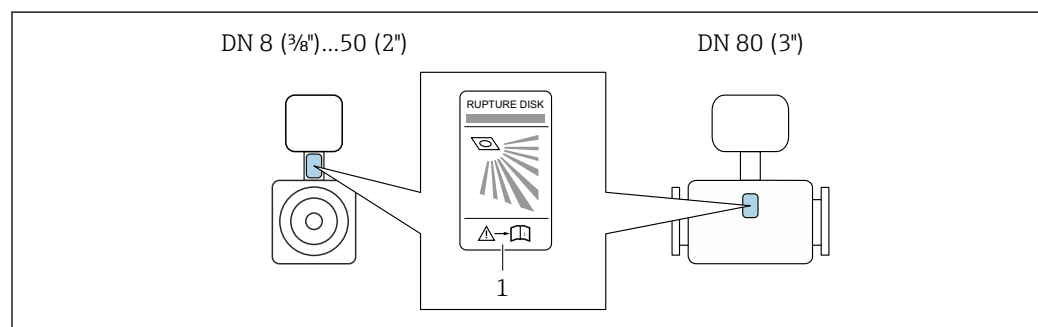


*1    Rupture disk label*

Weather protection cover
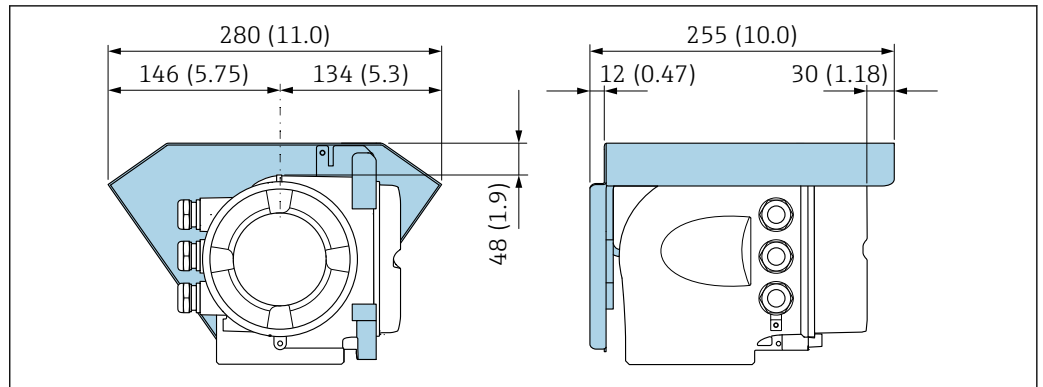


*▣ 25    Engineering unit mm (in)*

# Environment

| Ambient temperature range | Measuring device | • −40 to +60 °C (−40 to +140 °F)<br>• Order code for "Test, certificate", option JP:<br>  −50 to +60 °C (−58 to +140 °F) |
|---|---|---|
| | Readability of the 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 → 🖺 58

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

> You can order a weather protection cover from Endress+Hauser. → 🖺 109.

| Storage temperature | −50 to +80 °C (−58 to +176 °F) |
|---|---|

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

| Relative humidity | The device is suitable for use in outdoor and indoor areas with a relative humidity of 4 to 95%. |
|---|---|

| Operating height | According to EN 61010-1<br>• ≤ 2 000 m (6 562 ft)<br>• > 2 000 m (6 562 ft) with additional overvoltage protection (e.g. Endress+Hauser HAW Series) |
|---|---|

**Degree of protection**

**Transmitter**

• IP66/67, Type 4X enclosure, suitable for pollution degree 4
• When the housing is open: IP20, Type 1 enclosure, suitable for pollution degree 2
• Display module: IP20, Type 1 enclosure, suitable for pollution degree 2

**Optional**

Order code for "Sensor options", option CM "IP69

**External WLAN antenna**

IP67

| Vibration- and shock-resistance | **Vibration sinusoidal, in accordance with IEC 60068-2-6** |
|---|---|
| | • 2 to 8.4 Hz, 3.5 mm peak<br>• 8.4 to 2000 Hz, 1 g peak |
| | **Vibration broad-band random, according to IEC 60068-2-64** |
| | • 10 to 200 Hz, 0.003 $g^2$/Hz<br>• 200 to 2000 Hz, 0.001 $g^2$/Hz<br>• Total: 1.54 g rms |
| | **Shock half-sine, according to IEC 60068-2-27** |
| | 6 ms 30 g |
| | **Rough handling shocks, according to IEC 60068-2-31** |
| Interior cleaning | • Cleaning in place (CIP)<br>• Sterilization in place (SIP)<br>**Options**<br>Oil- and grease-free version for wetted parts, without declaration<br>Order code for "Service", option HA |
| Mechanical load | Transmitter housing:<br>• Protect against mechanical effects, such as shock or impact<br>• Do not use as a ladder or climbing aid |
| Electromagnetic compatibility (EMC) | • As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)<br>• Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784 |

The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud, an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Details are provided in the Declaration of Conformity.

This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

# Process

| Medium temperature range | −40 to +150 °C (−40 to +302 °F) |
|---|---|

**Dependency of ambient temperature on medium temperature**
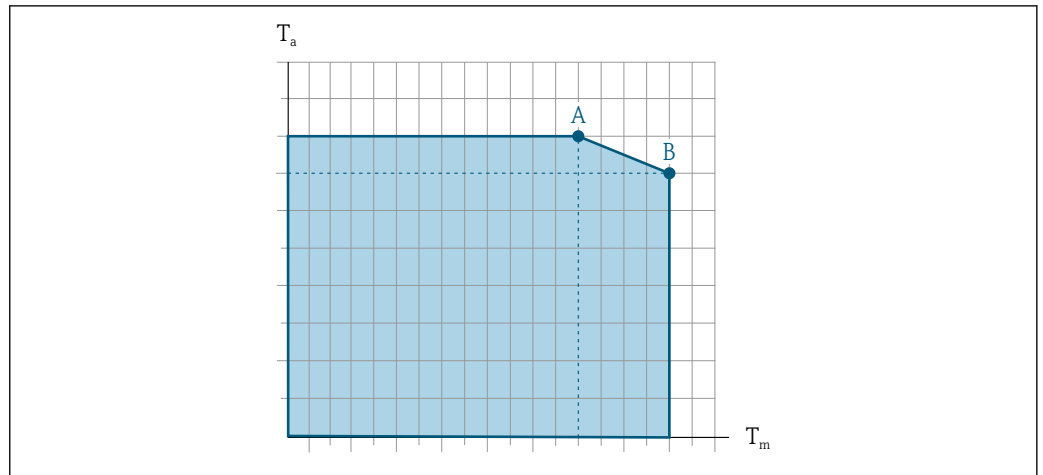


*A0031121*

⊠ *26   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 ℃ (140 ℉); 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 → 🖺 113.

| Not insulated | | | | Insulated | | | |
|---|---|---|---|---|---|---|---|
| **A** | | **B** | | **A** | | **B** | |
| $T_a$ | $T_m$ | $T_a$ | $T_m$ | $T_a$ | $T_m$ | $T_a$ | $T_m$ |
| 60 ℃ (140 ℉) | 150 ℃ (302 ℉) | – | – | 60 ℃ (140 ℉) | 110 ℃ (230 ℉) | 55 ℃ (131 ℉) | 150 ℃ (302 ℉) |

| | |
|---|---|
| **Density** | 0 to 5 000 kg/m³ (0 to 312 lb/cf) |

| | |
|---|---|
| **Pressure-temperature ratings** | The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature. |

**Flange according to EN 1092-1 (DIN 2501)**
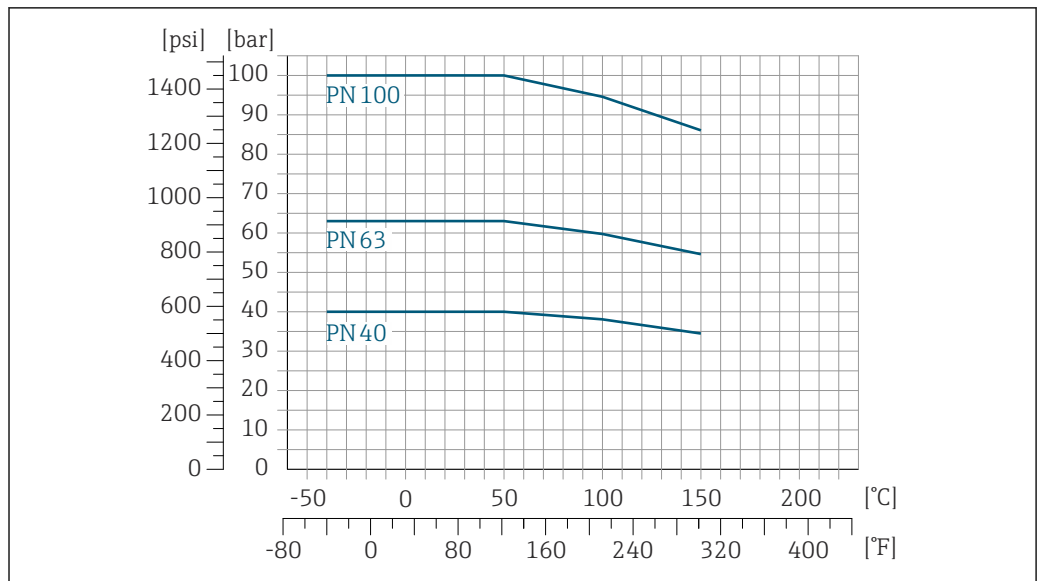


*⊠ 27    With flange material 1.4404 (F316/F316L)*

**Flange according to ASME B16.5**
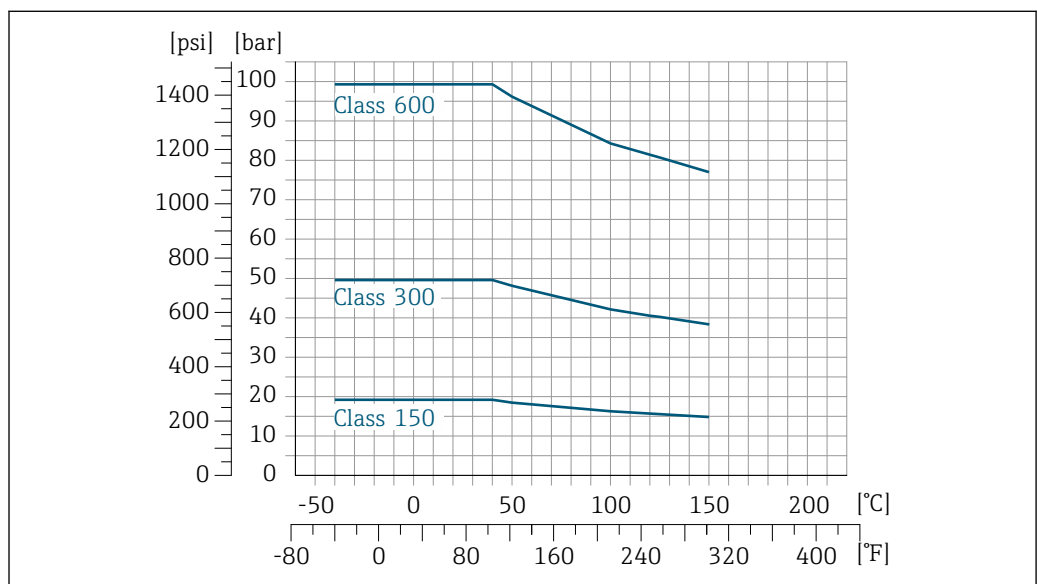


*⊠ 28    With flange material 1.4404 (F316/F316L)*

**Flange JIS B2220**
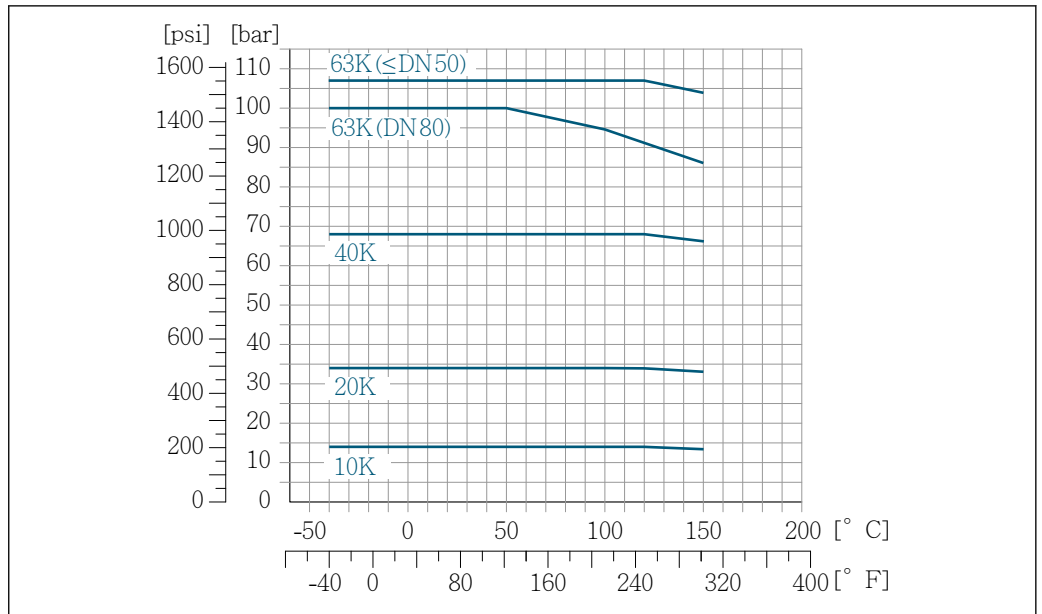


*⊞ 29   With flange material 1.4404 (F316/F316L)*

**Flange DIN 11864-2 Form A**
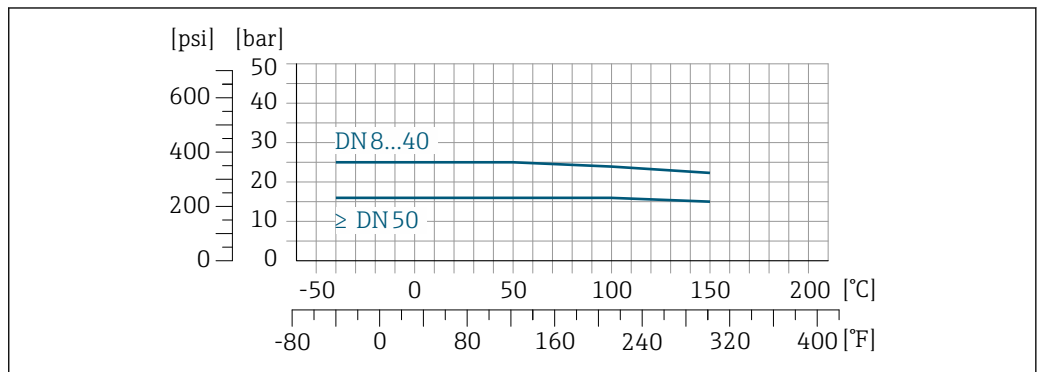


*⊞ 30   With flange material 1.4404 (316/316L)*

**Thread DIN 11851**
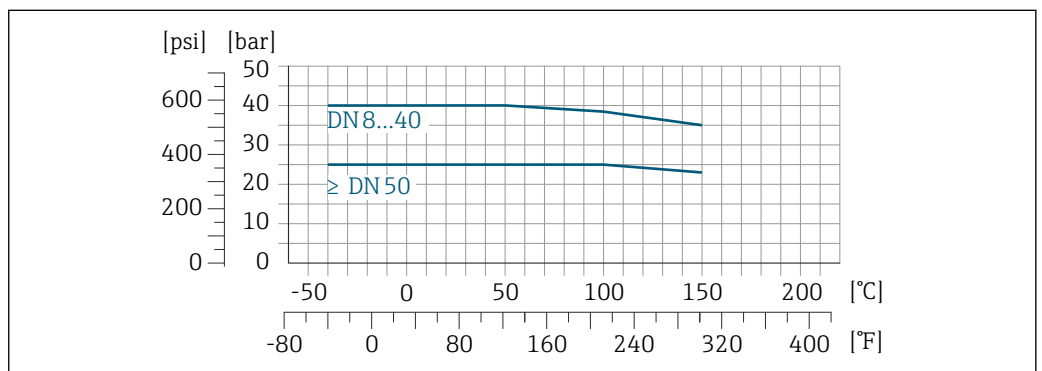


*⊞ 31   With connection material 1.4404 (316/316L)*

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 DIN 11864-1 Form A**
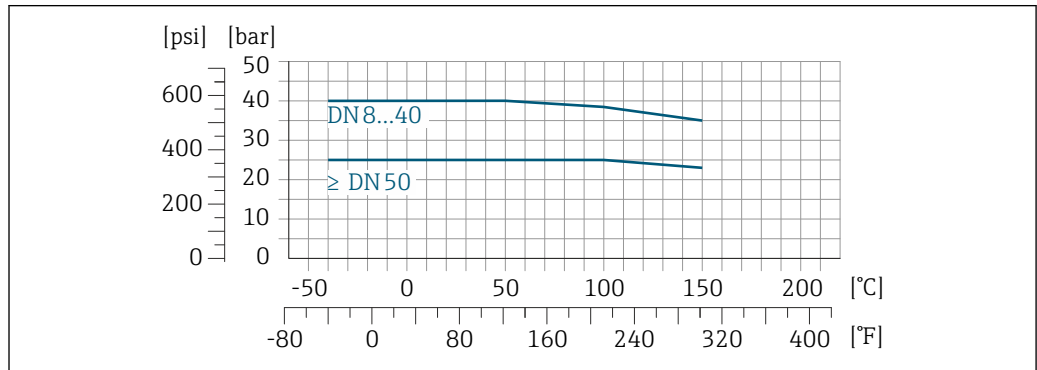


*A0029848-EN*

⊞ *32    With connection material 1.4404 (316/316L)*

**Thread ISO 2853**
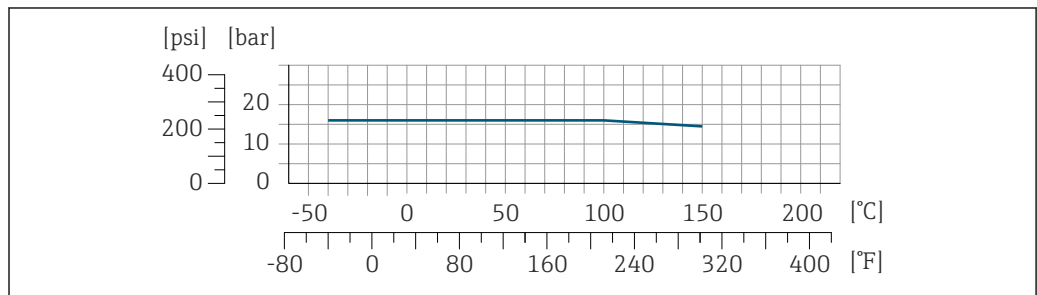


*A0029853-EN*

⊞ *33    With connection material 1.4404 (316/316L)*

**Thread SMS 1145**
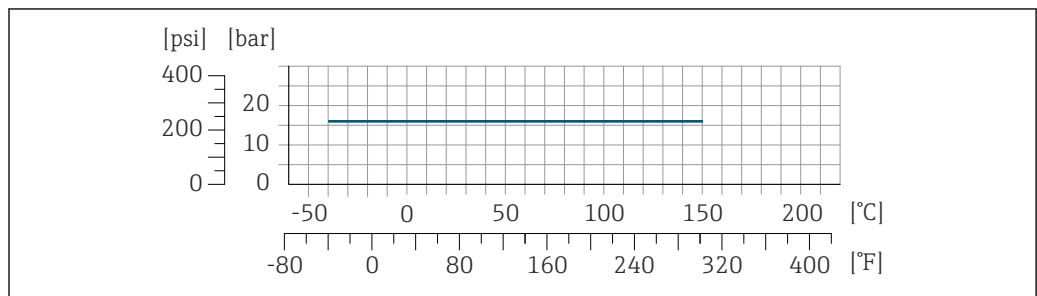


*A0032218-EN*

⊞ *34    With connection material 1.4404 (316/316L)*

**VCO**
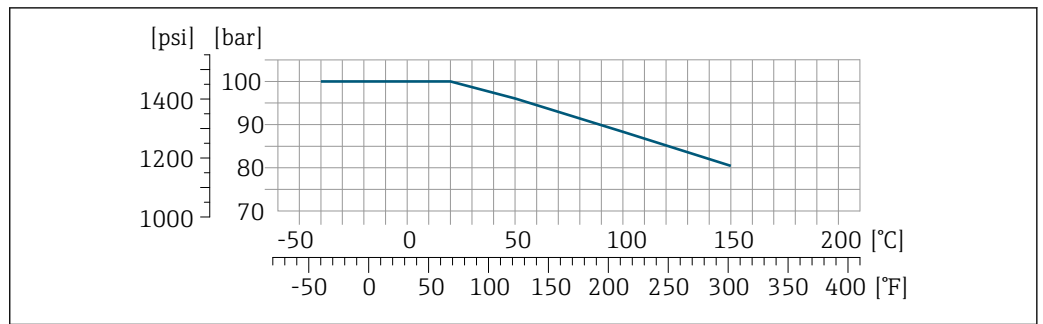


*35    With connection material 1.4404 (316/316L)*

A0029863-EN

**Tri-Clamp**
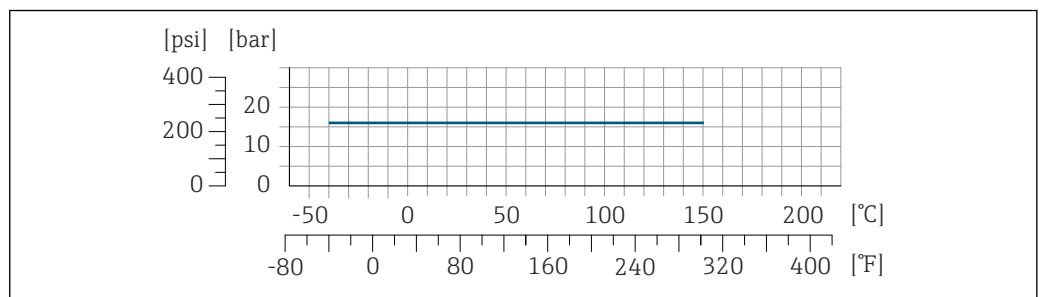


A0032218-EN

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 tube fails (e.g. due to process characteristics like corrosive or abrasive fluids), the fluid will initially be contained by the sensor housing.

In the event of a tube failure, the pressure level inside the sensor housing will rise according to the operating process pressure. If the user judges that the sensor housing burst pressure does not provide an adequate safety margin, the device can be fitted with a rupture disk. This prevents excessively high pressure from forming inside the sensor housing. Therefore, the use of a rupture disk is strongly recommended in applications involving high gas pressures, and particularly in applications in which the process pressure is greater than 2/3 of the sensor housing burst pressure.

**Burst pressure of the sensor housing**

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 |

| DN | | Sensor housing burst pressure | |
|---|---|---|---|
| [mm] | [in] | [bar] | [psi] |
| 50 | 2 | 180 | 2 610 |
| 80 | 3 | 120 | 1 740 |

For information on the dimensions: see the "Mechanical construction" section → 🖺 66

| | |
|---|---|
| Rupture disk | To increase the level of safety, a device version with a rupture disk with a trigger pressure of 10 to 15 bar (145 to 217.5 psi)can be used (order code for "Sensor option", option CA "rupture disk"). |
| | The use of rupture disks cannot be combined with the separately available heating jacket. |
| Flow limit | Select the nominal diameter by optimizing between the required flow range and permissible pressure loss. |

Flow limit

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

ℹ️ For an overview of the full scale values for the measuring range, see the "Measuring range" section → 🖺 10

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

ℹ️ To calculate the flow limit, use the *Applicator* sizing tool → 🖺 111

Pressure loss

ℹ️ To calculate the pressure loss, use the *Applicator* sizing tool → 🖺 111

System pressure

It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas. This is prevented by means of a sufficiently high system pressure.

For this reason, the following mounting locations are recommended:
- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of vacuum)
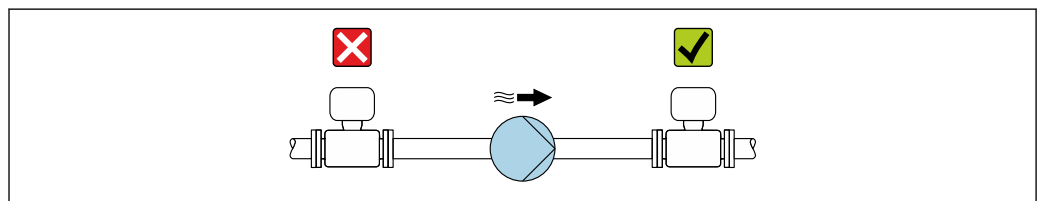


Thermal insulation

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

**NOTICE**

**Electronics overheating on account of thermal insulation!**
▶ Recommended orientation: horizontal orientation, transmitter housing pointing downwards.
▶ Do not insulate the transmitter housing .
▶ Maximum permissible temperature at the lower end of the transmitter housing: 80 ℃ (176 ℉)
▶ Thermal insulation with not isolated extended neck: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.
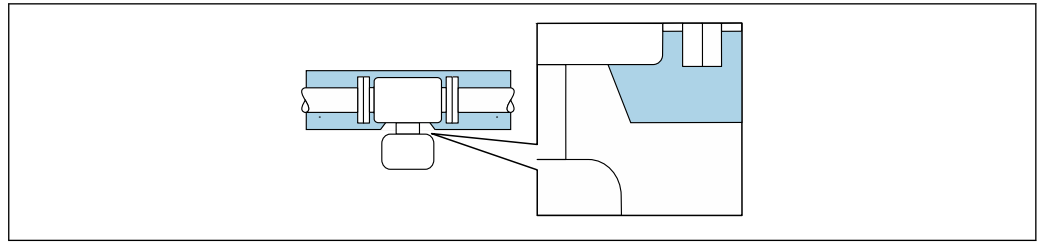
*🖾 36  Thermal insulation with not isolated extended neck*

| Heating | Some fluids require suitable measures to avoid loss of heat at the sensor. |
|---|---|

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

> Heating jackets for the sensors can be ordered as accessories from Endress+Hauser → 🖺 110.

**NOTICE**

**Danger of overheating when heating**

▸ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 ℃ (176 ℉).
▸ Ensure that sufficient convection takes place at the transmitter neck.
▸ Ensure that a sufficiently large area of the transmitter neck remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.
▸ When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation. For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

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

---

1) The use of parallel electric band heaters is generally recommended (bidirectional electricity flow). Particular considerations must be made if a single-wire heating cable is to be used. Additional information is provided in the document EA01339D "Installation instructions for electrical trace heating systems" → 🖺 114

# Mechanical construction

**Dimensions in SI units**   Compact version
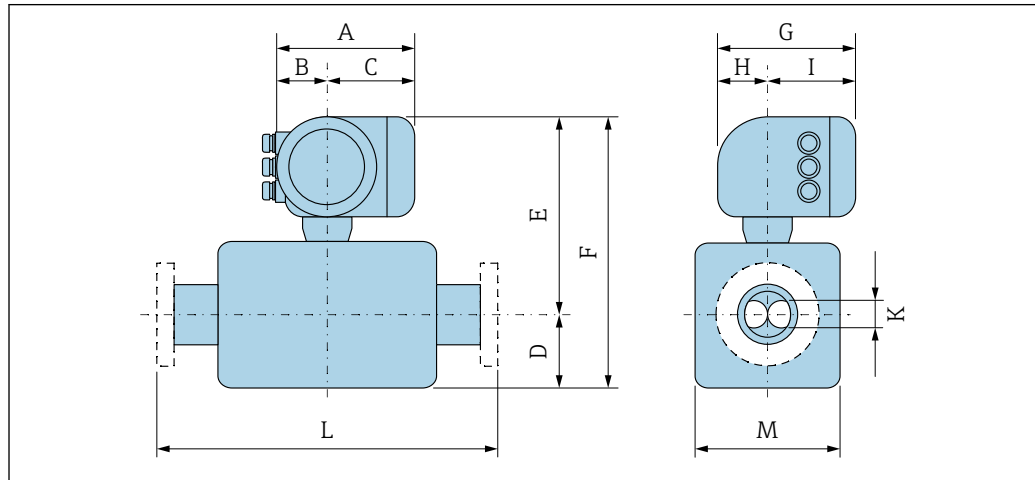


*Order code for "Housing", option A "Aluminum, coated"*

| DN | A [1] | B [1] | C | D | E | F | G [2] | H | I [2] | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] |
| 8 | 169 | 68 | 101 | 89 | 252 | 341 | 200 | 59 | 141 | 5.35 | [3] | 45 |
| 15 | 169 | 68 | 101 | 100 | 252 | 352 | 200 | 59 | 141 | 8.30 | [3] | 45 |
| 25 | 169 | 68 | 101 | 102 | 249 | 351 | 200 | 59 | 141 | 12.0 | [3] | 51 |
| 40 | 169 | 68 | 101 | 121 | 255 | 376 | 200 | 59 | 141 | 17.6 | [3] | 65 |
| 50 | 169 | 68 | 101 | 175.5 | 269.5 | 445 | 200 | 59 | 141 | 26.0 | [3] | 95 |
| 80 | 169 | 68 | 101 | 205 | 288.5 | 493.5 | 200 | 59 | 141 | 40.5 | [3] | 127 |

1) Depending on the cable gland used: values up to + 30 mm
2) For version without local display: values - 30 mm
3) Depending on the process connection

*Order code for "Housing", option A "Aluminum, coated"; Ex d*

| DN | A [1] | B [1] | C | D | E | F | G [2] | H | I [2] | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] |
| 8 | 188 | 85 | 103 | 89 | 253 | 342 | 217 | 58 | 159 | 5.35 | [3] | 45 |
| 15 | 188 | 85 | 103 | 100 | 253 | 353 | 217 | 58 | 159 | 8.30 | [3] | 45 |
| 25 | 188 | 85 | 103 | 102 | 250 | 352 | 217 | 58 | 159 | 12.0 | [3] | 51 |
| 40 | 188 | 85 | 103 | 121 | 256 | 377 | 217 | 58 | 159 | 17.6 | [3] | 65 |
| 50 | 188 | 85 | 103 | 175.5 | 270 | 445.5 | 217 | 58 | 159 | 26.0 | [3] | 95 |
| 80 | 188 | 85 | 103 | 205 | 289 | 494 | 217 | 58 | 159 | 40.5 | [3] | 127 |

1) Depending on the cable gland used: values up to + 30 mm
2) For version without local display: values - 40 mm
3) Depending on the process connection

*Order code for "Housing", option B "Stainless, hygienic"*

| DN | A [1] | B [1] | C | D | E | F | G [2] | H | I [2] | K | L | M |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [3] | [mm] |
| 8 | 183 | 73 | 110 | 89 | 252 | 341 | 200 | 65 | 135 | 5.35 | [3] | 45 |
| 15 | 183 | 73 | 110 | 100 | 252 | 352 | 200 | 65 | 135 | 8.30 | [3] | 45 |
| 25 | 183 | 73 | 110 | 102 | 249 | 351 | 200 | 65 | 135 | 12.0 | [3] | 51 |
| 40 | 183 | 73 | 110 | 121 | 255 | 376 | 200 | 65 | 135 | 17.6 | [3] | 65 |
| 50 | 183 | 73 | 110 | 175.5 | 269.5 | 445 | 200 | 65 | 135 | 26.0 | [3] | 95 |
| 80 | 183 | 73 | 110 | 205 | 288.5 | 493.5 | 200 | 65 | 135 | 40.5 | [3] | 127 |

1)   Depending on the cable gland used: values up to + 30 mm
2)   For version without local display: values - 13 mm
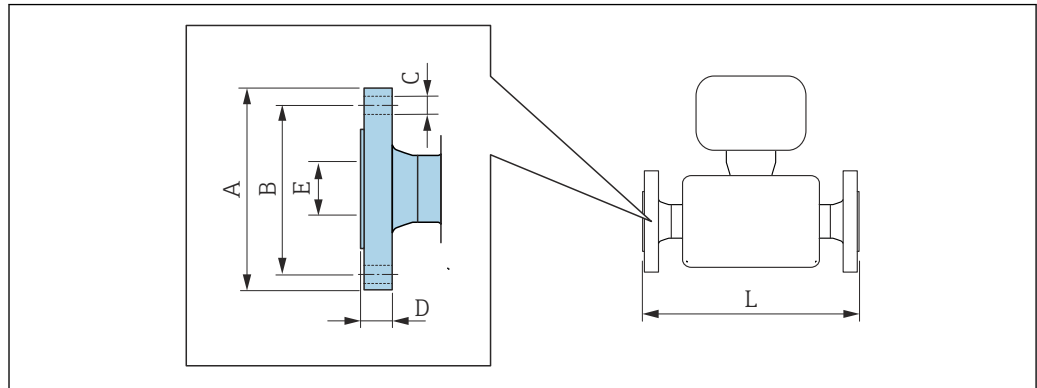3)   Depending on the process connection

**Flange connections**

*Fixed flange EN 1092-1, ASME B16.5, JIS B2220*



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

| Flange according to EN 1092-1 (DIN 2501 / DIN 2512N), PN 40 |||||||
|---|---|---|---|---|---|---|
| **1.4404 (F316/F316L)**: *order code for "Process connection", option* **D2S** |||||||
| **Flange with groove according to EN 1092-1 Form D (DIN 2512N), PN 40** |||||||
| **1.4404 (F316/F316L)**: *order code for "Process connection", option* **D6S** |||||||
| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
| 8 [1] | 95 | 65 | 4 × Ø14 | 16 | 17.3 | 232/510 [2] |
| 15 | 95 | 65 | 4 × Ø14 | 16 | 17.3 | 279/510 [2] |
| 25 | 115 | 85 | 4 × Ø14 | 18 | 28.5 | 329/600 [2] |
| 40 | 150 | 110 | 4 × Ø18 | 18 | 43.1 | 445 |
| 50 | 165 | 125 | 4 × Ø18 | 20 | 54.5 | 556/715 [2] |
| 80 | 200 | 160 | 8 × Ø18 | 24 | 82.5 | 611/915 [2] |
| Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm |||||||

1) DN 8 with DN 15 flanges as standard
2) Installed length in accordance with NAMUR recommendation NE 132 optionally available (order code for "Process connection", option D2N or D6N (with groove))

| Flange according to EN 1092-1 (DIN 2501), PN 40 (with DN 25 flanges) |||||||
|---|---|---|---|---|---|---|
| **1.4404 (F316/F316L)** |||||||
| *Order code for "Process connection", option* **R2S** |||||||
| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
| 8 | 115 | 85 | 4 × Ø14 | 18 | 28.5 | 329 |
| 15 | 115 | 85 | 4 × Ø14 | 18 | 28.5 | 329 |
| Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm |||||||

**Flange according to EN 1092-1 (DIN 2501 / DIN 2512N), PN 63**
**1.4404 (F316/F316L)**: *order code for "Process connection", option* **D3S**

**Flange with groove according to EN 1092-1 Form D (DIN 2512N), PN 63**
**1.4404 (F316/F316L)**: *order code for "Process connection", option* **D7S**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 50 | 180 | 135 | 4 × Ø22 | 26 | 54.5 | 565 |
| 80 | 215 | 170 | 8 × Ø22 | 28 | 81.7 | 646 |

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

**Flange according to EN 1092-1 (DIN 2501 / DIN 2512N), PN 100**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **D4S**

**Flange with groove according to EN 1092-1 Form D (DIN 2512N) available, PN 100**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **D8S**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 105 | 75 | 4 × Ø14 | 20 | 17.3 | 261 |
| 15 | 105 | 75 | 4 × Ø14 | 20 | 17.3 | 295 |
| 25 | 140 | 100 | 4 × Ø18 | 24 | 28.5 | 360 |
| 40 | 170 | 125 | 4 × Ø22 | 26 | 42.5 | 486 |
| 50 | 195 | 145 | 4 × Ø26 | 28 | 53.9 | 581 |
| 80 | 230 | 180 | 8 × Ø26 | 32 | 80.9 | 656 |

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

1)    DN 8 with DN 15 flanges as standard

**Flange according to ASME B16.5, Class 150**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **AAS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 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 |

Surface roughness (flange): Ra 3.2 to 6.3 µm

1)    DN 8 with DN 15 flanges as standard

**Flange according to ASME B16.5, Class 300**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **ABS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 95 | 66.7 | 4 × Ø15.7 | 14.2 | 15.7 | 232 |
| 15 | 95 | 66.7 | 4 × Ø15.7 | 14.2 | 15.7 | 279 |

**Flange according to ASME B16.5, Class 300**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **ABS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 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 |
| Surface roughness (flange): Ra 3.2 to 6.3 µm | | | | | | |

1)   DN 8 with DN 15 flanges as standard

**Flange according to ASME B16.5, Class 600**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **ACS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 95 | 66.7 | 4 × Ø15.7 | 20.6 | 13.9 | 261 |
| 15 | 95 | 66.7 | 4 × Ø15.7 | 20.6 | 13.9 | 295 |
| 25 | 125 | 88.9 | 4 × Ø19.1 | 23.9 | 24.3 | 380 |
| 40 | 155 | 114.3 | 4 × Ø22.4 | 28.7 | 38.1 | 496 |
| 50 | 165 | 127 | 8 × Ø19.1 | 31.8 | 49.2 | 583 |
| 80 | 210 | 168.3 | 8 × Ø22.4 | 38.2 | 73.7 | 671 |
| Surface roughness (flange): Ra 3.2 to 6.3 µm | | | | | | |

1)   DN 8 with DN 15 flanges as standard

**Flange JIS B2220, 10K**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **NDS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 50 | 155 | 120 | 4 × Ø19 | 16 | 50 | 556 |
| 80 | 185 | 150 | 8 × Ø19 | 18 | 80 | 603 |
| Surface roughness (flange): Ra 3.2 to 6.3 µm | | | | | | |

**Flange JIS B2220, 20K**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **NES**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 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 |

**Flange JIS B2220, 20K**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **NES**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 80 | 200 | 160 | 8 × Ø23 | 22 | 80 | 603 |
| Surface roughness (flange): Ra 3.2 to 6.3 µm | | | | | | |

1)      DN 8 with DN 15 flanges as standard

**Flange JIS B2220, 40K**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **NGS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 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 |
| Surface roughness (flange): Ra 3.2 to 6.3 µm | | | | | | |

1)      DN 8 with DN 15 flanges as standard

**Flange JIS B2220, 63K**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **NHS**

| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
|---|---|---|---|---|---|---|
| 8 [1] | 120 | 85 | 4 × Ø19 | 23 | 12 | 282 |
| 15 | 120 | 85 | 4 × Ø19 | 23 | 12 | 315 |
| 25 | 140 | 100 | 4 × Ø23 | 27 | 22 | 383 |
| 40 | 175 | 130 | 4 × Ø25 | 32 | 35 | 515 |
| 50 | 185 | 145 | 4 × Ø23 | 34 | 48 | 616 |
| 80 | 230 | 185 | 4 × Ø25 | 40 | 73 | 686 |
| Surface roughness (flange): Ra 3.2 to 6.3 µm | | | | | | |

1)      DN 8 with DN 15 flanges as standard

*Fixed flange DIN 11864-2*
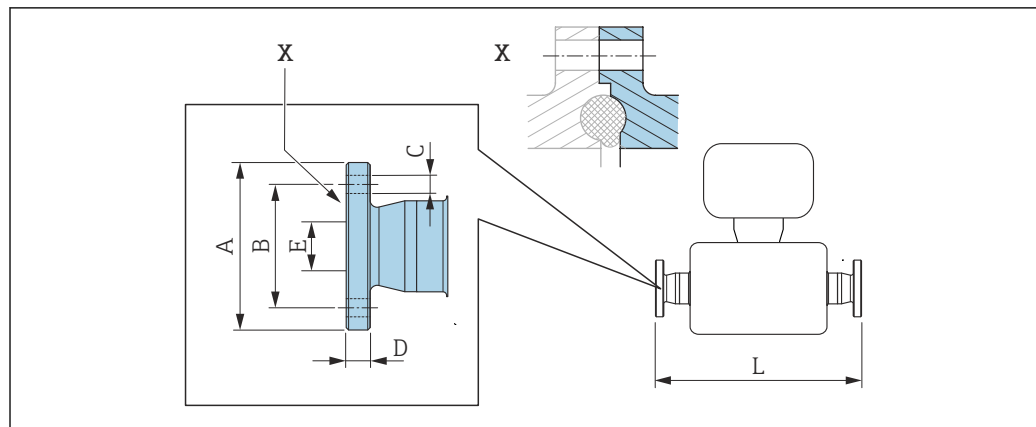


⊞ *37   Detail X: Asymmetrical process connection; the part shown in blue is provided by the supplier.*

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

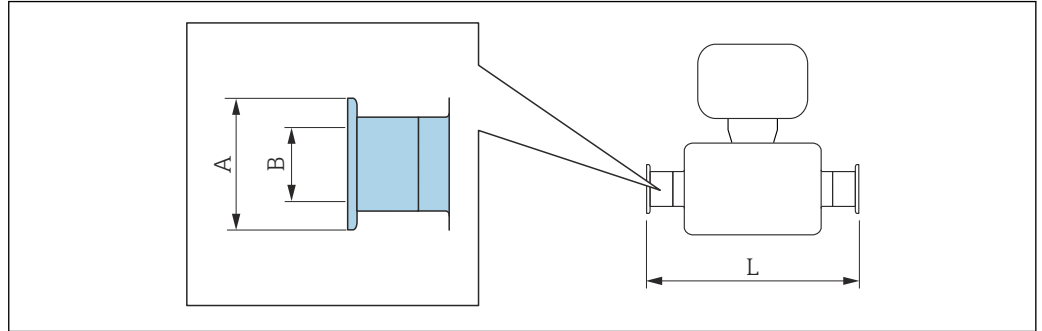| Flange DIN11864-2 Form A, for pipe according to DIN11866 series A, flange with notch 1.4404 (316/316L) *Order code for "Process connection", option* **KCS** | | | | | | |
|---|---|---|---|---|---|---|
| DN [mm] | A [mm] | B [mm] | C [mm] | D [mm] | E [mm] | L [mm] |
| 8 [1] | 54 | 37 | 4 × Ø9 | 10 | 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 |
| 3-A version available: order code for "Additional approval", option LP in conjunction with $Ra_{max}$ = 0.76 µm: order code for "Measuring tube material", option SB $Ra_{max}$ = 0.38 µm: order code for "Measuring tube material", option SC | | | | | | |

1)   DN 8 with DN 10 flanges as standard

**Clamp connections**

*Tri-Clamp*



A0015625

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

**Tri-Clamp (½"), for pipe according to DIN 11866 series C**
**1.4404 (316/316L)**
*Order code for "Process connection", option* **FDW**

| DN [mm] | Clamp [in] | A [mm] | B [mm] | L [mm] |
|---|---|---|---|---|
| 8 | ½ | 25.0 | 9.5 | 229 |
| 15 | ½ | 25.0 | 9.5 | 273 |

3-A version available: order code for "Additional approval", option LP in conjunction with
$Ra_{max}$ = 0.76 µm: order code for "Measuring tube material", option SB
$Ra_{max}$ = 0.38 µm: order code for "Measuring tube material", option SC

**Tri-Clamp (≥ 1"), for pipe according to DIN 11866 series C**
**1.4404 (316/316L)**
*Order code for "Process connection", option* **FTS**

| DN [mm] | Clamp [in] | 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 |

3-A version available: order code for "Additional approval", option LP in conjunction with
$Ra_{max}$ = 0.76 µm: order code for "Measuring tube material", option SB
$Ra_{max}$ = 0.38 µm: order code for "Measuring tube material", option SC

**Threaded couplings**

*Thread DIN 11851, DIN11864-1, SMS 1145*
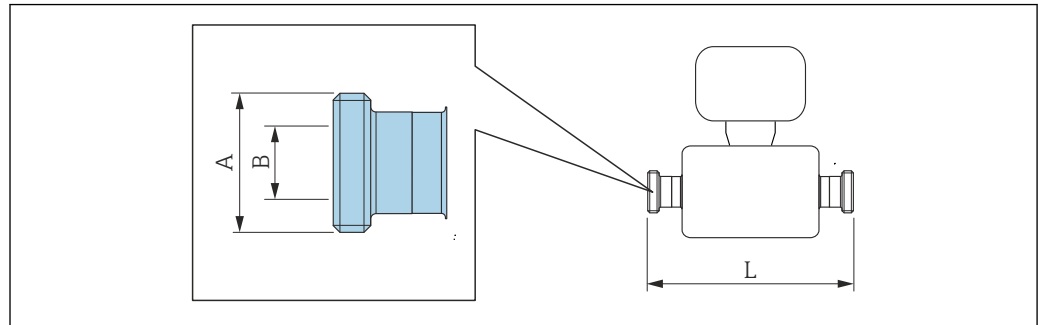


A0015628

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

**Thread DIN 11851, for pipe according to DIN11866, series A**
**1.4404 (316/316L)**
*Order code for "Process connection", option* **FMW**

| DN<br>[mm] | A<br>[in] | B<br>[mm] | L<br>[mm] |
|---|---|---|---|
| 8 | Rd 34 × $\frac{1}{8}$ | 16 | 229 |
| 15 | Rd 34 × $\frac{1}{8}$ | 16 | 273 |
| 25 | Rd 52 × $\frac{1}{6}$ | 26 | 324 |
| 40 | Rd 65 × $\frac{1}{6}$ | 38 | 456 |
| 50 | Rd 78 × $\frac{1}{6}$ | 50 | 562 |
| 80 | Rd 110 × $\frac{1}{4}$ | 81 | 671 |

3-A version available: order code for "Additional approval", option LP in conjunction with
$Ra_{max}$ = 0.76 µm: order code for "Measuring tube material", option SB
$Ra_{max}$ = 0.38 µm: order code for "Measuring tube material", option SC

**Thread DIN11864-1 Form A, for pipe according to DIN11866, series A**
**1.4404 (316/316L)**
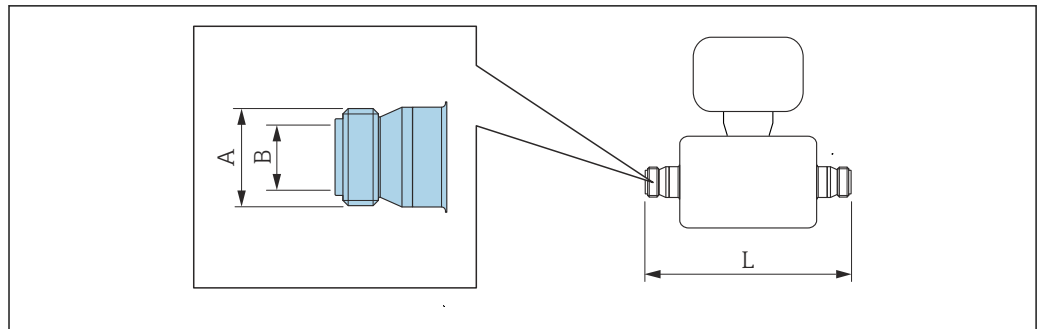*Order code for "Process connection", option* **FLW**

| DN<br>[mm] | A<br>[in] | B<br>[mm] | L<br>[mm] |
|---|---|---|---|
| 8 | Rd 28 × $\frac{1}{8}$ | 10 | 229 |
| 15 | Rd 34 × $\frac{1}{8}$ | 16 | 273 |
| 25 | Rd 52 × $\frac{1}{6}$ | 26 | 324 |
| 40 | Rd 65 × $\frac{1}{6}$ | 38 | 456 |
| 50 | Rd 78 × $\frac{1}{6}$ | 50 | 562 |
| 80 | Rd 110 × $\frac{1}{4}$ | 81 | 671 |

3-A version available: order code for "Additional approval", option LP in conjunction with
$Ra_{max}$ = 0.76 µm: order code for "Measuring tube material", option SB
$Ra_{max}$ = 0.38 µm: order code for "Measuring tube material", option SC

**Thread SMS 1145**
**1.4404 (316/316L)**
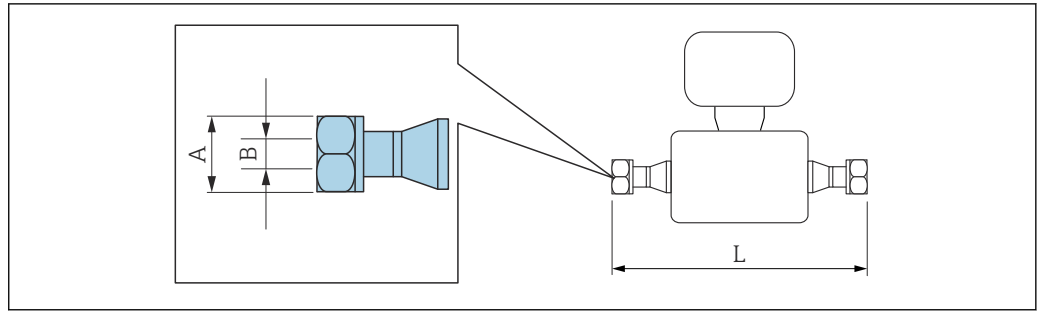*Order code for "Process connection", option* **SCS**

| DN<br>[mm] | A<br>[in] | B<br>[mm] | L<br>[mm] |
|:---:|:---:|:---:|:---:|
| 8 | Rd 40 × $\frac{1}{6}$ | 22.5 | 229 |
| 15 | Rd 40 × $\frac{1}{6}$ | 22.5 | 273 |
| 25 | Rd 40 × $\frac{1}{6}$ | 22.5 | 324 |
| 40 | Rd 60 × $\frac{1}{6}$ | 35.5 | 456 |
| 50 | Rd 70 × $\frac{1}{6}$ | 48.5 | 562 |
| 80 | Rd 98 × $\frac{1}{6}$ | 72.9 | 671 |

3-A version available: order code for "Additional approval", option LP in conjunction with
$Ra_{max}$ = 0.76 μm: order code for "Measuring tube material", option SB
$Ra_{max}$ = 0.38 μm: order code for "Measuring tube material", option SC

*Thread ISO 2853*



A0015623

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

| Thread ISO 2853, for pipe according to ISO 2037<br>1.4404 (316/316L)<br>*Order code for "Process connection", option* **JSF** | | | |
|---|---|---|---|
| DN<br>[mm] | A [1)]<br>[mm] | B<br>[mm] | L<br>[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 |
| 3-A version available: order code for "Additional approval", option LP in conjunction with<br>$Ra_{max}$ = 0.76 µm: order code for "Measuring tube material", option SB<br>$Ra_{max}$ = 0.38 µm: order code for "Measuring tube material", option SC | | | |

1)      Max. thread diameter according to ISO 2853 Annex A

*VCO*



A0015624

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

| 8-VCO-4 (½")<br>1.4404 (316/316L)<br>Order code for "Process connection", option CVS | | | |
|---|---|---|---|
| DN<br>[mm] | A<br>[in] | B<br>[mm] | L<br>[mm] |
| 8 | AF 1 | 10.2 | 252 |

| 12-VCO-4 (¾")<br>1.4404 (316/316L)<br>Order code for "Process connection", option CWS | | | |
|---|---|---|---|
| DN<br>[mm] | A<br>[in] | B<br>[mm] | L<br>[mm] |
| 15 | AF 1½ | 15.7 | 305 |

**Accessories**

*Weather protection cover*
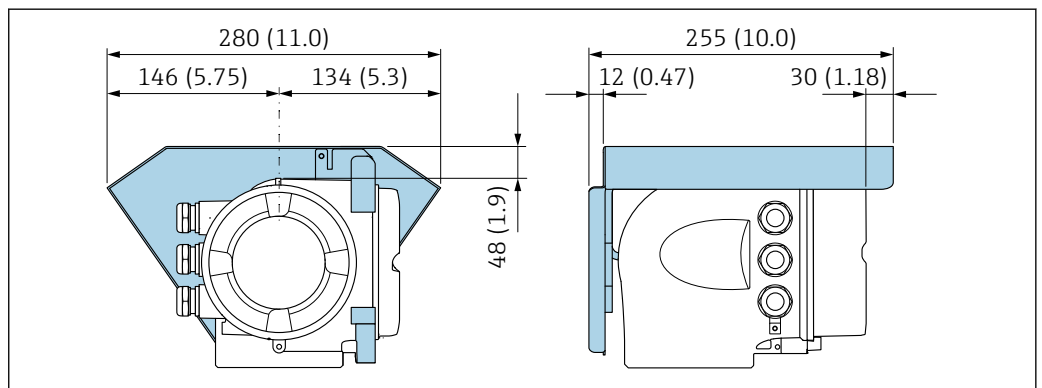


A0029553

🖳 *38   Engineering unit mm (in)*
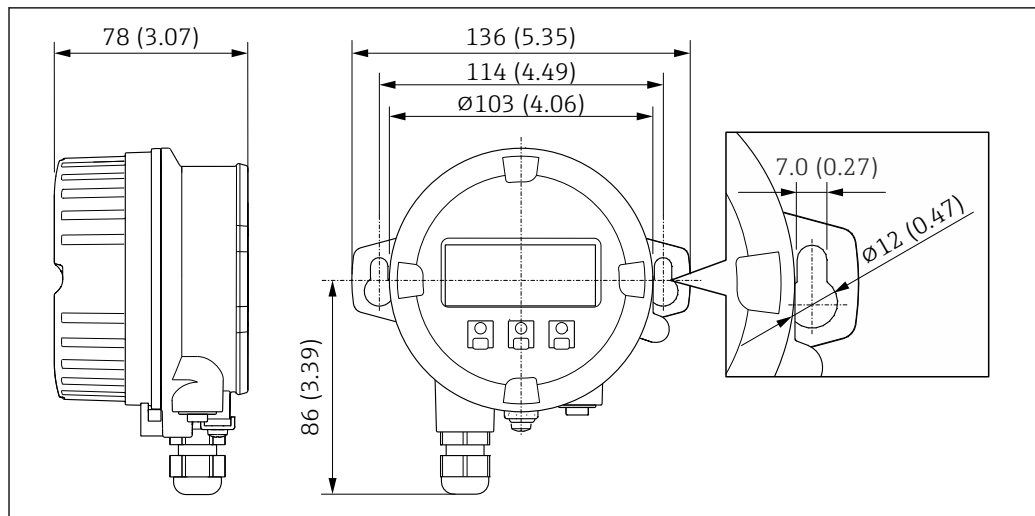
*Remote display and operating module DKX001*



*39    Engineering unit mm (in)*

A0028921

*External WLAN antenna*

ℹ️ The external WLAN antenna is not suitable for use in hygienic applications.
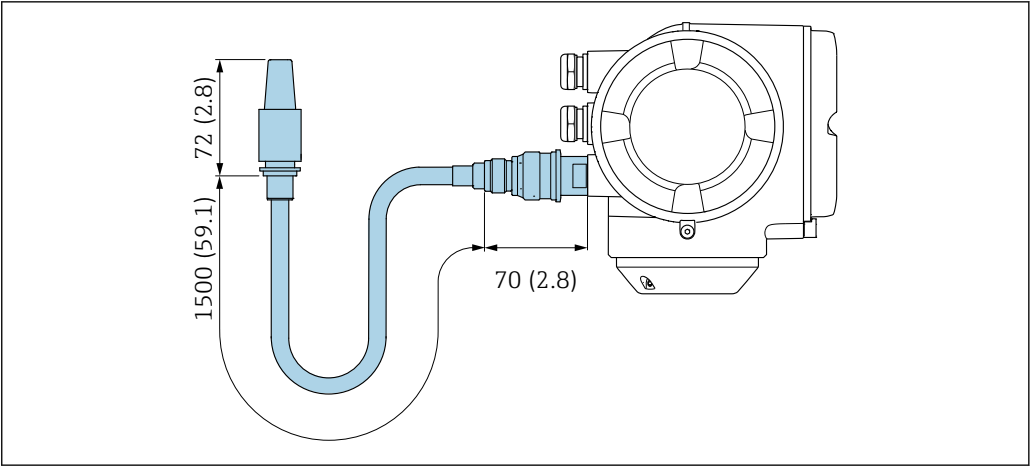
*External WLAN antenna mounted on device*
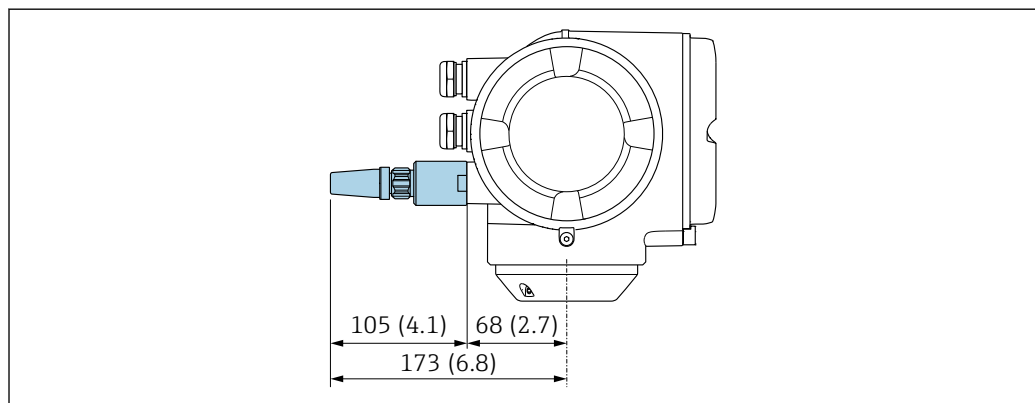


*40    Engineering unit mm (in)*

A0028923

*External WLAN antenna mounted with cable*

The external WLAN antenna can be mounted separately from the transmitter if the transmission/ reception conditions at the transmitter mounting location are poor.
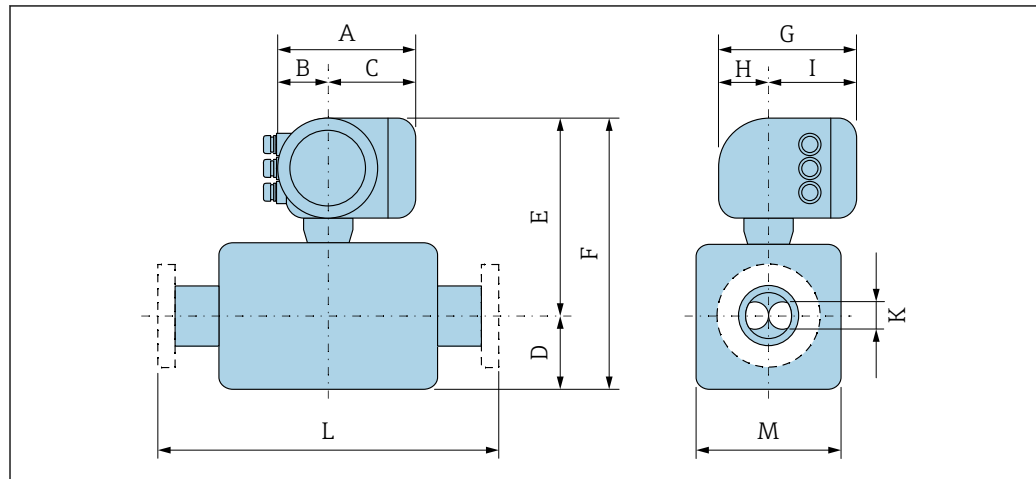
⊞ 41   *Engineering unit mm (in)*

**Dimensions in US units**      **Compact version**



A0033786

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

| DN | A [1] | B [1] | C | D | E | F | G [2] | H | I [2] | K | L | M |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] |
| ³⁄₈ | 6.65 | 2.68 | 3.98 | 3.5 | 9.92 | 13.43 | 7.87 | 2.32 | 5.55 | 0.21 | [3] | 1.77 |
| ½ | 6.65 | 2.68 | 3.98 | 3.94 | 9.92 | 13.86 | 7.87 | 2.32 | 5.55 | 0.33 | [3] | 1.77 |
| 1 | 6.65 | 2.68 | 3.98 | 4.02 | 9.8 | 13.82 | 7.87 | 2.32 | 5.55 | 0.47 | [3] | 2.01 |
| 1½ | 6.65 | 2.68 | 3.98 | 4.76 | 10.04 | 14.8 | 7.87 | 2.32 | 5.55 | 0.69 | [3] | 2.56 |
| 2 | 6.65 | 2.68 | 3.98 | 6.91 | 10.61 | 17.52 | 7.87 | 2.32 | 5.55 | 1.02 | [3] | 3.74 |
| 3 | 6.65 | 2.68 | 3.98 | 8.07 | 11.36 | 19.43 | 7.87 | 2.32 | 5.55 | 1.59 | [3] | 5.00 |

1)    Depending on the cable gland used: values up to + 1.18 in
2)    For version without local display: values - 1.18 in
3)    Depending on the process connection

*Order code for "Housing", option A "Aluminum, coated"; Ex d*

| DN | A [1] | B [1] | C | D | E | F | G [2] | H | I [2] | K | L | M |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] |
| ³⁄₈ | 7.40 | 3.35 | 4.06 | 3.5 | 9.96 | 13.46 | 8.54 | 2.28 | 6.26 | 0.21 | [3] | 1.77 |
| ½ | 7.40 | 3.35 | 4.06 | 3.94 | 9.96 | 13.9 | 8.54 | 2.28 | 6.26 | 0.33 | [3] | 1.77 |
| 1 | 7.40 | 3.35 | 4.06 | 4.02 | 9.84 | 13.86 | 8.54 | 2.28 | 6.26 | 0.47 | [3] | 2.01 |
| 1½ | 7.40 | 3.35 | 4.06 | 4.76 | 10.08 | 14.84 | 8.54 | 2.28 | 6.26 | 0.69 | [3] | 2.56 |
| 2 | 7.40 | 3.35 | 4.06 | 6.91 | 10.63 | 17.54 | 8.54 | 2.28 | 6.26 | 1.02 | [3] | 3.74 |
| 3 | 7.40 | 3.35 | 4.06 | 8.07 | 11.38 | 19.45 | 8.54 | 2.28 | 6.26 | 1.59 | [3] | 5.00 |

1)    Depending on the cable gland used: values up to + 1.18 in
2)    For version without local display: values - 1.57 in
3)    Depending on the process connection

*Order code for "Housing", option B "Stainless, hygienic"*

| DN | A [1] | B [1] | C | D | E | F | G [2] | H | I [2] | K | L | M |
|----|----|----|----|----|----|----|----|----|----|----|----|----|
| [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] | [in] |
| ⅜ | 7.20 | 2.87 | 4.33 | 3.5 | 9.92 | 13.43 | 7.87 | 2.56 | 5.31 | 0.21 | [3] | 1.77 |
| ½ | 7.20 | 2.87 | 4.33 | 3.94 | 9.92 | 13.86 | 7.87 | 2.56 | 5.31 | 0.33 | [3] | 1.77 |
| 1 | 7.20 | 2.87 | 4.33 | 4.02 | 9.8 | 13.82 | 7.87 | 2.56 | 5.31 | 0.47 | [3] | 2.01 |
| 1½ | 7.20 | 2.87 | 4.33 | 4.76 | 10.04 | 14.8 | 7.87 | 2.56 | 5.31 | 0.69 | [3] | 2.56 |
| 2 | 7.20 | 2.87 | 4.33 | 6.91 | 10.61 | 17.52 | 7.87 | 2.56 | 5.31 | 1.02 | [3] | 3.74 |
| 3 | 7.20 | 2.87 | 4.33 | 8.07 | 11.36 | 19.43 | 7.87 | 2.56 | 5.31 | 1.59 | [3] | 5.00 |

1)   Depending on the cable gland used: values up to + 1.18 in
2)   For version without local display: values - 0.51 in
3)   Depending on the process connection

**Flange connections**

*Fixed flange ASME B16.5*
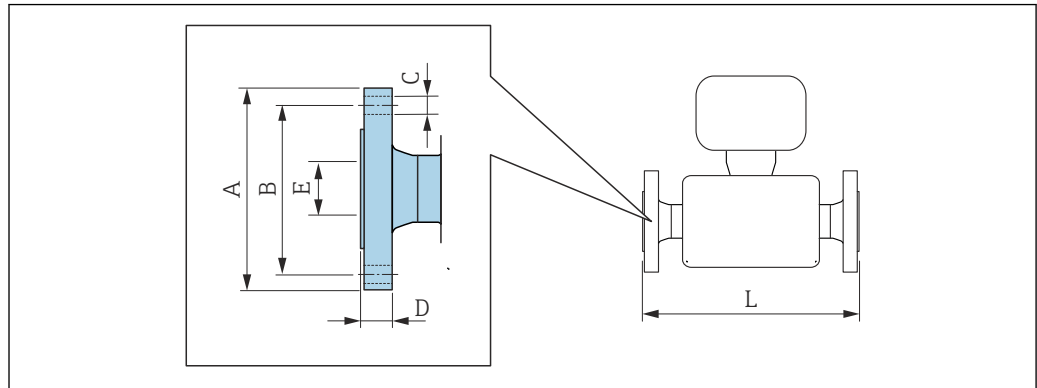


A0015621

Length tolerance for dimension L in inch:
+0.06 / −0.08

**Flange according to ASME B16.5, Cl 150**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **AAS**

| DN [in] | A [in] | B [in] | C [in] | D [in] | E [in] | L [in] |
|---|---|---|---|---|---|---|
| ⅜ 1) | 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 | 6.00 | 4 × Ø0.75 | 0.94 | 3.07 | 24.06 |
| Surface roughness (flange): Ra 126 to 248 µin | | | | | | |

1)      DN ⅜" with DN ½" flanges as standard

**Flange according to ASME B16.5, Class 300**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **ABS**

| DN [in] | A [in] | B [in] | C [in] | D [in] | E [in] | L [in] |
|---|---|---|---|---|---|---|
| ⅜ 1) | 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 | 3.50 | 4 × Ø0.75 | 0.69 | 1.05 | 12.95 |
| 1½ | 6.10 | 4.50 | 4 × Ø0.88 | 0.81 | 1.61 | 17.52 |
| 2 | 6.50 | 5.00 | 8 × Ø0.75 | 0.88 | 2.07 | 21.89 |
| 3 | 8.27 | 6.63 | 8 × Ø0.88 | 1.12 | 3.07 | 24.06 |
| Surface roughness (flange): Ra 126 to 248 µin | | | | | | |

1)      DN ⅜" with DN ½" flanges as standard

**Flange according to ASME B16.5, Class 600**
**1.4404 (F316/F316L)**
*Order code for "Process connection", option* **ACS**

| DN [in] | A [in] | B [in] | C [in] | D [in] | E [in] | L [in] |
|---|---|---|---|---|---|---|
| ⅜ 1) | 3.74 | 2.63 | 4 × Ø0.62 | 0.81 | 0.55 | 10.28 |
| ½ | 3.74 | 2.63 | 4 × Ø0.62 | 0.81 | 0.55 | 11.61 |
| 1 | 4.92 | 3.50 | 4 × Ø0.75 | 0.94 | 0.96 | 14.96 |
| 1½ | 6.10 | 4.50 | 4 × Ø0.88 | 1.13 | 1.50 | 19.53 |
| 2 | 6.50 | 5.00 | 8 × Ø0.75 | 1.25 | 1.94 | 22.95 |
| 3 | 8.27 | 6.63 | 8 × Ø0.88 | 1.50 | 2.9 | 26.42 |
| Surface roughness (flange): Ra 126 to 248 μin | | | | | | |

1)      DN ⅜" with DN ½" flanges as standard

**Clamp connections**
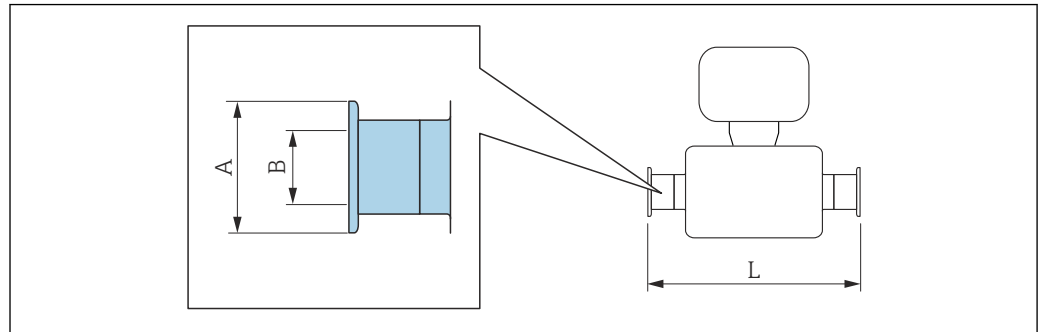
*Tri-Clamp*



A0015625

Length tolerance for dimension L in inch:
+0.06 / −0.08

**Tri-Clamp (½"), DIN 11866 series C**
**1.4404 (316/316L)**
*Order code for "Process connection", option* **FDW**

| DN [in] | Clamp [in] | A [in] | B [in] | L [in] |
|---|---|---|---|---|
| ⅜ | ½ | 0.98 | 0.37 | 9.02 |
| ½ | ½ | 0.98 | 0.37 | 10.75 |
| 3-A version available: order code for "Additional approval", option LP in conjunction with $Ra_{max}$ = 30 µin: order code for "Measuring tube material", option SB $Ra_{max}$ = 15 µin: order code for "Measuring tube material", option SC ||||||

**Tri-Clamp (≥ 1"), DIN 11866 series C**
**1.4404 (316/316L)**
*Order code for "Process connection", option* **FTS**

| 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 |
| 3-A version available: order code for "Additional approval", option LP in conjunction with $Ra_{max}$ = 30 µin: order code for "Measuring tube material", option SB $Ra_{max}$ = 15 µin: order code for "Measuring tube material", option SC ||||||

**Threaded couplings**

*Thread SMS 1145*
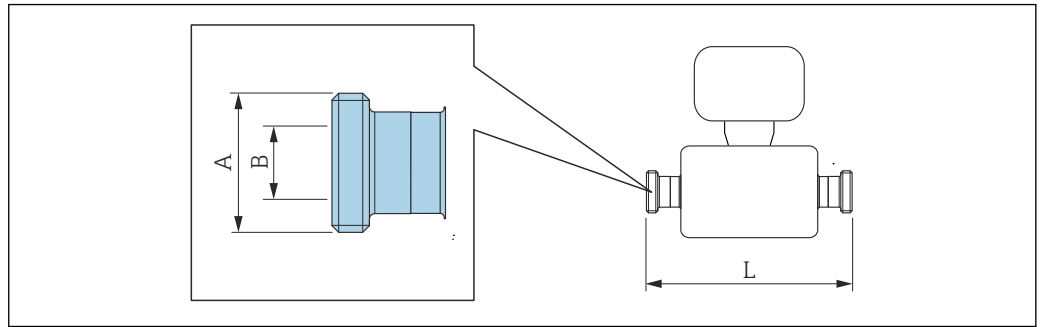


A0015628

Length tolerance for dimension L in inch:
+0.06 / −0.08

| **Thread SMS 1145** **1.4404 (316/316L)** *Order code for "Process connection", option* **SCS** | | | |
|---|---|---|---|
| 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 | 1.40 | 17.95 |
| 2 | Rd 70 × ⅙ | 1.91 | 22.13 |
| 3 | Rd 98 × ⅙ | 2.87 | 26.42 |
| 3-A version available: order code for "Additional approval", option LP in conjunction with $Ra_{max}$ = 30 µin: order code for "Measuring tube material", option SB $Ra_{max}$ = 15 µin: order code for "Measuring tube material", option SC | | | |

*VCO*



A0015624

Length tolerance for dimension L in inch:
+0.06 / −0.08

| **8-VCO-4 (½")** | | | |
|---|---|---|---|
| **1.4404 (316/316L)** | | | |
| *Order code for "Process connection", option* **CVS** | | | |
| **DN** [in] | **A** [in] | **B** [in] | **L** [in] |
| ⅜ | AF 1 | 0.40 | 9.92 |

| **12-VCO-4 (¾")** | | | |
|---|---|---|---|
| **1.4404 (316/316L)** | | | |
| *Order code for "Process connection", option* **CWS** | | | |
| **DN** [in] | **A** [in] | **B** [in] | **L** [in] |
| ½ | AF 1½ | 0.62 | 12.01 |

### Accessories

*Weather protection cover*
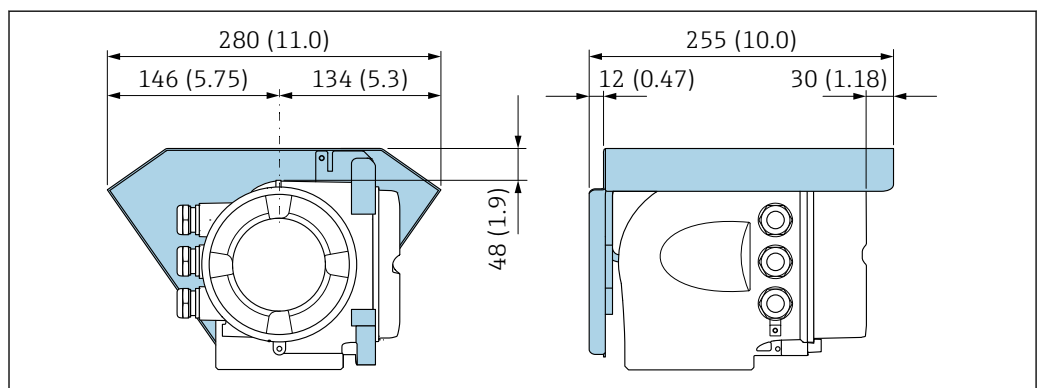


A0029553

🖼 *42*  *Engineering unit mm (in)*
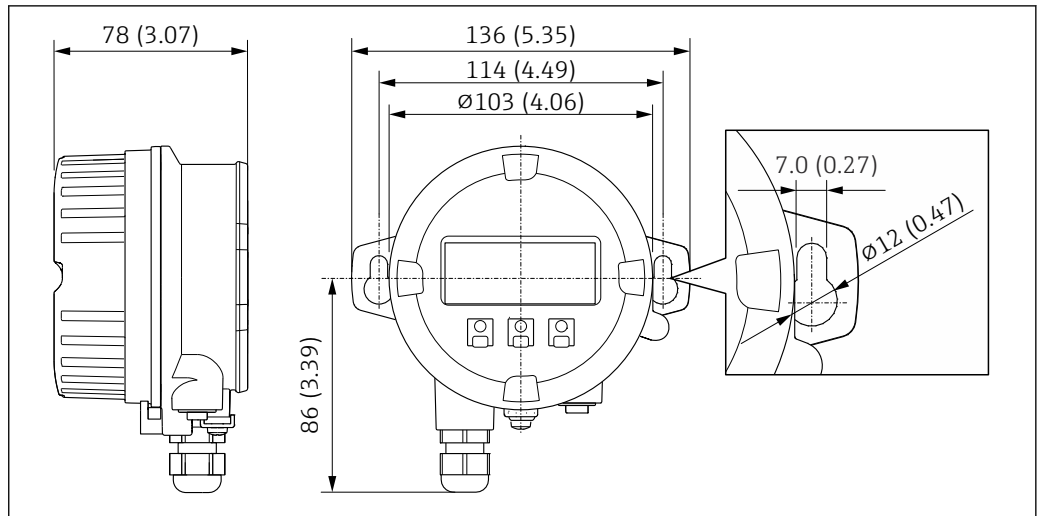
*Remote display and operating module DKX001*



*Engineering unit mm (in)*

A0028921

**43**

*External WLAN antenna*

ℹ The external WLAN antenna is not suitable for use in hygienic applications.

*External WLAN antenna mounted on device*



*Engineering unit mm (in)*

A0028923

**44**
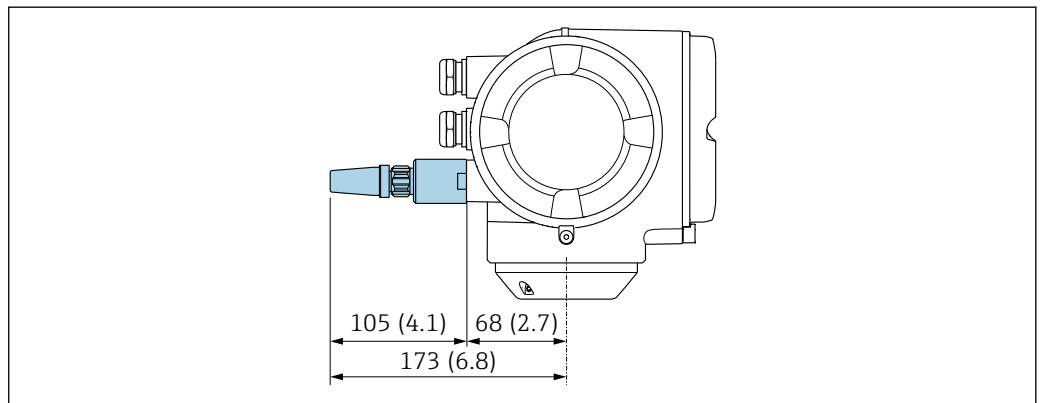
*External WLAN antenna mounted with cable*

The external WLAN antenna can be mounted separately from the transmitter if the transmission/
reception conditions at the transmitter mounting location are poor.
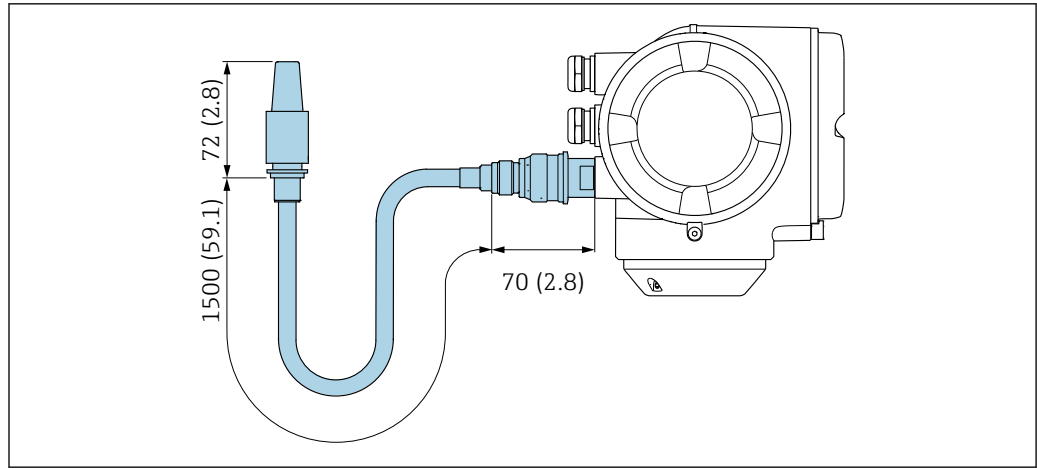
*45   Engineering unit mm (in)*

A0033597

**Weight**

All values (weight exclusive of packaging material) refer to devices with EN/DIN PN 40 flanges. Weight specifications 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
  (Order code for "Housing", option A "Aluminum, coated"; Ex d): +2 kg (+4.4 lbs)
• Transmitter version for hygienic area
  (Order code for "Housing", option B "Stainless, hygienic"): +0.2 kg (+0.44 lbs)

**Weight in SI units**

| DN [mm] | Weight [kg] |
|---------|-------------|
| 8 | 5 |
| 15 | 5.5 |
| 25 | 7 |
| 40 | 11 |
| 50 | 16 |
| 80 | 32 |

**Weight in US units**

| DN [in] | Weight [lbs] |
|---------|--------------|
| 3/8 | 11 |
| ½ | 12 |
| 1 | 15 |
| 1 ½ | 24 |
| 2 | 35 |
| 3 | 71 |

**Materials**

**Transmitter housing**

Order code for "Housing":
• Option **A** "Aluminum, coated": aluminum, AlSi10Mg, coated
• Option **B** "Stainless, hygienic": stainless steel, 1.4404 (316L)

*Window material*

Order code for "Housing":
• Option **A** "Aluminum, coated": glass
• Option **B** "Stainless, hygienic": polycarbonate

*Seals*

Order code for "Housing":
Option **B** "Stainless, hygienic": EPDM and silicone

**Cable entries/cable glands**
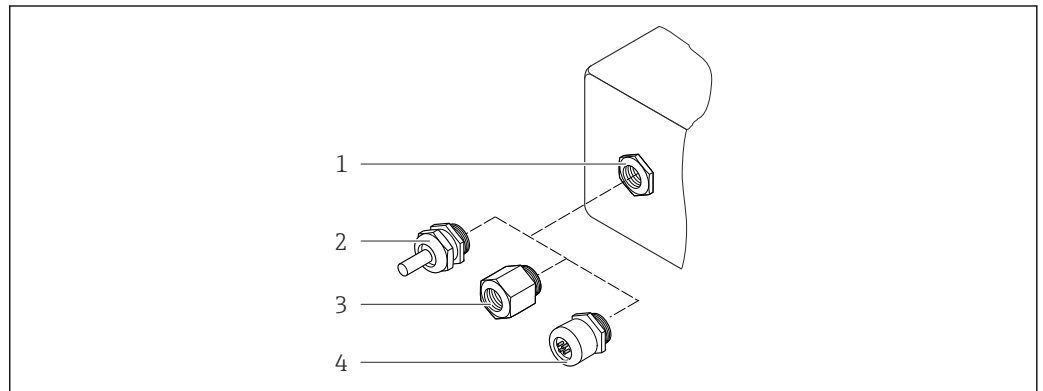


🖼 *46   Possible cable entries/cable glands*

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

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

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

| Cable entry/cable gland | Material |
|---|---|
| Compression fitting M20 × 1.5 | Non-Ex: plastic |
|  | Z2, D2, Ex d/de: brass with plastic |
| Adapter for cable entry with female thread G ½" | Nickel-plated brass |
| Adapter for cable entry with female thread NPT ½" | |

*Order code for "Housing", option B "Stainless, hygienic"*

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

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

**Device plug**

| Electrical connection | Material |
|---|---|
| Plug M12x1 | • Socket: Stainless steel, 1.4404 (316L)<br>• Contact housing: Polyamide<br>• Contacts: Gold-plated brass |

### Sensor housing

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

### Measuring tubes

Stainless steel, 1.4539 (904L); manifold: stainless steel, 1.4404 (316L)

### Process connections

- Flanges according to EN 1092-1 (DIN2501) / according to ASME B 16.5 / as per JIS B2220:
  Stainless steel, 1.4404 (F316/F316L)
- All other process connections:
  Stainless steel, 1.4404 (316/316L)

Available process connections→ 🗎 90

### Seals

Welded process connections without internal seals

### Accessories

*Protective cover*

Stainless steel, 1.4404 (316L)

*External WLAN antenna*

- Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter: Stainless steel and nickel-plated brass
- Cable: Polyethylene
- Plug: Nickel-plated brass
- Angle bracket: Stainless steel

| | |
|---|---|
| **Process connections** | • Fixed flange connections:<br>  • EN 1092-1 (DIN 2501) flange<br>  • EN 1092-1 (DIN 2512N) flange<br>  • Namur lengths in accordance with NE 132<br>  • ASME B16.5 flange<br>  • JIS B2220 flange<br>  • DIN 11864-2 Form A flange, DIN 11866 series A, flange with notch<br>• Clamp connections:<br>  Tri-Clamp (OD tubes), DIN 11866 series C<br>• Thread:<br>  • DIN 11851 thread, DIN 11866 series A<br>  • SMS 1145 thread<br>  • ISO 2853 thread, ISO 2037<br>  • DIN 11864-1 Form A thread, DIN 11866 series A<br>• VCO connections:<br>  • 8-VCO-4<br>  • 12-VCO-4<br><br>Process connection materials → 🗎 90 |
| **Surface roughness** | All data refer to parts in contact with the medium. The following surface roughness categories can be ordered.<br>• Not polished<br>• $Ra_{max}$ = 0.76 µm (30 µin)<br>• $Ra_{max}$ = 0.38 µm (15 µin) |

# Operability

| | |
|---|---|
| Operating concept | **Operator-oriented menu structure for user-specific tasks**<br>• Commissioning<br>• Operation<br>• Diagnostics<br>• Expert level<br><br>**Fast and safe commissioning**<br>• Guided menus ("Make-it-run" wizards) for applications<br>• Menu guidance with brief descriptions of the individual parameter functions<br>• Access to the device via Web server<br>• WLAN access to the device via mobile handheld terminal, tablet or smart phone<br><br>**Reliable operation**<br>• Operation in local language<br>• Uniform operating philosophy applied to device and operating tools<br>• If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.<br><br>**Efficient diagnostic behavior increases measurement availability**<br>• Troubleshooting measures can be called up via the device and in the operating tools<br>• Diverse simulation options, logbook for events that occur and optional line recorder functions |
| Languages | Can be operated in the following languages:<br>• Via local operation<br>  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Vietnamese, Czech, Swedish<br>• Via Web browser<br>  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Vietnamese, Czech, Swedish<br>• Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese |
| Local operation | **Via display module**<br><br>Equipment:<br>• Order code for "Display; operation", option F "4-line, illuminated, graphic display; touch control"<br>• Order code for "Display; operation", option G "4-line, illuminated, graphic display; touch control + WLAN"<br><br>Information about WLAN interface → 🖺 99 |



A0026785
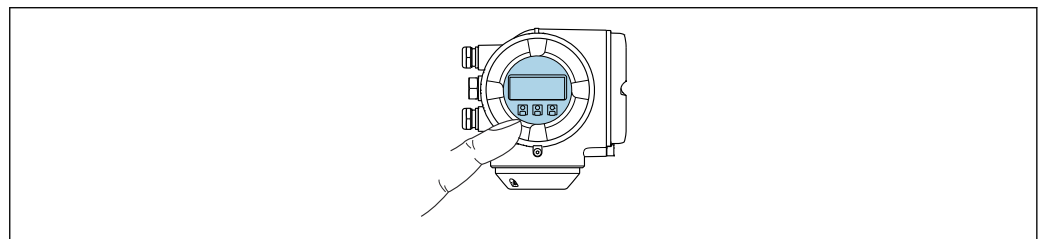
  *47    Operation with touch control*

*Display elements*

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: −20 to +60 ℃ (−4 to +140 ℉)
  The readability of the display may be impaired at temperatures outside the temperature range.

*Operating elements*

- External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, ⋤
- Operating elements also accessible in the various zones of the hazardous area

**Via remote display and operating module DKX001**

The remote display and operating module DKX001 is available as an optional extra → 🖺 109.

- The remote display and operating module DKX001 is only available for the following housing version: order code for "Housing": option A "Aluminum, coated"
- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



A0026786

🖾 *48    Operation via remote display and operating module DKX001*

*Display and operating elements*

The display and operating elements correspond to those of the display module → 🖺 91.

*Housing material*

The housing material of the display and operating module DKX001 depends on the choice of transmitter housing material.

| Transmitter housing | | Remote display and operating module |
| Order code for "Housing" | Material | Material |
| --- | --- | --- |
| Option **A** "Aluminum, coated" | AlSi10Mg, coated | AlSi10Mg, coated |

*Cable entry*

Corresponds to the choice of transmitter housing, order code for "Electrical connection".

*Connecting cable*

→ 🖺 49

*Dimensions*

→ 🖺 78

Remote operation    **Via HART protocol**

This communication interface is available in device versions with a HART output.
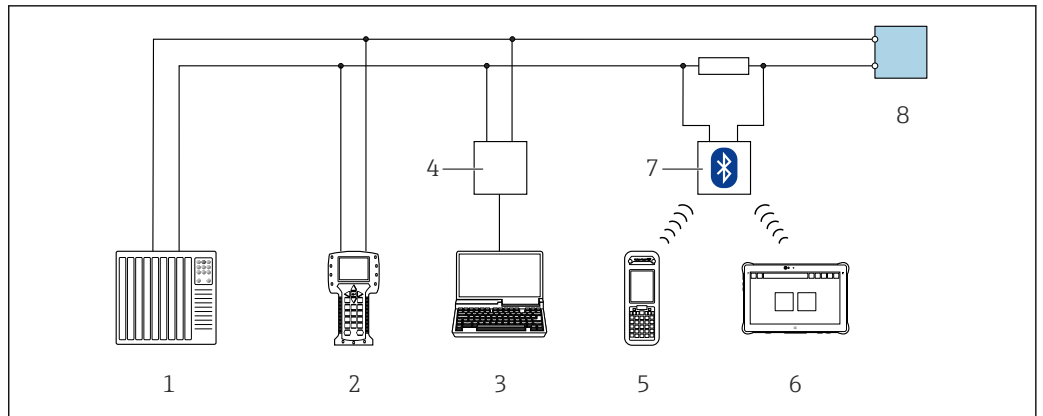
*🖼 49   Options for remote operation via HART protocol (active)*

*1   Control system (e.g. PLC)*
*2   Field Communicator 475*
*3   Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
*4   Commubox FXA195 (USB)*
*5   Field Xpert SFX350 or SFX370*
*6   Field Xpert SMT70*
*7   VIATOR Bluetooth modem with connecting cable*
*8   Transmitter*
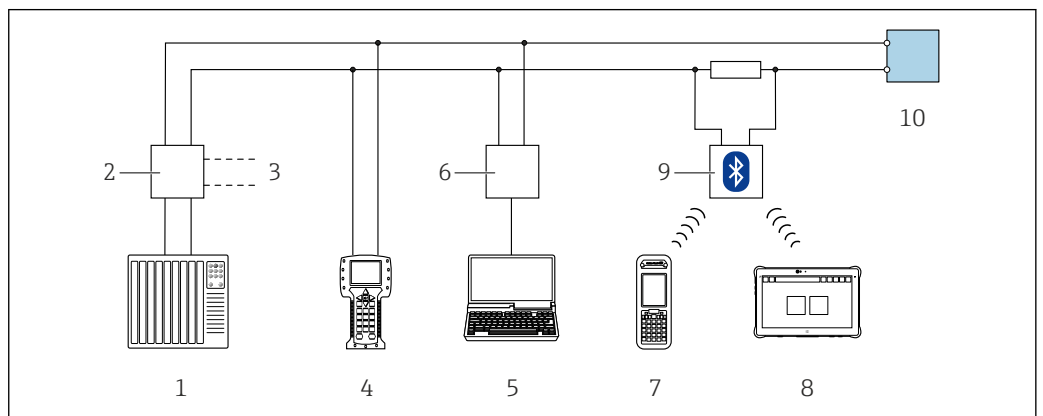


*🖼 50   Options for remote operation via HART protocol (passive)*

*1   Control system (e.g. PLC)*
*2   Transmitter power supply unit, e.g. RN221N (with communication resistor)*
*3   Connection for Commubox FXA195 and Field Communicator 475*
*4   Field Communicator 475*
*5   Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
*6   Commubox FXA195 (USB)*
*7   Field Xpert SFX350 or SFX370*
*8   Field Xpert SMT70*
*9   VIATOR Bluetooth modem with connecting cable*
*10   Transmitter*

**Via FOUNDATION Fieldbus network**

This communication interface is available in device versions with FOUNDATION Fieldbus.
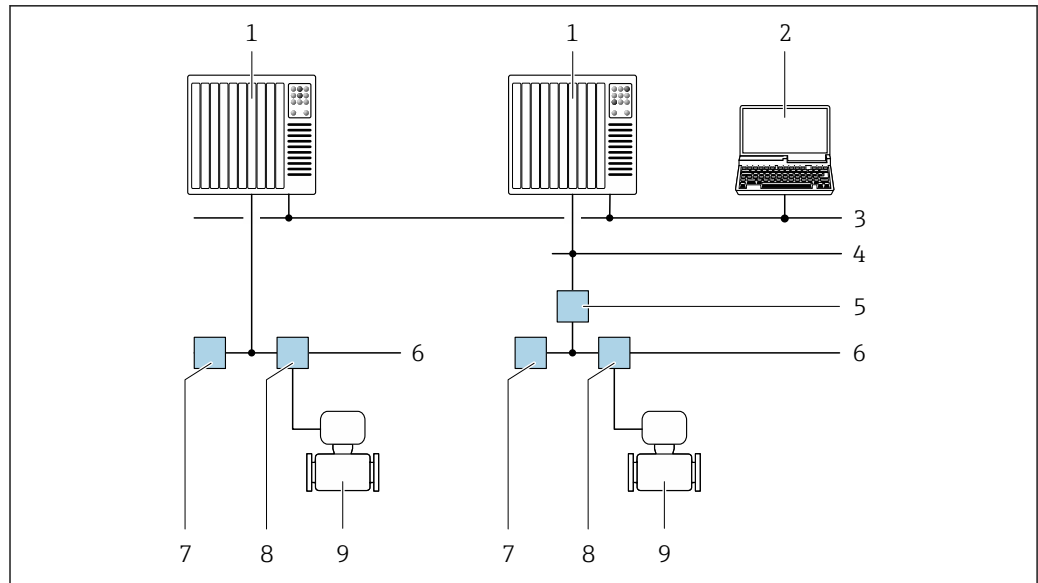
*51   Options for remote operation via FOUNDATION Fieldbus network*

*1   Automation system*
*2   Computer with FOUNDATION Fieldbus network card*
*3   Industry network*
*4   High Speed Ethernet FF-HSE network*
*5   Segment coupler FF-HSE/FF-H1*
*6   FOUNDATION Fieldbus FF-H1 network*
*7   Power supply FF-H1 network*
*8   T-box*
*9   Measuring device*

**Via PROFIBUS DP network**

This communication interface is available in device versions with PROFIBUS DP.
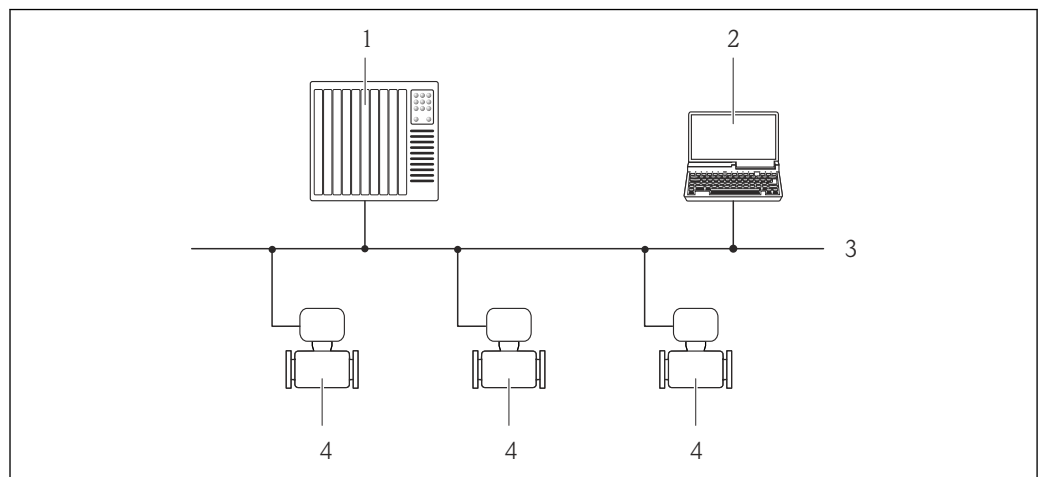


*52   Options for remote operation via PROFIBUS DP network*

*1   Automation system*
*2   Computer with PROFIBUS network card*
*3   PROFIBUS DP network*
*4   Measuring device*

**Via PROFIBUS PA network**

This communication interface is available in device versions with PROFIBUS PA.
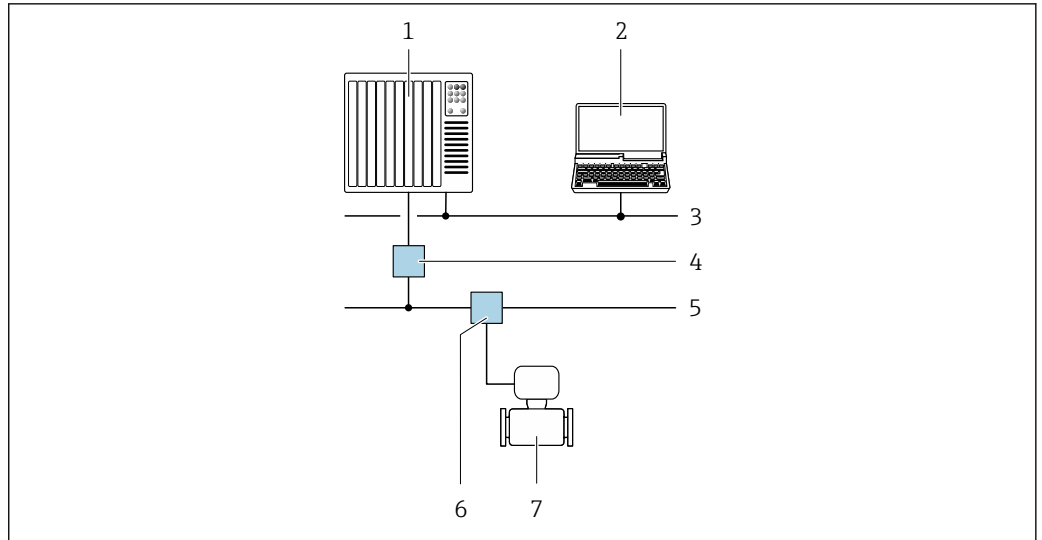
*53  Options for remote operation via PROFIBUS PA network*

*1  Automation system*
*2  Computer with PROFIBUS network card*
*3  PROFIBUS DP network*
*4  Segment coupler PROFIBUS DP/PA*
*5  PROFIBUS PA network*
*6  T-box*
*7  Measuring device*

**Via Modbus RS485 protocol**

This communication interface is available in device versions with a Modbus-RS485 output.
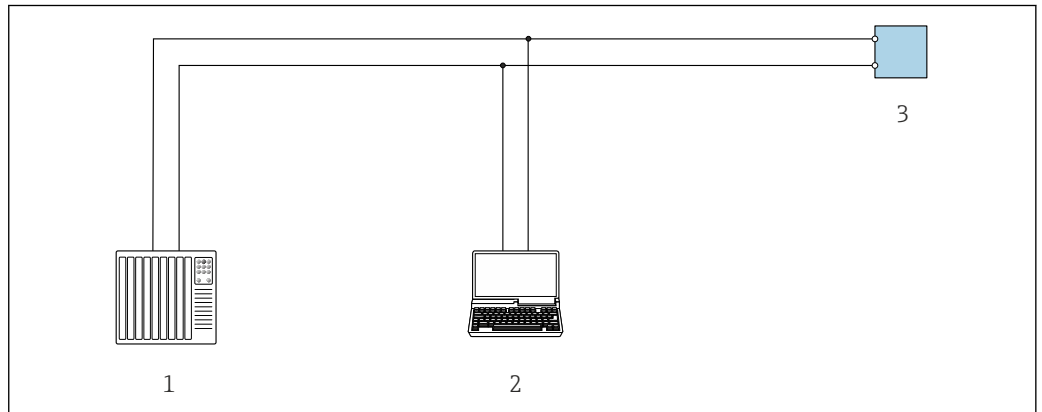


*54  Options for remote operation via Modbus-RS485 protocol (active)*

*1  Control system (e.g. PLC)*
*2  Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM*
*3  Transmitter*

**Via EtherNet/IP network**

This communication interface is available in device versions with EtherNet/IP.

*Star topology*
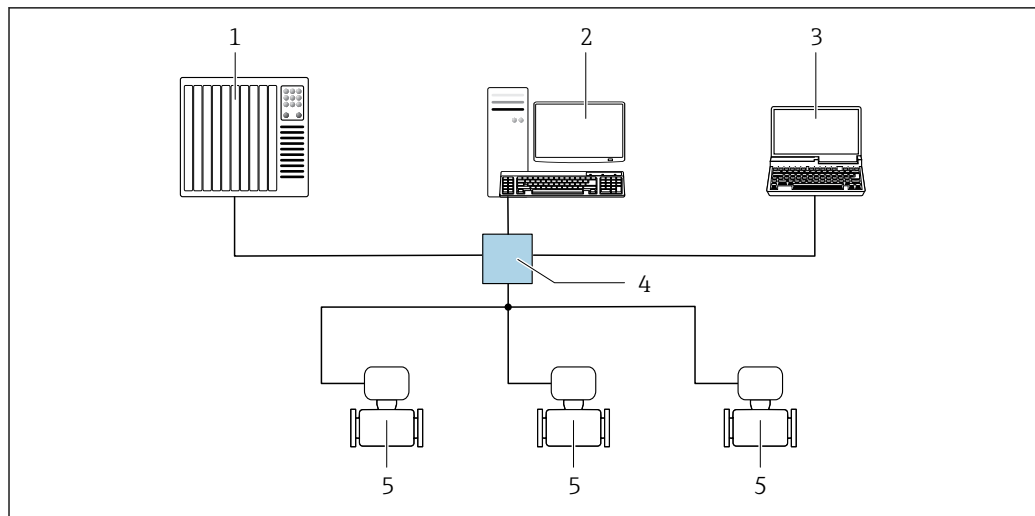


A0032078

🖾 *55    Options for remote operation via EtherNet/IP network: star topology*

1    *Automation system, e.g. "RSLogix" (Rockwell Automation)*
2    *Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)*
3    *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated Web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"*
4    *Standard Ethernet switch, e.g. Scalance X204 (Siemens)*
5    *Measuring device*

*Ring topology*

The device is integrated via the terminal connection for signal transmission (output 1) and the service interface (CDI-RJ45).
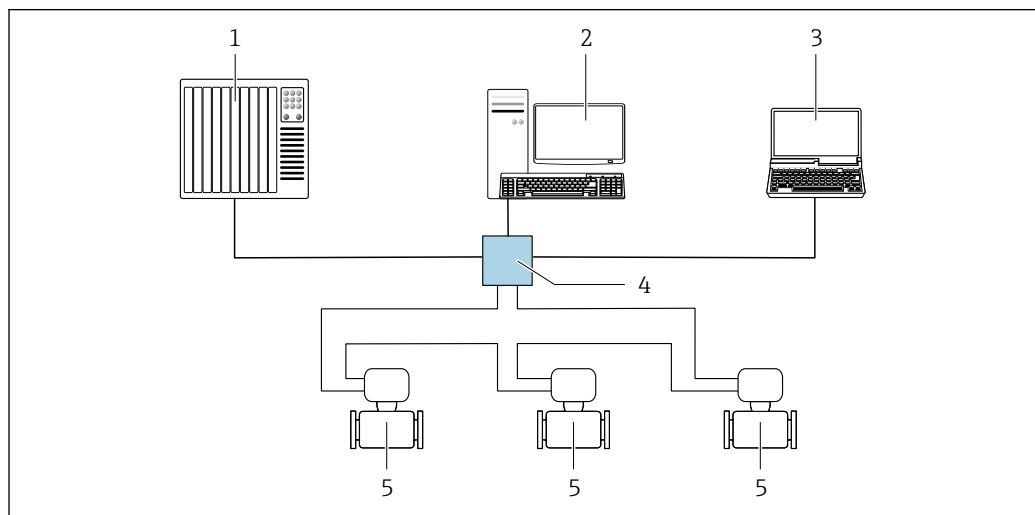


A0033725

🖾 *56    Options for remote operation via EtherNet/IP network: ring topology*

1    *Automation system, e.g. "RSLogix" (Rockwell Automation)*
2    *Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)*
3    *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated Web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"*
4    *Standard Ethernet switch, e.g. Scalance X204 (Siemens)*
5    *Measuring device*

**Via PROFINET network**

This communication interface is available in device versions with PROFINET.

*Star topology*
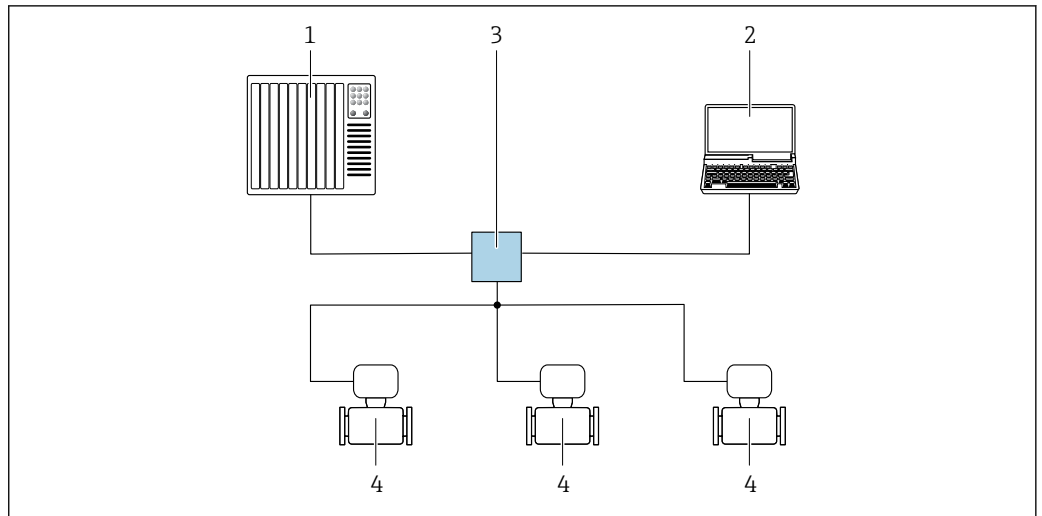


A0026545

🖾 *57 Options for remote operation via PROFINET network: star topology*

*1 Automation system, e.g. Simatic S7 (Siemens)*
*2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated Web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
*3 Standard Ethernet switch, e.g. Scalance X204 (Siemens)*
*4 Measuring device*

*Ring topology*

The device is integrated via the terminal connection for signal transmission (output 1) and the service interface (CDI-RJ45).
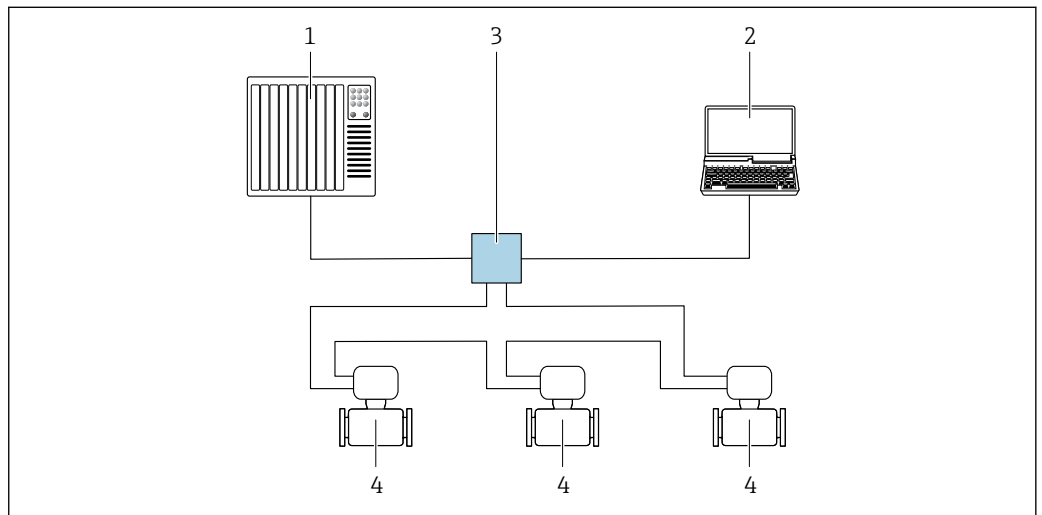


A0033719

🖾 *58 Options for remote operation via PROFINET network: ring topology*

*1 Automation system, e.g. Simatic S7 (Siemens)*
*2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated Web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
*3 Standard Ethernet switch, e.g. Scalance X204 (Siemens)*
*4 Measuring device*

**Via APL network**
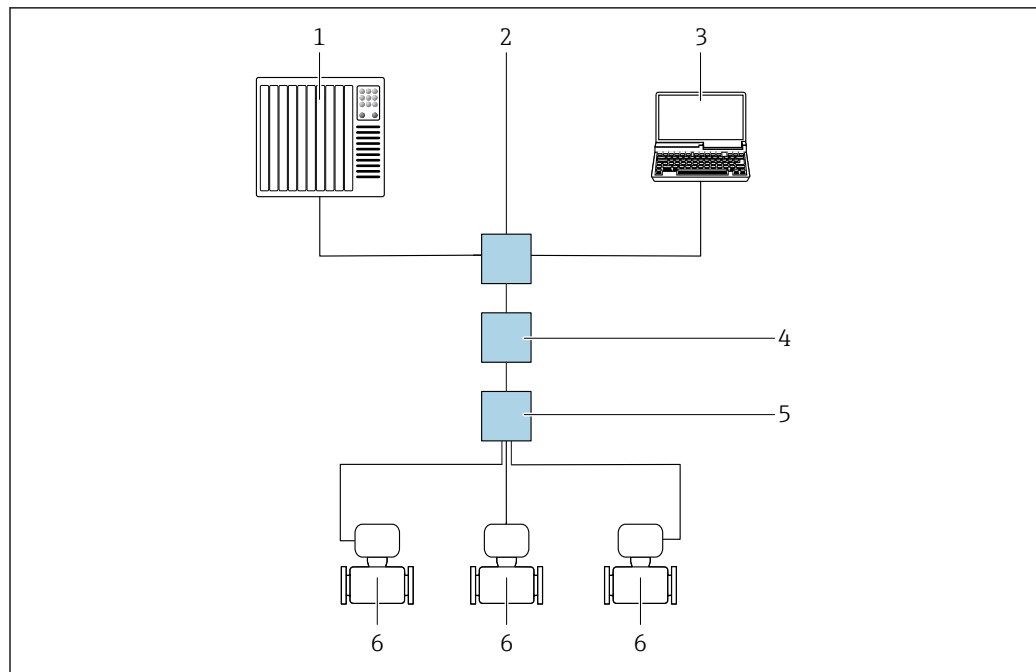


🖾 *59    Options for remote operation via APL network*

*1    Automation system, e.g. Simatic S7 (Siemens)*
*2    Ethernet switch, e.g. Scalance X204 (Siemens)*
*3    Computer with Web browser (e.g. Internet Explorer) for access to integrated Web server or computer with operating tool (e.g. FieldCare or DeviceCare with PROFINET COM DTM or SIMATIC PDM with FDI-Package)*
*4    APL power switch (optional)*
*5    APL field switch*
*6    Measuring device*

| | |
|---|---|
| **Service interface** | **Via service interface (CDI-RJ45)** |

A point-to-point connection can be established via onsite device configuration. With the housing open, the connection is established directly via the service interface (CDI-RJ45) of the device.

An adapter for RJ45 to the M12 plug is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 plug mounted in the cable entry. The connection to the service interface can be established via an M12 plug without opening the device.
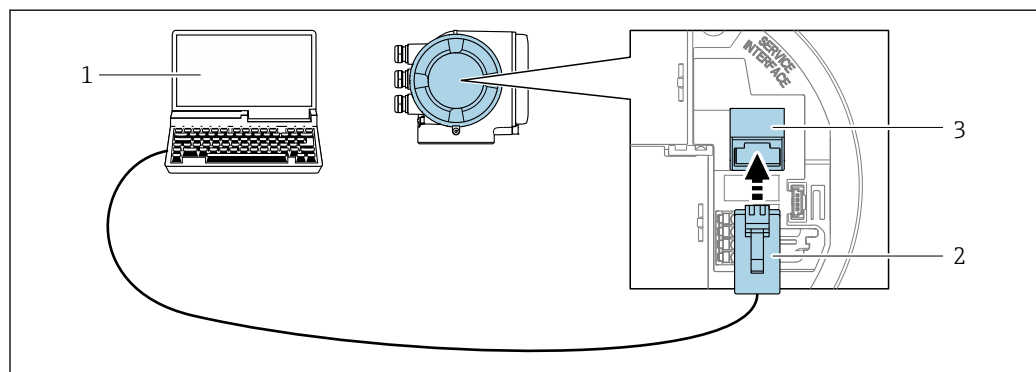


🖾 *60    Connection via service interface (CDI-RJ45)*

*1    Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP" or Modbus DTM*
*2    Standard Ethernet connecting cable with RJ45 plug*
*3    Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server*

### Via WLAN interface

The optional WLAN interface is available on the following device version:
Order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN"



A0034570
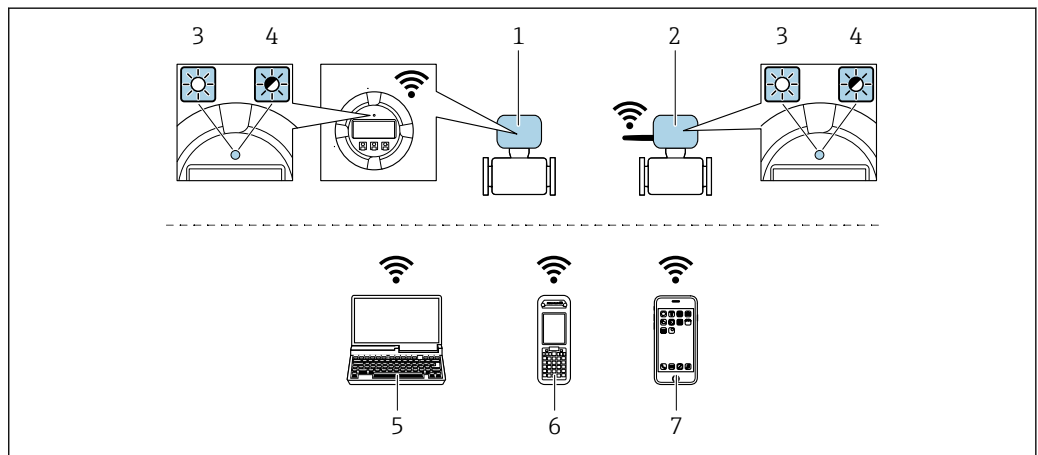
*1    Transmitter with integrated WLAN antenna*
*2    Transmitter with external WLAN antenna*
*3    LED lit constantly: WLAN reception is enabled on measuring device*
*4    LED flashing: WLAN connection established between operating unit and measuring device*
*5    Computer with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare)*
*6    Mobile handheld terminal with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or operating tool (e.g. FieldCare, DeviceCare)*
*7    Smart phone or tablet (e.g. Field Xpert SMT70)*

| Function | WLAN: IEEE 802.11 b/g (2.4 GHz)<br>• Access Point with DHCP server (factory setting)<br>• Network |
|---|---|
| Encryption | WPA2-PSK AES-128 (in accordance with IEEE 802.11i) |
| Configurable WLAN channels | 1 to 11 |
| Degree of protection | IP67 |
| Available antennas | • Internal antenna<br>• External antenna (optional)<br>In the event of poor transmission/reception conditions at the place of installation.<br>Available as an accessory .<br><br>ℹ️  Only 1 antenna is active at any one time! |
| Range | • Internal antenna: typically 10 m (32 ft)<br>• External antenna: typically 50 m (164 ft) |
| Materials (external antenna) | • Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass<br>• Adapter: Stainless steel and nickel-plated brass<br>• Cable: Polyethylene<br>• Plug: Nickel-plated brass<br>• Angle bracket: Stainless steel |

**Network integration**

ℹ️  Network integration is only available for the HART communication protocol.

With the optional "OPC-UA Server" application package, the device can be integrated into an Ethernet network via the service interface (CDI-RJ45 and WLAN) and communicate with OPC-UA clients. If the device is used in this way, IT security must be considered.

ℹ️  Transmitters with an Ex de approval may **not** be connected via the service interface (CDI-RJ45)!
Order code for "Approval transmitter + sensor", options (Ex de):
BA, BB, C1, C2, GA, GB, MA, MB, NA, NB

For permanent access to device data and for device configuration via the Web server, the device is incorporated directly in a network via the service interface (CDI-RJ45). In this way, the device can be accessed any time from the control station. The measured values are processed separately via the inputs and outputs through the automation system.
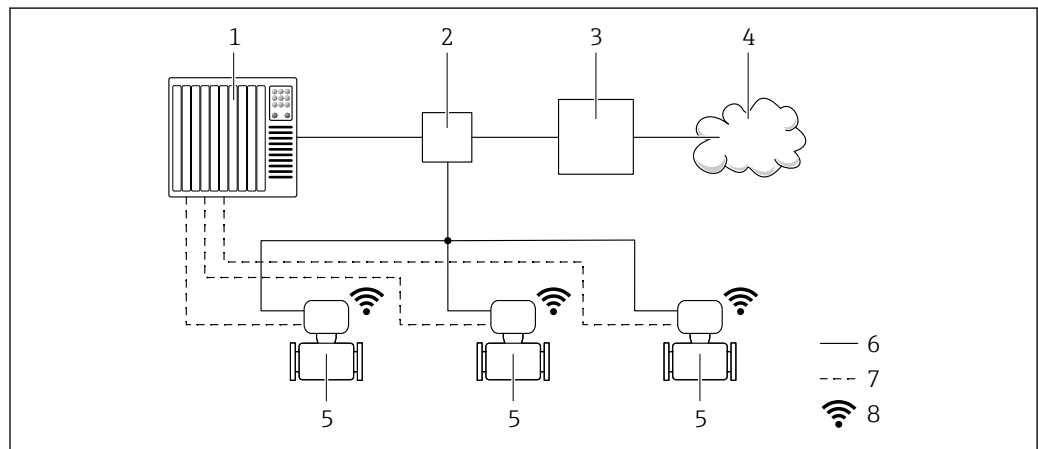


*1   Automation system, e.g. Simatic S7 (Siemens)*
*2   Ethernet switch*
*3   Edge Gateway*
*4   Cloud*
*5   Measuring device*
*6   Ethernet network*
*7   Measured values via inputs and outputs*
*8   Optional WLAN interface*

The optional WLAN interface is available on the following device version:
Order code for "Display; operation", option **G** "4-line, backlit, graphic display; touch control + WLAN"

Special Documentation for the OPC-UA Server application package → 🖺 113.

Supported operating tools

Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces.

| Supported operating tools | Operating unit | Interface | Additional information |
|---|---|---|---|
| Web browser | Notebook, PC or tablet with Web browser | • CDI-RJ45 service interface<br>• WLAN interface<br>• Ethernet-based fieldbus (EtherNet/IP, PROFINET) | Special Documentation for the device → 🖺 113 |
| DeviceCare SFE100 | Notebook, PC or tablet with Microsoft Windows system | • CDI-RJ45 service interface<br>• WLAN interface<br>• Fieldbus protocol | → 🖺 111 |
| FieldCare SFE500 | Notebook, PC or tablet with Microsoft Windows system | • CDI-RJ45 service interface<br>• WLAN interface<br>• Fieldbus protocol | → 🖺 111 |

| Supported operating tools | Operating unit | Interface | Additional information |
|---|---|---|---|
| Field Xpert | SMT70/77/50 | • All fieldbus protocols<br>• WLAN interface<br>• Bluetooth<br>• CDI-RJ45 service interface | Operating Instructions BA01202S<br><br>Device description files:<br>Use update function of handheld terminal |
| SmartBlue app | Smart phone or tablet with iOs or Android | WLAN | → 🖺 111 |

Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) from Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) from Siemens → www.siemens.com
- Asset Management Solutions (AMS) from Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 from Emerson → www.emersonprocess.com
- Field Device Manager (FDM) from Honeywell → www.process.honeywell.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The related device description files are available: www.endress.com → Downloads

**Web server**

Thanks to the integrated Web server the device can be operated and configured via a Web browser and via the service interface (CDI-RJ45) or via the WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed and allows users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

*Supported functions*
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package → 🖺 108)

Web server special documentation → 🖺 113

HistoROM data management | The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.

When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, for example after commissioning.

**Additional information on the data storage concept**

*There are different types of data storage units in which device data are stored and used by the device:*

|  | HistoROM backup | T-DAT | S-DAT |
|---|---|---|---|
| Available data | • Event logbook such as diagnostic events for example<br>• Parameter data record backup<br>• Device firmware package<br>• Driver for system integration for exporting via Web server, e.g:<br>  • GSD for PROFIBUS DP<br>  • GSD for PROFIBUS PA<br>  • GSDML for PROFINET<br>  • EDS for EtherNet/IP<br>  • DD for FOUNDATION Fieldbus | • Measured value logging ("Extended HistoROM" order option)<br>• Current parameter data record (used by firmware at run time)<br>• Maximum indicators (min/max values)<br>• Totalizer values | • Sensor data: nominal diameter etc.<br>• Serial number<br>• Calibration data<br>• Device configuration (e.g. SW options, fixed I/O or multi I/O) |
| Storage location | Fixed on the user interface board in the connection compartment | Attachable to the user interface board in the connection compartment | In the sensor plug in the transmitter neck part |

**Data backup**

**Automatic**
• The most important device data (sensor and transmitter) are automatically saved in the DAT modules
• If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
• If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors
• If exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

**Manual**
Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:
• Data backup function
  Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
• Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

**Data transmission**

**Manual**
• Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)
• Transmission of the drivers for system integration via Web server, e.g.:
  • GSD for PROFIBUS DP
  • GSD for PROFIBUS PA
  • GSDML for PROFINET
  • EDS for EtherNet/IP
  • DD for FOUNDATION Fieldbus

**Event list**

**Automatic**
- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server

**Data logging**

**Manual**
If the **Extended HistoROM** application package (order option) is enabled:
- Record up to 1000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

# Certificates and approvals

Current certificates and approvals that are available for the product can be selected via 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**.

| | |
|---|---|
| **CE mark** | The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied. |
| | Endress+Hauser confirms successful testing of the device by affixing to it the CE mark. |
| **UKCA marking** | The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark. |
| | Contact address Endress+Hauser UK: Endress+Hauser Ltd. Floats Road Manchester M23 9NF United Kingdom www.uk.endress.com |
| **RCM mark** | The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)". |
| **Ex approval** | The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate. |

Devices with the order code for "Approval; transmitter + sensor", option BA, BB, BC or BD have equipment protection level (EPL) Ga/Gb (Zone 0 in the measuring tube).

The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

**ATEX/IECEx**

Currently, the following versions for use in hazardous areas are available:

*Ex db eb*

| Category | Type of protection |
|----------|--------------------|
| II1/2G | Ex db eb ia IIC T6…T1 Ga/Gb<br>Ex db eb ia IIB T6…T1 Ga/Gb |
| II2G | Ex db eb ia IIC T6…T1 Gb<br>Ex db eb ia IIB T6…T1 Gb |

*Ex db*

| Category | Type of protection |
|----------|--------------------|
| II1/2G | Ex db ia IIC T6…T1 Ga/Gb<br>Ex db ia IIB T6…T1 Ga/Gb |
| II2G | Ex db ia IIC T6…T1 Gb<br>Ex db ia IIB T6…T1 Gb |

*Ex ec*

| Category | Type of protection |
|----------|--------------------|
| II3G | Ex ec IIC T5…T1 Gc |

*Ex tb*

| Category | Type of protection |
|----------|--------------------|
| II2D | Ex tb IIIC T** °C Db |

### cCSAus

Currently, the following versions for use in hazardous areas are available:

**IS (Ex i) and XP (Ex d)**
- Class I, II, III Division 1 Groups A-G
- Class I, II, III Division 1 Groups C-G

**NI (Ex ec)**
Class I Division 2 Groups A - D

**Ex db eb**
- Class I, Zone 1 AEx/ Ex db eb ia IIC T6…T1 Ga/Gb
  Class I, Zone 1 AEx/ Ex db eb ia IIB T6…T1 Ga/Gb
- Class I, Zone 1 AEx/Ex db eb ia IIC T6…T1 Gb
  Class I, Zone 1 AEx/Ex db eb ia IIB T6…T1 Gb

**Ex db**
- Class I, Zone 1 AEx/ Ex db ia IIC T6…T1 Ga/Gb
  Class I, Zone 1 AEx/ Ex db ia IIB T6…T1 Ga/Gb
- Class I, Zone 1 AEx/ Ex db ia IIC T6…T1 Gb
  Class I, Zone 1 AEx/ Ex db ia IIB T6…T1 Gb

**Ex ec**
Class I, Zone 2 AEx/ Ex ec IIC T5…T1 Gc

**Ex tb**
Zone 21 AEx/ Ex tb IIIC T** °C Db

| | |
|---|---|
| **Hygienic compatibility** | • 3-A approval<br>  • Only measuring devices with the order code for "Additional approval", option LP "3A" have 3-A approval.<br>  • The 3-A approval refers to the measuring device.<br>  • When installing the measuring device, ensure that no liquid can accumulate on the outside of the measuring device.<br>    A remote display module must be installed in accordance with the 3-A Standard.<br>  • Accessories (e.g. heating jacket, weather protection cover, wall holder unit) must be installed in accordance with the 3-A Standard.<br>    Each accessory can be cleaned. Disassembly may be necessary under certain circumstances.<br>• EHEDG-tested<br>  Only devices with the order code for "Additional approval", option LT "EHEDG" have been tested and meet the requirements of the EHEDG.<br>  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).<br>• FDA<br>• Food Contact Materials Regulation (EC) 1935/2004 |
| **Pharmaceutical compatibility** | • FDA 21 CFR 177<br>• USP <87><br>• USP <88> Class VI 121 ℃<br>• TSE/BSE Certificate of Suitability<br>• cGMP<br>  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.<br>  A serial number-specific declaration is generated. |
| **Functional safety** | The measuring device can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture; order code for "Additional approval", option LA) and SIL 3 (multi-channel architecture with homogeneous redundancy) and is independently evaluated and certified in accordance with IEC 61508.<br><br>The following types of monitoring in safety equipment are possible:<br>• Mass flow<br>• Volume flow<br>• Density<br><br>🛈 Functional Safety Manual with information on the SIL device → 🗎 113 |
| **HART certification** | **HART interface**<br><br>The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:<br>• Certified according to HART 7<br>• The device can also be operated with certified devices of other manufacturers (interoperability) |
| **FOUNDATION Fieldbus certification** | **FOUNDATION Fieldbus interface**<br><br>The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:<br>• Certified in accordance with FOUNDATION Fieldbus H1<br>• Interoperability Test Kit (ITK), revision version 6.2.0 (certificate available on request)<br>• Physical Layer Conformance Test<br>• The device can also be operated with certified devices of other manufacturers (interoperability) |
| **Certification PROFIBUS** | **PROFIBUS interface**<br><br>The measuring device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e.V./ PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:<br>• Certified according to PA Profile 3.02<br>• The device can also be operated with certified devices of other manufacturers (interoperability) |

| EtherNet/IP certification | The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications:<br>• Certified in accordance with the ODVA Conformance Test<br>• EtherNet/IP Performance Test<br>• EtherNet/IP PlugFest compliance<br>• The device can also be operated with certified devices of other manufacturers (interoperability) |
|---|---|
| Certification PROFINET | **PROFINET interface**<br><br>The measuring device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e.V. / PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:<br>• Certified according to:<br>  • Test specification for PROFINET devices<br>  • PROFINET Security Level 2– Netload Class 2 0 Mbps<br>• The device can also be operated with certified devices of other manufacturers (interoperability)<br>• The device supports PROFINET S2 system redundancy. |
| Certification PROFINET with Ethernet-APL | **PROFINET interface**<br><br>The measuring device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e.V. / PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:<br>• Certified according to:<br>  • Test specification for PROFINET devices<br>  • PROFINET PA Profile 4<br>  • PROFINET Security Level 2– Netload Class 2 0 Mbps<br>  • APL conformance test<br>• The device can also be operated with certified devices of other manufacturers (interoperability)<br>• The device supports PROFINET S2 system redundancy. |
| Pressure Equipment Directive | The devices can be ordered with or without a PED or UKCA approval. If a device with a PED or UKCA approval is required, this must be explicitly stated in the order. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary. A UK Ex approval must be selected for UKCA.<br><br>• With the marking:<br>a) PED/G1/x (x = category) or<br>b) UK/G1/x (x = category)<br>on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements"<br>a) specified in Annex I of the Pressure Equipment Directive 2014/68/EU or<br>b) Schedule 2 of Statutory Instruments 2016 No. 1105.<br>• Devices bearing this marking (PED or UKCA) are suitable for the following types of medium:<br>  • Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to 0.5 bar (7.3 psi)<br>  • Unstable gases<br>• Devices not bearing this marking (without PED or UKCA) are designed and manufactured according to sound engineering practice. They meet the requirements of<br>a) Art. 4 Para. 3 of the Pressure Equipment Directive 2014/68/EU or<br>b) Part 1, Para. 8 of Statutory Instruments 2016 No. 1105.<br>The scope of application is indicated<br>a) in diagrams 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU or<br>b) Schedule 3, Para. 2 of Statutory Instruments 2016 No. 1105. |
| Radio approval | The measuring device has radio approval.<br><br>  For detailed information on the radio approval, see the Special Documentation →  🗎 113 |
| Additional certification | **CRN approval**<br><br>Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. |

**Tests and certificates**

- EN10204-3.1 material certificate, wetted parts and sensor housing
- Pressure test, internal process, inspection certificate
- PMI test (XRF), internal procedure, wetted parts, test report
- Compliance with requirements derived from cGMP, Declaration
- EN10204-2.1 confirmation of compliance with the order and EN10204-2.2 test report

| Other standards and guidelines | |
|---|---|

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- IEC/EN 60068-2-6
  Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal).
- IEC/EN 60068-2-31
  Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices.
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326-2-3
  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).

# 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 measuring point-specific information such as 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

# Application packages

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

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

Detailed information on the application packages:
Special Documentation for the device → 📄 113

| | |
|---|---|
| **Diagnostic functionality** | Order code for "Application package", option EA "Extended HistoROM" |

Comprises extended functions concerning the event log and the activation of the measured value memory.

Event log:
Memory volume is extended from 20 message entries (standard version) to up to 100 entries.

Data logging (line recorder):
• Memory capacity for up to 1000 measured values is activated.
• 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user.
• Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

For detailed information, see the Operating Instructions for the device.

| | |
|---|---|
| **Heartbeat Technology** | Order code for "Application package", option EB "Heartbeat Verification + Monitoring" |

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

**Heartbeat Monitoring**
Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:
• Draw conclusions - using these data and other information - about the impact the process influences (e.g. corrosion, abrasion, formation of buildup etc.) have on measuring performance over time.
• Schedule servicing in time.
• Monitor the process or product quality, e.g. gas pockets.

For detailed information, see the Special Documentation for the device.

| | |
|---|---|
| **Concentration measurement** | Order code for "Application package", option ED "Concentration" |

Calculation and outputting of fluid concentrations.

The measured density is converted to the concentration of a substance of a binary mixture using the "Concentration" application package:
• Choice of predefined fluids (e.g. various sugar solutions, acids, alkalis, salts, ethanol etc.).
• Common or user-defined units (°Brix, °Plato, % mass, % volume, mol/l etc.) for standard applications.
• Concentration calculation from user-defined tables.

For detailed information, see the Special Documentation for the device.

| | |
|---|---|
| **Petroleum** | Order code for "Application package", option EJ "Petroleum" |

The most important parameters for the Oil & Gas Industry can be calculated and displayed with this application package.

- Corrected volume flow and calculated reference density in accordance with the "API Manual of Petroleum Measurement Standards, Chapter 11.1"
- Water content, based on density measurement
- Weighted mean of the density and temperature

For detailed information, see the Special Documentation for the device.

| | |
|---|---|
| Petroleum & locking function | Order code for "Application package", option EM "Petroleum & locking function" |

The most important parameters for the Oil & Gas Industry can be calculated and displayed with this application package. It is also possible to lock the settings.

- Corrected volume flow and calculated reference density in accordance with the "API Manual of Petroleum Measurement Standards, Chapter 11.1"
- Water content, based on density measurement
- Weighted mean of the density and temperature

For detailed information, see the Special Documentation for the device.

| | |
|---|---|
| OPC-UA Server | Order code for "Application package", option EL "OPC-UA Server" |

The application package provides an integrated OPC-UA server for comprehensive device services for IoT and SCADA applications.

For detailed information, see the Special Documentation for the device.

# Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

| | |
|---|---|
| Device-specific accessories | **For the transmitter** |

| Accessories | Description |
|---|---|
| Proline 300 transmitter | Transmitter for replacement or storage. Use the order code to define the following specifications:<br>• Approvals<br>• Output<br>• Input<br>• Display/operation<br>• Housing<br>• Software<br><br>    Order code: 8X3BXX<br><br>    Installation Instructions EA01200D |

| Remote display and operating module DKX001 | • If ordered directly with the measuring device:<br>Order code for "Display; operation", option O "Remote display 4-line, illuminated; 10 m (30 ft) cable; touch control"<br>• If ordered separately:<br>• Measuring device: order code for "Display; operation", option M "W/o, prepared for remote display"<br>• DKX001: Via the separate product structure DKX001<br>• If ordered subsequently:<br>DKX001: Via the separate product structure DKX001<br><br>**Mounting bracket for DKX001**<br>• If ordered directly: order code for "Accessory enclosed", option RA "Mounting bracket, pipe 1/2"<br>• If ordered subsequently: order number: 71340960<br><br>**Connecting cable (replacement cable)**<br>Via the separate product structure: DKX002<br><br>Further information on display and operating module DKX001→ 🖻 92.<br><br>Special Documentation SD01763D |
|---|---|
| External WLAN antenna | External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Accessory enclosed", option P8 "Wireless antenna wide area".<br><br>• The external WLAN antenna is not suitable for use in hygienic applications.<br>• Additional information regarding the WLAN interface → 🖻 99.<br><br>Order number: 71351317<br><br>Installation Instructions EA01238D |
| Weather protection cover | Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight.<br><br>Order number: 71343505<br><br>Installation Instructions EA01160D |

**For the sensor**

| Accessories | Description |
|---|---|
| Heating jacket | Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids.<br><br>If using oil as a heating medium, please consult with Endress+Hauser.<br><br>Heating jackets cannot be used with sensors fitted with a rupture disk.<br>Use the order code with the product root DK8003.<br><br>Special Documentation SD02151D |

**Communication-specific accessories**

| Accessories | Description |
|---|---|
| Commubox FXA195 HART | For intrinsically safe HART communication with FieldCare via the USB interface.<br><br>Technical Information TI00404F |
| HART Loop Converter HMX50 | Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.<br><br>• Technical Information TI00429F<br>• Operating Instructions BA00371F |

| Fieldgate FXA42 | Is used to transmit the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices |
|---|---|
| | • Technical Information TI01297S<br>• Operating Instructions BA01778S<br>• Product page: www.endress.com/fxa42 |
| Field Xpert SMT50 | The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in non-hazardous areas. 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. |
| | • Technical Information TI01342S<br>• Operating Instructions BA01709S<br>• Product page: www.endress.com/smt50 |
| Field Xpert SMT70 | The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. 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. |
| | • Technical Information TI01342S<br>• Operating Instructions BA01709S<br>• Product page: www.endress.com/smt70 |
| Field Xpert SMT77 | The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. |
| | • Technical Information TI01418S<br>• Operating Instructions BA01923S<br>• Product page: www.endress.com/smt77 |

**Service-specific accessories**

| Accessory | Description |
|---|---|
| Applicator | Software for selecting and sizing Endress+Hauser measuring devices:<br>• Choice of measuring devices with industrial requirements<br>• Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy.<br>• Graphic illustration of the calculation results<br>• Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.<br><br>Applicator is available:<br>• Via the Internet: https://portal.endress.com/webapp/applicator<br>• As a downloadable DVD for local PC installation. |
| W@M | W@M Life Cycle Management<br>Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle.<br>W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime.<br>Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: www.endress.com/lifecyclemanagement |
| FieldCare | FDT-based plant asset management tool from Endress+Hauser.<br>It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.<br><br>Operating Instructions BA00027S and BA00059S |
| DeviceCare | Tool for connecting and configuring Endress+Hauser field devices.<br><br>Innovation brochure IN01047S |

**System components**

| Accessories | Description |
|---|---|
| Memograph M graphic data manager | The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.<br><br>• Technical Information TI00133R<br>• Operating Instructions BA00247R |
| Cerabar M | The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value.<br><br>• Technical Information TI00426P and TI00436P<br>• Operating Instructions BA00200P and BA00382P |
| Cerabar S | The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value.<br><br>• Technical Information TI00383P<br>• Operating Instructions BA00271P |
| iTEMP | The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature.<br><br>"Fields of Activity" document FA00006T |

# Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
• *Device Viewer* (www.endress.com/deviceviewer): Enter serial number from nameplate.
• *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

**Standard documentation**  Brief Operating Instructions

*Brief Operating Instructions for the sensor*

| Measuring device | Documentation code |
|---|---|
| Proline Promass E | KA01260D |

*Brief Operating Instructions for the transmitter*

| Measuring device | Documentation code | | | | | | | PROFINET with Ethernet-APL |
|---|---|---|---|---|---|---|---|---|
| | HART | FOUNDATION Fieldbus | PROFIBUS PA | PROFIBUS DP | Modbus RS485 | EtherNet/IP | PROFINET | |
| Proline 300 | KA01309D | KA01229D | KA01227D | KA01386D | KA01311D | KA01339D | KA01341D | KA01517D |

Operating Instructions

| Measuring device | Documentation code | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HART | FOUNDATION Fieldbus | PROFIBUS PA | PROFIBUS DP | Modbus RS485 | EtherNet/IP | PROFINET | PROFINET with Ethernet-APL |
| Promass E 300 | BA01484D | BA01517D | BA01506D | BA01855D | BA01495D | BA01727D | BA01738D | BA02110D |

Description of Device Parameters

| Measuring device | Documentation code | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HART | FOUNDATION Fieldbus | PROFIBUS PA | PROFIBUS DP | Modbus RS485 | EtherNet/IP | PROFINET | PROFINET with Ethernet-APL |
| Promass 300 | GP01057D | GP01094D | GP01058D | GP01134D | GP01059D | GP01114D | GP01115D | GP01168D |

Supplementary device-dependent documentation

**Safety instructions**

Safety instructions for electrical equipment for hazardous areas.

| Contents | Documentation code |
|---|---|
| ATEX/IECEx Ex d/Ex de | XA01405D |
| ATEX/IECEx Ex ec | XA01439D |
| cCSAus XP | XA01373D |
| cCSAus Ex d/ Ex de | XA01372D |
| cCSAus Ex nA | XA01507D |
| INMETRO Ex d/Ex de | XA01468D |
| INMETRO Ex ec | XA01470D |
| NEPSI Ex d/Ex de | XA01469D |
| NEPSI Ex nA | XA01471D |
| EAC Ex d/Ex de | XA01656D |
| EAC Ex nA | XA01657D |
| JPN Ex d | XA01778D |

*Remote display and operating module DKX001*

| Contents | Documentation code |
|---|---|
| ATEX/IECEx Ex i | XA01494D |
| ATEX/IECEx Ex ec | XA01498D |
| cCSAus IS | XA01499D |
| cCSAus Ex nA | XA01513D |
| INMETRO Ex i | XA01500D |
| INMETRO Ex ec | XA01501D |
| NEPSI Ex i | XA01502D |
| NEPSI Ex nA | XA01503D |

**Functional Safety Manual**

| Contents | Documentation code |
|---|---|
| Proline Promass 300 | SD01727D |

**Special Documentation**

| Contents | Documentation code |
|---|---|
| Information on the Pressure Equipment Directive | SD01614D |
| Remote display and operating module DKX001 | SD01763D |

| Contents | Documentation code |
|---|---|
| Radio approvals for WLAN interface for A309/A310 display module | SD01793D |
| OPC-UA server [1] | SD02039D |

1)  This Special Documentation is only available for device versions with a HART output.

| Contents | Documentation code | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HART | FOUNDATION Fieldbus | PROFIBUS PA | PROFIBUS DP | Modbus RS485 | PROFINET | EtherNet/IP | PROFINET with Ethernet-APL |
| Web server | SD01662D | SD01665D | SD01664D | SD02226D | SD01663D | SD01969D | SD01968D | SD02762D |
| Heartbeat Technology | SD01642D | SD01696D | SD01698D | SD02202D | SD01697D | SD01988D | SD01982 | SD02731D |
| Concentration measurement | SD01644D | SD01706D | SD01708D | SD02212D | SD01707D | SD02005D | SD02004D | SD02735D |
| Petroleum | SD02097D | – | SD02291D | SD02216D | SD02098D | SD02099D | SD02096D | SD02739D |
| Petroleum & locking function | SD02499D | – | – | – | SD02500D | – | – | SD02739D |
| Gas Fraction Handler | SD02584D | – | – | – | SD02584D | SD02584D | – | SD02584D |

### Installation Instructions

| Contents | Comment |
|---|---|
| Installation instructions for spare part sets and accessories | Documentation code: specified for each individual accessory → 🗎 109. |

# Registered trademarks

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