

# Technical Information

## Proline Promass O 100

Coriolis flowmeter



The robust high-pressure flowmeter with an ultra-compact transmitter

### Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Premium accuracy at highest process pressures, fully suitable for onshore/offshore conditions

### Device properties

- Measuring tube in 25Cr Duplex, 1.4410 (UNS S32750)
- Process pressure up to PN 250 (Class 1500)
- Nominal diameter: DN 80 to 150 (3 to 6")
- Robust, ultra-compact transmitter housing
- Highest degree of protection: IP69K
- Local display available

### Your benefits

- Maximum safety – highest resistance to stress corrosion cracking
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no inlet/outlet run needs
- Space-saving transmitter – full functionality on smallest footprint
- Time-saving local operation without additional software and hardware – integrated web server
- Integrated verification – Heartbeat Technology™

## Table of contents







<b>Document information</b> . . . . .	<b>4</b>	Vibration resistance . . . . .	50
Symbols used . . . . .	4	Shock resistance . . . . .	50
<b>Function and system design</b> . . . . .	<b>5</b>	Shock resistance . . . . .	50
Measuring principle . . . . .	5	Electromagnetic compatibility (EMC) . . . . .	50
Measuring system . . . . .	5	<b>Process</b> . . . . .	<b>50</b>
Equipment architecture . . . . .	7	Medium temperature range . . . . .	50
Safety . . . . .	7	Density . . . . .	51
<b>Input</b> . . . . .	<b>8</b>	Pressure-temperature ratings . . . . .	51
Measured variable . . . . .	8	Sensor housing . . . . .	52
Measuring range . . . . .	8	Rupture disk . . . . .	53
Operable flow range . . . . .	8	Flow limit . . . . .	53
Input signal . . . . .	9	Pressure loss . . . . .	53
<b>Output</b> . . . . .	<b>9</b>	System pressure . . . . .	53
Output signal . . . . .	9	Thermal insulation . . . . .	53
Signal on alarm . . . . .	11	Heating . . . . .	54
Ex connection data . . . . .	12	Vibrations . . . . .	54
Low flow cut off . . . . .	13	<b>Mechanical construction</b> . . . . .	<b>55</b>
Protocol-specific data . . . . .	13	Dimensions in SI units . . . . .	55
<b>Power supply</b> . . . . .	<b>23</b>	Dimensions in US units . . . . .	59
Terminal assignment . . . . .	23	Weight . . . . .	64
Pin assignment, device plug . . . . .	30	Materials . . . . .	64
Supply voltage . . . . .	33	Process connections . . . . .	66
Power consumption . . . . .	33	Surface roughness . . . . .	66
Current consumption . . . . .	33	<b>Human interface</b> . . . . .	<b>66</b>
Power supply failure . . . . .	33	Operating concept . . . . .	66
Electrical connection . . . . .	34	Local display . . . . .	66
Potential equalization . . . . .	38	Remote operation . . . . .	66
Terminals . . . . .	38	Service interface . . . . .	69
Cable entries . . . . .	39	<b>Certificates and approvals</b> . . . . .	<b>71</b>
Cable specification . . . . .	39	CE mark . . . . .	71
<b>Performance characteristics</b> . . . . .	<b>40</b>	C-Tick symbol . . . . .	71
Reference operating conditions . . . . .	40	Ex approval . . . . .	71
Maximum measured error . . . . .	40	HART certification . . . . .	72
Repeatability . . . . .	42	Certification PROFIBUS . . . . .	72
Response time . . . . .	42	Certification PROFINET . . . . .	72
Influence of ambient temperature . . . . .	42	EtherNet/IP certification . . . . .	72
Influence of medium temperature . . . . .	42	Modbus RS485 certification . . . . .	72
Influence of medium pressure . . . . .	43	Pressure Equipment Directive . . . . .	72
Design fundamentals . . . . .	43	Other standards and guidelines . . . . .	72
<b>Installation</b> . . . . .	<b>44</b>	<b>Ordering information</b> . . . . .	<b>73</b>
Mounting location . . . . .	44	<b>Application packages</b> . . . . .	<b>73</b>
Orientation . . . . .	45	Heartbeat Technology . . . . .	74
Inlet and outlet runs . . . . .	46	Concentration . . . . .	74
Special mounting instructions . . . . .	46	<b>Accessories</b> . . . . .	<b>74</b>
Mounting Safety Barrier Promass 100 . . . . .	47	Communication-specific accessories . . . . .	74
<b>Environment</b> . . . . .	<b>47</b>	Service-specific accessories . . . . .	75
Ambient temperature range . . . . .	47	System components . . . . .	76
Storage temperature . . . . .	49		
Climate class . . . . .	49		
Degree of protection . . . . .	49		

<b>Supplementary documentation</b> . . . . .	<b>76</b>
Standard documentation . . . . .	76
Supplementary device-dependent documentation . . . . .	76
<b>Registered trademarks</b> . . . . .	<b>77</b>









## Document information

### Symbols used





#### Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Direct current		Alternating current
	Direct current and alternating current		<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective ground connection</b> A terminal which must be connected to ground prior to establishing any other connections.		<b>Equipotential connection</b> A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

#### Symbols for certain types of information

Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.
	<b>Preferred</b> Procedures, processes or actions that are preferred.
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.
	<b>Tip</b> Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

#### Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers		Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	Sections
	Hazardous area		Safe area (non-hazardous area)
	Flow direction		

## 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

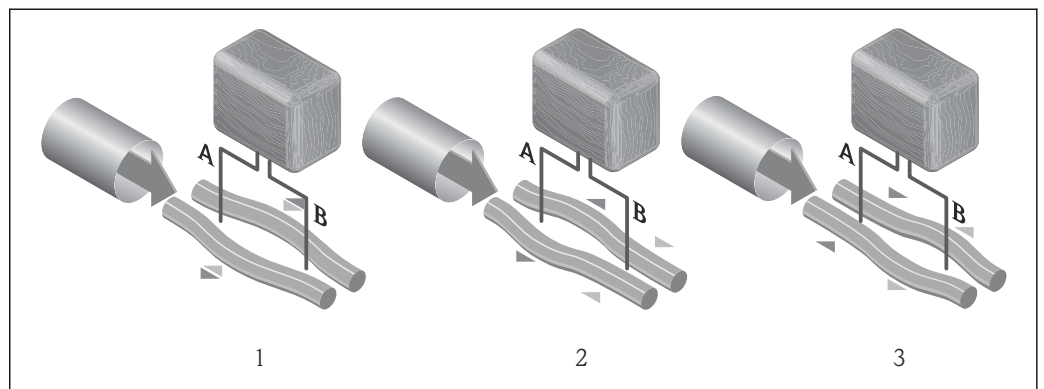
$\omega$  = rotational velocity

$v$  = 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).



The phase difference (A-B) increases with increasing mass flow. Electrodynamical 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. Resonance frequency is thus a function of 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

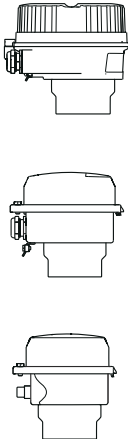
The temperature of the measuring tube is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output signal.

### Measuring system

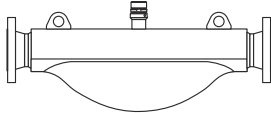
The device consists of a transmitter and a sensor. If a device with Modbus RS485 intrinsically safe is ordered, the Safety Barrier Promass 100 is part of the scope of supply and must be implemented to operate the device.

The device is available as a compact version:  
The transmitter and sensor form a mechanical unit.

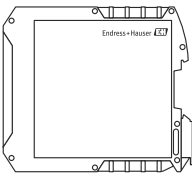
**Transmitter**

<p><b>Promass 100</b></p>  <p>A0016693</p> <p>A0016694</p> <p>A0016695</p>	<p>Device versions and materials:</p> <ul style="list-style-type: none"> <li>▪ Compact, aluminum coated: Aluminum, AlSi10Mg, coated</li> <li>▪ Compact, stainless: Stainless steel 1.4404 (316L)</li> <li>▪ Ultra-compact, stainless: Stainless steel 1.4404 (316L)</li> </ul> <p>Configuration:</p> <ul style="list-style-type: none"> <li>▪ Via operating tools (e.g. FieldCare)</li> <li>▪ Additionally for device version with local display: Via Web browser (e.g. Microsoft Internet Explorer)</li> <li>▪ Also for device version with 4-20 mA HART, pulse/frequency/switch output: Via Web browser (e.g. Microsoft Internet Explorer)</li> <li>▪ Also for device version with EtherNet/IP output: <ul style="list-style-type: none"> <li>▪ Via Web browser (e.g. Microsoft Internet Explorer)</li> <li>▪ Via Add-on Profile Level 3 for automation system from Rockwell Automation</li> <li>▪ Via Electronic Data Sheet (EDS)</li> </ul> </li> <li>▪ Also for device version with PROFINET output: <ul style="list-style-type: none"> <li>▪ Via Web browser (e.g. Microsoft Internet Explorer)</li> <li>▪ Via device master file (GSD)</li> </ul> </li> </ul>
---	--

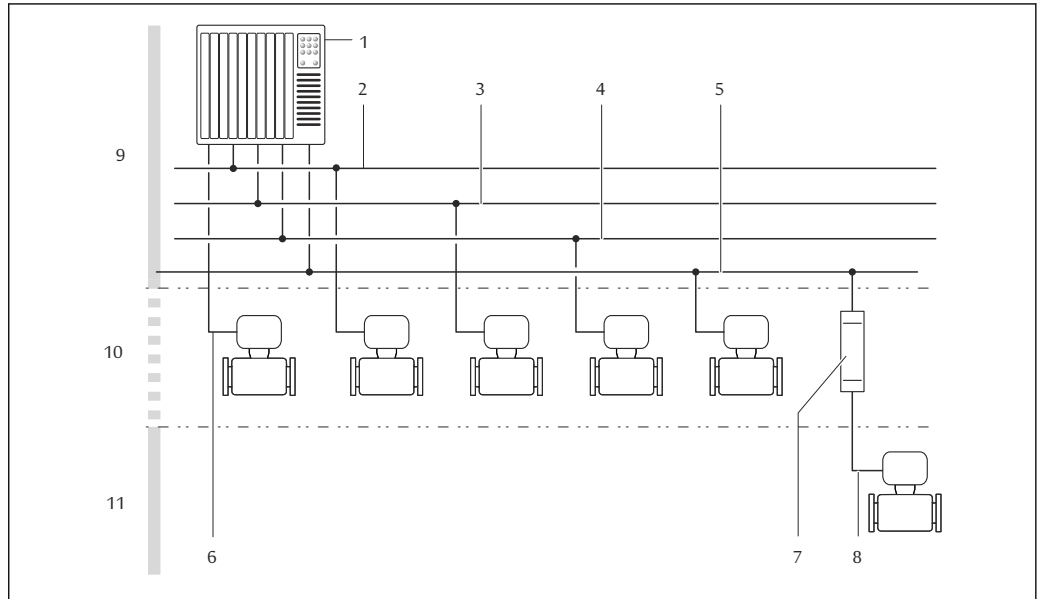
**Sensor**

<p><b>Promass O</b></p>  <p>A0019545</p>	<ul style="list-style-type: none"> <li>▪ For use at high pressures</li> <li>▪ Simultaneous measurement of flow, volume flow, density and temperature (multivariable)</li> <li>▪ Suitable for offshore applications</li> <li>▪ Nominal diameters: DN 80 to 150 (3 to 6")</li> <li>▪ Materials: <ul style="list-style-type: none"> <li>▪ Sensor: stainless steel, 1.4404 (316L)</li> <li>▪ Measuring tubes: stainless steel, 25Cr Duplex (Super Duplex) 1.4410 (UNS S32750)</li> <li>▪ Process connections: 25Cr Duplex (Super Duplex) 1.4410 (F53)</li> </ul> </li> </ul>
---	--

**Safety Barrier Promass 100**

 <p>A0016763</p>	<ul style="list-style-type: none"> <li>▪ Dual-channel safety barrier for installation in non-hazardous locations or zone 2/div. 2: <ul style="list-style-type: none"> <li>▪ Channel 1: DC 24 V power supply</li> <li>▪ Channel 2: Modbus RS485</li> </ul> </li> <li>▪ In addition to current, voltage and power limitation, it offers galvanic isolation of circuits for explosion protection.</li> <li>▪ Easy top-hat rail mounting (DIN 35 mm) for installation in control cabinets</li> </ul>
---	--

Equipment architecture



A0016779

1 Possibilities for integrating measuring devices into a system

- 1 Automation system (e.g. PLC)
- 2 EtherNet/IP
- 3 PROFIBUS DP
- 4 Modbus RS485
- 5 4-20 mA HART, pulse/frequency/switch output
- 6 Safety Barrier Promass 100
- 7 Modbus RS485 intrinsically safe
- 8 Non-hazardous area
- 9 Non-hazardous area and Zone 2/Div. 2
- 10 Intrinsically safe area and Zone 1/Div. 1

Safety

IT security

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

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

## Input

### Measured variable

#### Direct measured variables

- Mass flow
- Density
- Temperature

#### Calculated measured variables

- Volume flow
- Corrected volume flow
- Reference density

### Measuring range

#### Measuring ranges for liquids

DN		Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
80	3	0 to 180 000	0 to 6 615
100	4	0 to 350 000	0 to 12 860
150	6	0 to 800 000	0 to 29 400



#### Measuring ranges for gases

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

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

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

DN		x
[mm]	[in]	[kg/m <sup>3</sup> ]
80	3	110
100	4	130
150	6	200

 To calculate the measuring range, use the *Applicator* sizing tool →  75

#### Calculation example for gas

- Sensor: Promass O, DN 80
- Gas: Air with a density of 60.3 kg/m<sup>3</sup> (at 20 °C and 50 bar)
- Measuring range (liquid): 180 000 kg/h
- x = 130 kg/m<sup>3</sup> (for Promass O, DN 80)

Maximum possible full scale value:

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

#### Recommended measuring range

"Flow limit" section →  53

### Operable flow range

Over 1000 : 1.

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



**Input signal**

**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 transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section →  76

It is recommended to read in external measured values to calculate the following measured variables:

- Mass flow
- 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

*Digital communication*


The measured values can be written from the automation system to the measuring via:

- PROFIBUS DP
- Modbus RS485
- EtherNet/IP
- PROFINET

## Output



**Output signal**

**HART current output**

<b>Current output</b>	4-20 mA HART (active)
<b>Maximum output values</b>	<ul style="list-style-type: none"> <li>■ DC 24 V (no flow)</li> <li>■ 22.5 mA</li> </ul>
<b>Load</b>	0 to 700 Ω
<b>Resolution</b>	0.38 µA
<b>Damping</b>	Configurable: 0.07 to 999 s
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ Density</li> <li>■ Reference density</li> <li>■ Temperature</li> </ul> <p> The range of options increases if the measuring device has one or more application packages.</p>

**Pulse/frequency/switch output**

<b>Function</b>	Can be set to pulse, frequency or switch output
<b>Version</b>	Passive, open collector
<b>Maximum input values</b>	<ul style="list-style-type: none"> <li>■ DC 30 V</li> <li>■ 25 mA</li> </ul>
<b>Voltage drop</b>	For 25 mA: ≤ DC 2 V
<b>Pulse output</b>	

<b>Pulse width</b>	Configurable: 0.05 to 2 000 ms
<b>Maximum pulse rate</b>	10 000 Impulse/s
<b>Pulse value</b>	Adjustable
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> </ul>
<b>Frequency output</b>	
<b>Output frequency</b>	Configurable: 0 to 10 000 Hz
<b>Damping</b>	Configurable: 0 to 999 s
<b>Pulse/pause ratio</b>	1:1
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> </ul> <p> The range of options increases if the measuring device has one or more application packages.</p>
<b>Switch output</b>	
<b>Switching behavior</b>	Binary, conductive or non-conductive
<b>Switching delay</b>	Configurable: 0 to 100 s
<b>Number of switching cycles</b>	Unlimited
<b>Assignable functions</b>	<ul style="list-style-type: none"> <li>▪ Off</li> <li>▪ On</li> <li>▪ Diagnostic behavior</li> <li>▪ Limit value <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> </ul> </li> <li>▪ Totalizer 1-3</li> <li>▪ Flow direction monitoring</li> <li>▪ Status <ul style="list-style-type: none"> <li>▪ Partially filled pipe detection</li> <li>▪ Low flow cut off</li> </ul> </li> </ul> <p> The range of options increases if the measuring device has one or more application packages.</p>

**PROFIBUS DP**

<b>Signal encoding</b>	NRZ code
<b>Data transfer</b>	9.6 kBaud...12 MBaud

**Modbus RS485**

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

**EtherNet/IP**

<b>Standards</b>	In accordance with IEEE 802.3
------------------	-------------------------------

**PROFINET**

<b>Standards</b>	In accordance with IEEE 802.3
------------------	-------------------------------

**Signal on alarm**

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

**Current output 4 to 20 mA**

*4 to 20 mA*

<b>Failure mode</b>	Choose from: <ul style="list-style-type: none"> <li>▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43</li> <li>▪ 4 to 20 mA in accordance with US</li> <li>▪ Min. value: 3.59 mA</li> <li>▪ Max. value: 22.5 mA</li> <li>▪ Freely definable value between: 3.59 to 22.5 mA</li> <li>▪ Actual value</li> <li>▪ Last valid value</li> </ul>
---------------------	--

**Pulse/frequency/switch output**

<b>Pulse output</b>	
<b>Failure mode</b>	Choose from: <ul style="list-style-type: none"> <li>▪ Actual value</li> <li>▪ No pulses</li> </ul>
<b>Frequency output</b>	
<b>Failure mode</b>	Choose from: <ul style="list-style-type: none"> <li>▪ Actual value</li> <li>▪ 0 Hz</li> <li>▪ Defined value: 0 to 12 500 Hz</li> </ul>
<b>Switch output</b>	
<b>Failure mode</b>	Choose from: <ul style="list-style-type: none"> <li>▪ Current status</li> <li>▪ Open</li> <li>▪ Closed</li> </ul>

**PROFIBUS DP**

<b>Status and alarm messages</b>	Diagnostics in accordance with PROFIBUS PA Profile 3.02
----------------------------------	---

**Modbus RS485**

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

**EtherNet/IP**

<b>Device diagnostics</b>	Device condition can be read out in Input Assembly
---------------------------	--

**PROFINET**

<b>Device diagnostics</b>	According to "Application Layer protocol for decentralized periphery", Version 2.3
---------------------------	--

**Local display**

<b>Plain text display</b>	With information on cause and remedial measures
<b>Backlight</b>	Red backlighting indicates a device error.



Status signal as per NAMUR recommendation NE 107

**Interface/protocol**

- Via digital communication:
  - HART protocol
  - PROFIBUS DP
  - Modbus RS485
  - EtherNet/IP
  - PROFINET
- Via service interface  
CDI-RJ45 service interface

<b>Plain text display</b>	With information on cause and remedial measures
---------------------------	---



Additional information on remote operation → 66

**Web browser**

<b>Plain text display</b>	With information on cause and remedial measures
---------------------------	---

**Light emitting diodes (LED)**

<b>Status information</b>	<p>Status indicated by various light emitting diodes</p> <p>The following information is displayed depending on the device version:</p> <ul style="list-style-type: none"> <li>▪ Supply voltage active</li> <li>▪ Data transmission active</li> <li>▪ Device alarm/error has occurred</li> <li>▪ EtherNet/IP network available</li> <li>▪ EtherNet/IP connection established</li> <li>▪ PROFINET network available</li> <li>▪ PROFINET connection established</li> <li>▪ PROFINET blinking feature</li> </ul>
---------------------------	---


**Ex connection data**

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

**Safety Barrier Promass 100***Safety-related values*

Terminal numbers			
Supply voltage		Signal transmission	
2 (L-)	1 (L+)	26 (B)	27 (A)
$U_{nom} = DC\ 24\ V$ $U_{max} = AC\ 260\ V$		$U_{nom} = DC\ 5\ V$ $U_{max} = AC\ 260\ V$	


*Intrinsically safe values*

Terminal numbers			
Supply voltage		Signal transmission	
20 (L-)	10 (L+)	62 (B)	72 (A)
$U_o = 16.24 \text{ V}$ $I_o = 623 \text{ mA}$ $P_o = 2.45 \text{ W}$ With IIC <sup>1)</sup> : $L_o = 92.8 \text{ } \mu\text{H}$ , $C_o = 0.433 \text{ } \mu\text{F}$ , $L_o/R_o = 14.6 \text{ } \mu\text{H}/\Omega$ With IIB: $L_o = 372 \text{ } \mu\text{H}$ , $C_o = 2.57 \text{ } \mu\text{F}$ , $L_o/R_o = 58.3 \text{ } \mu\text{H}/\Omega$			
 For an overview and for information on the interdependencies between the gas group - sensor - nominal diameter, see the "Safety Instructions" (XA) document for the measuring device			

1) The gas group depends on the sensor and nominal diameter ff.

**Transmitter**

*Intrinsically safe values*

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


**Low flow cut off**

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

**Protocol-specific data**

**HART**

<b>Manufacturer ID</b>	0x11
<b>Device type ID</b>	0x4A
<b>HART protocol revision</b>	7
<b>Device description files (DTM, DD)</b>	Information and files under: <a href="http://www.endress.com">www.endress.com</a>
<b>HART load</b>	Min. 250 $\Omega$

<b>Dynamic variables</b>	<p>Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables.</p> <p><b>Measured variables for PV (primary dynamic variable)</b></p> <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> </ul> <p><b>Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)</b></p> <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> <li>▪ Totalizer 1</li> <li>▪ Totalizer 2</li> <li>▪ Totalizer 3</li> </ul> <p> The range of options increases if the measuring device has one or more application packages.</p> <p><b>Heartbeat Technology application package</b> Additional measured variables are available with the Heartbeat Technology application package:</p> <ul style="list-style-type: none"> <li>▪ Carrier pipe temperature</li> <li>▪ Oscillation amplitude 0</li> </ul>
<b>Device variables</b>	<p>Read out the device variables: HART command 9 The device variables are permanently assigned.</p> <p>A maximum of 8 device variables can be transmitted:</p> <ul style="list-style-type: none"> <li>▪ 0 = mass flow</li> <li>▪ 1 = volume flow</li> <li>▪ 2 = corrected volume flow</li> <li>▪ 3 = density</li> <li>▪ 4 = reference density</li> <li>▪ 5 = temperature</li> <li>▪ 6 = totalizer 1</li> <li>▪ 7 = totalizer 2</li> <li>▪ 8 = totalizer 3</li> <li>▪ 13 = target mass flow</li> <li>▪ 14 = carrier mass flow</li> <li>▪ 15 = concentration</li> </ul>



**PROFIBUS DP**

<b>Manufacturer ID</b>	0x11
<b>Ident number</b>	0x1561
<b>Profile version</b>	3.02
<b>Device description files (GSD, DTM, DD)</b>	<p>Information and files under:</p> <ul style="list-style-type: none"> <li>▪ <a href="http://www.endress.com">www.endress.com</a> On the product page for the device: Documents/Software → Device drivers</li> <li>▪ <a href="http://www.profibus.org">www.profibus.org</a></li> </ul>

<p><b>Output values</b> (from measuring device to automation system)</p>	<p><b>Analog input 1 to 8</b></p> <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Target mass flow</li> <li>▪ Carrier mass flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Concentration</li> <li>▪ Temperature</li> <li>▪ Carrier pipe temperature</li> <li>▪ Electronic temperature</li> <li>▪ Oscillation frequency</li> <li>▪ Oscillation amplitude</li> <li>▪ Frequency fluctuation</li> <li>▪ Oscillation damping</li> <li>▪ Tube damping fluctuation</li> <li>▪ Signal asymmetry</li> <li>▪ Exciter current</li> </ul> <p><b>Digital input 1 to 2</b></p> <ul style="list-style-type: none"> <li>▪ Partially filled pipe detection</li> <li>▪ Low flow cut off</li> </ul> <p><b>Totalizer 1 to 3</b></p> <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> </ul>
<p><b>Input values</b> (from automation system to measuring device)</p>	<p><b>Analog output 1 to 3 (fixed assignment)</b></p> <ul style="list-style-type: none"> <li>▪ Pressure</li> <li>▪ Temperature</li> <li>▪ Reference density</li> </ul> <p><b>Digital output 1 to 3 (fixed assignment)</b></p> <ul style="list-style-type: none"> <li>▪ Digital output 1: switch positive zero return on/off</li> <li>▪ Digital output 2: perform zero point adjustment</li> <li>▪ Digital output 3: switch switch output on/off</li> </ul> <p><b>Totalizer 1 to 3</b></p> <ul style="list-style-type: none"> <li>▪ Totalize</li> <li>▪ Reset and hold</li> <li>▪ Preset and hold</li> <li>▪ Stop</li> <li>▪ Operating mode configuration: <ul style="list-style-type: none"> <li>▪ Net flow total</li> <li>▪ Forward flow total</li> <li>▪ Reverse flow total</li> </ul> </li> </ul>
<p><b>Supported functions</b></p>	<ul style="list-style-type: none"> <li>▪ Identification &amp; Maintenance Simplest device identification on the part of the control system and nameplate</li> <li>▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download</li> <li>▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur</li> </ul>
<p><b>Configuration of the device address</b></p>	<ul style="list-style-type: none"> <li>▪ DIP switches on the I/O electronics module</li> <li>▪ Via operating tools (e.g. FieldCare)</li> </ul>

**Modbus RS485**

<p><b>Protocol</b></p>	<p>Modbus Applications Protocol Specification V1.1</p>
<p><b>Device type</b></p>	<p>Slave</p>
<p><b>Slave address range</b></p>	<p>1 to 247</p>
<p><b>Broadcast address range</b></p>	<p>0</p>


<b>Function codes</b>	<ul style="list-style-type: none"> <li>▪ 03: Read holding register</li> <li>▪ 04: Read input register</li> <li>▪ 06: Write single registers</li> <li>▪ 08: Diagnostics</li> <li>▪ 16: Write multiple registers</li> <li>▪ 23: Read/write multiple registers</li> </ul>
<b>Broadcast messages</b>	Supported by the following function codes: <ul style="list-style-type: none"> <li>▪ 06: Write single registers</li> <li>▪ 16: Write multiple registers</li> <li>▪ 23: Read/write multiple registers</li> </ul>
<b>Supported baud rate</b>	<ul style="list-style-type: none"> <li>▪ 1 200 BAUD</li> <li>▪ 2 400 BAUD</li> <li>▪ 4 800 BAUD</li> <li>▪ 9 600 BAUD</li> <li>▪ 19 200 BAUD</li> <li>▪ 38 400 BAUD</li> <li>▪ 57 600 BAUD</li> <li>▪ 115 200 BAUD</li> </ul>
<b>Data transfer mode</b>	<ul style="list-style-type: none"> <li>▪ ASCII</li> <li>▪ RTU</li> </ul>
<b>Data access</b>	Each device parameter can be accessed via Modbus RS485.  For Modbus register information, see "Description of device parameters" documentation →  76

### EtherNet/IP

<b>Protocol</b>	<ul style="list-style-type: none"> <li>▪ The CIP Networks Library Volume 1: Common Industrial Protocol</li> <li>▪ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP</li> </ul>
<b>Communication type</b>	<ul style="list-style-type: none"> <li>▪ 10Base-T</li> <li>▪ 100Base-TX</li> </ul>
<b>Device profile</b>	Generic device (product type: 0x2B)
<b>Manufacturer ID</b>	0x49E
<b>Device type ID</b>	0x104A
<b>Baud rates</b>	Automatic <sup>10</sup> / <sub>100</sub> Mbit with half-duplex and full-duplex detection
<b>Polarity</b>	Auto-polarity for automatic correction of crossed TxD and RxD pairs
<b>Supported CIP connections</b>	Max. 3 connections
<b>Explicit connections</b>	Max. 6 connections
<b>I/O connections</b>	Max. 6 connections (scanner)
<b>Configuration options for measuring device</b>	<ul style="list-style-type: none"> <li>▪ DIP switches on the electronics module for IP addressing</li> <li>▪ Manufacturer-specific software (FieldCare)</li> <li>▪ Add-on Profile Level 3 for Rockwell Automation control systems</li> <li>▪ Web browser</li> <li>▪ Electronic Data Sheet (EDS) integrated in the measuring device</li> </ul>
<b>Configuration of the EtherNet interface</b>	<ul style="list-style-type: none"> <li>▪ Speed: 10 MBit, 100 MBit, auto (factory setting)</li> <li>▪ Duplex: half-duplex, full-duplex, auto (factory setting)</li> </ul>
<b>Configuration of the device address</b>	<ul style="list-style-type: none"> <li>▪ DIP switches on the electronics module for IP addressing (last octet)</li> <li>▪ DHCP</li> <li>▪ Manufacturer-specific software (FieldCare)</li> <li>▪ Add-on Profile Level 3 for Rockwell Automation control systems</li> <li>▪ Web browser</li> <li>▪ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)</li> </ul>
<b>Device Level Ring (DLR)</b>	No





<b>Fix Input</b>			
<b>RPI</b>	5 ms to 10 s (factory setting: 20 ms)		
<b>Exclusive Owner Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x68	398
	O → T configuration:	0x66	64
	T → O configuration:	0x64	44
<b>Exclusive Owner Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x69	-
	O → T configuration:	0x66	64
	T → O configuration:	0x64	44
<b>Input only Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	44
<b>Input only Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	44
<b>Input Assembly</b>	<ul style="list-style-type: none"> <li>▪ Current device diagnostics</li> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> <li>▪ Totalizer 1</li> <li>▪ Totalizer 2</li> <li>▪ Totalizer 3</li> </ul>		
<b>Configurable Input</b>			
<b>RPI</b>	5 ms to 10 s (factory setting: 20 ms)		
<b>Exclusive Owner Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x68	398
	O → T configuration:	0x66	64
	T → O configuration:	0x65	88
<b>Exclusive Owner Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x69	-
	O → T configuration:	0x66	64
	T → O configuration:	0x65	88
<b>Input only Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88
<b>Input only Multicast</b>		<b>Instance</b>	<b>Size [byte]</b>
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88

<b>Configurable Input Assembly</b>	<ul style="list-style-type: none"> <li>▪ Current device diagnostics</li> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> <li>▪ Totalizer 1</li> <li>▪ Totalizer 2</li> <li>▪ Totalizer 3</li> </ul> <p> The range of options increases if the measuring device has one or more application packages.</p>
<b>Fix Output</b>	
<b>Output Assembly</b>	<ul style="list-style-type: none"> <li>▪ Activation of reset totalizers 1-3</li> <li>▪ Activation of pressure compensation</li> <li>▪ Activation of reference density compensation</li> <li>▪ Activation of temperature compensation</li> <li>▪ Reset totalizers 1-3</li> <li>▪ External pressure value</li> <li>▪ Pressure unit</li> <li>▪ External reference density</li> <li>▪ Reference density unit</li> <li>▪ External temperature</li> <li>▪ Temperature unit</li> </ul>
<b>Configuration</b>	
<b>Configuration Assembly</b>	<p>Only the most common configurations are listed below.</p> <ul style="list-style-type: none"> <li>▪ Software write protection</li> <li>▪ Mass flow unit</li> <li>▪ Mass unit</li> <li>▪ Volume flow unit</li> <li>▪ Volume unit</li> <li>▪ Corrected volume flow unit</li> <li>▪ Corrected volume unit</li> <li>▪ Density unit</li> <li>▪ Reference density unit</li> <li>▪ Temperature unit</li> <li>▪ Pressure unit</li> <li>▪ Length</li> <li>▪ Totalizer 1-3: <ul style="list-style-type: none"> <li>▪ Assignment</li> <li>▪ Unit</li> <li>▪ Operating mode</li> <li>▪ Failsafe mode</li> </ul> </li> <li>▪ Alarm delay</li> </ul>

**PROFINET**

<b>Protocol</b>	"Application layer protocol for decentral device periphery and distributed automation", version 2.3
<b>Conformity class</b>	B
<b>Communication type</b>	100 MBit/s
<b>Device profile</b>	Application interface identifier 0xF600 Generic device
<b>Manufacturer ID</b>	0x11
<b>Device type ID</b>	0x844A
<b>Device description files (GSD, DTM)</b>	Information and files under: <ul style="list-style-type: none"> <li>▪ <a href="http://www.endress.com">www.endress.com</a> On the product page for the device: Documents/Software → Device drivers</li> <li>▪ <a href="http://www.profibus.org">www.profibus.org</a></li> </ul>
<b>Baud rates</b>	Automatic 100 Mbit/s with full-duplex detection

<b>Cycle times</b>	From 8 ms
<b>Polarity</b>	Auto-polarity for automatic correction of crossed TxD and RxD pairs
<b>Supported connections</b>	<ul style="list-style-type: none"> <li>▪ 1 x AR (Application Relation)</li> <li>▪ 1 x Input CR (Communication Relation)</li> <li>▪ 1 x Output CR (Communication Relation)</li> <li>▪ 1 x Alarm CR (Communication Relation)</li> </ul>
<b>Configuration options for measuring device</b>	<ul style="list-style-type: none"> <li>▪ DIP switches on the electronics module, for device name assignment (last part)</li> <li>▪ Manufacturer-specific software (FieldCare, DeviceCare)</li> <li>▪ Web browser</li> <li>▪ Device master file (GSD), can be read out via the integrated Web server of the measuring device</li> </ul>
<b>Configuration of the device name</b>	<ul style="list-style-type: none"> <li>▪ DIP switches on the electronics module, for device name assignment (last part)</li> <li>▪ DCP protocol</li> </ul>
<b>Output values</b> (from measuring device to automation system)	<p><b>Analog Input module (slot 1 to 14)</b></p> <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> <li>▪ Target mass flow</li> <li>▪ Carrier mass flow</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Concentration</li> <li>▪ Temperature</li> <li>▪ Carrier pipe temperature</li> <li>▪ Electronic temperature</li> <li>▪ Oscillation frequency</li> <li>▪ Oscillation amplitude</li> <li>▪ Frequency fluctuation</li> <li>▪ Oscillation damping</li> <li>▪ Tube damping fluctuation</li> <li>▪ Signal asymmetry</li> <li>▪ Exciter current</li> </ul> <p><b>Discrete Input module (slot 1 to 14)</b></p> <ul style="list-style-type: none"> <li>▪ Empty pipe detection</li> <li>▪ Low flow cut off</li> </ul> <p><b>Diagnostics Input module (slot 1 to 14)</b></p> <ul style="list-style-type: none"> <li>▪ Last diagnostics</li> <li>▪ Current diagnosis</li> </ul> <p><b>Totalizer 1 to 3 (slot 15 to 17)</b></p> <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Volume flow</li> <li>▪ Corrected volume flow</li> </ul> <p><b>Heartbeat Verification module (fixed assignment)</b> Verification status (slot 23)</p> <p> The range of options increases if the measuring device has one or more application packages.</p>

<p><b>Input values</b> (from automation system to measuring device)</p>	<p><b>Analog Output module (fixed assignment)</b></p> <ul style="list-style-type: none"> <li>▪ External pressure (slot 18)</li> <li>▪ External temperature (slot 19)</li> <li>▪ External reference density (slot 20)</li> </ul> <p><b>Discrete Output module (fixed assignment)</b></p> <ul style="list-style-type: none"> <li>▪ Activate/deactivate positive zero return (slot 21)</li> <li>▪ Perform zero point adjustment (slot 22)</li> </ul> <p><b>Totalizer 1 to 3 (slot 15 to 17)</b></p> <ul style="list-style-type: none"> <li>▪ Totalize</li> <li>▪ Reset and hold</li> <li>▪ Preset and hold</li> <li>▪ Stop</li> <li>▪ Operating mode configuration:                             <ul style="list-style-type: none"> <li>▪ Net flow total</li> <li>▪ Forward flow total</li> <li>▪ Reverse flow total</li> </ul> </li> </ul> <p><b>Heartbeat Verification module (fixed assignment)</b> Start verification (slot 23)</p> <p> The range of options increases if the measuring device has one or more application packages.</p>
<p><b>Supported functions</b></p>	<ul style="list-style-type: none"> <li>▪ Identification &amp; Maintenance Simple device identification via:                             <ul style="list-style-type: none"> <li>▪ Control system</li> <li>▪ Nameplate</li> </ul> </li> <li>▪ Measured value status The process variables are communicated with a measured value status</li> <li>▪ Blinking feature via the local display for simple device identification and assignment</li> </ul>

*Administration of software options*

Input/output value	Process variable	Category	Slot
Output value	Mass flow	Process variable	1 to 14
	Volume flow		
	Corrected volume flow		
	Density		
	Reference density		
	Temperature		
	Electronic temperature		
	Oscillation frequency		
	Frequency fluctuation		
	Oscillation damping		
	Oscillation frequency		
	Signal asymmetry		
	Exciter current		
	Empty pipe detection		
	Low flow cut off		
Current device diagnostics			
Previous device diagnostics			
Output value	Target mass flow	Concentration <sup>1)</sup>	1 to 14
	Carrier mass flow		
	Concentration		
Output value	Carrier pipe temperature	Heartbeat <sup>2)</sup>	1 to 14

Input/output value	Process variable	Category	Slot
	Oscillation damping 1		
	Oscillation frequency 1		
	Oscillation amplitude 0		
	Oscillation amplitude 1		
	Frequency fluctuation 1		
	Tube damping fluctuation 1		
	Exciter current 1		
Input value	External density	Process monitoring	18
	External temperature		19
	External reference density		20
	Flow override		21
	Zero point adjustment		22
	Status verification	Heartbeat Verification <sup>2)</sup>	23

- 1) Only available with the "Concentration" application package.
- 2) Only available with the "Heartbeat" application package.

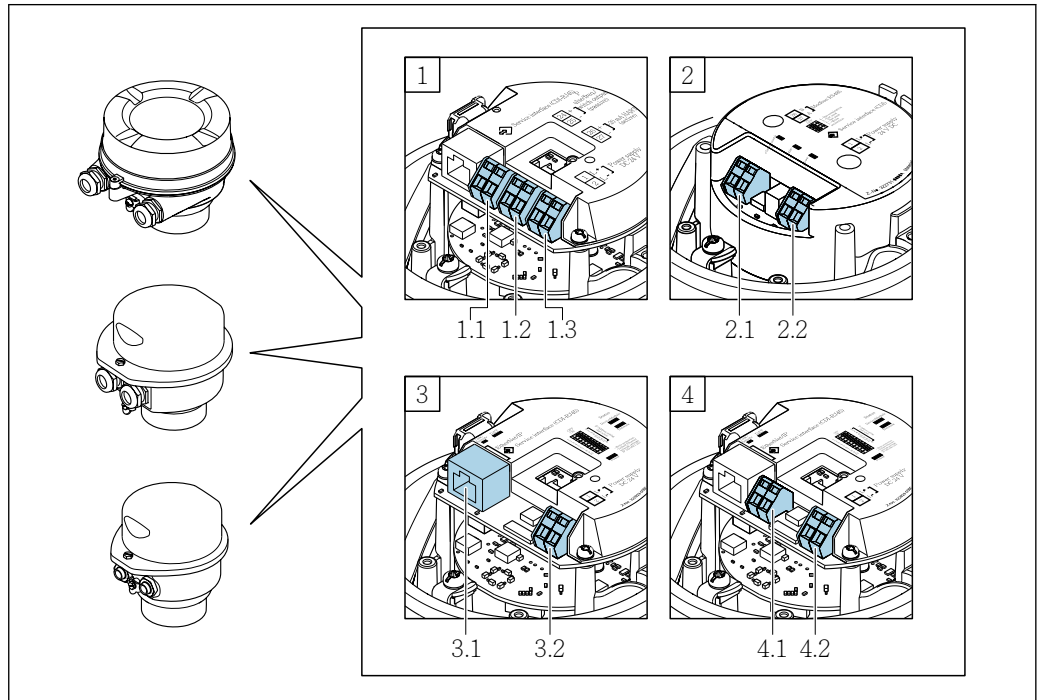
*Startup configuration*

Startup configuration (NSU)	<p>If startup configuration is enabled, the configuration of the most important device parameters is taken from the automation system and used.</p> <p>The following configuration is taken from the automation system:</p> <ul style="list-style-type: none"> <li>▪ Management <ul style="list-style-type: none"> <li>▪ Software revision</li> <li>▪ Write protection</li> </ul> </li> <li>▪ System units <ul style="list-style-type: none"> <li>▪ Mass flow</li> <li>▪ Mass</li> <li>▪ Volume flow</li> <li>▪ Volume</li> <li>▪ Corrected volume flow</li> <li>▪ Corrected volume</li> <li>▪ Density</li> <li>▪ Reference density</li> <li>▪ Temperature</li> <li>▪ Pressure</li> </ul> </li> <li>▪ Concentration application package <ul style="list-style-type: none"> <li>▪ Coefficients A0 to A4</li> <li>▪ Coefficients B1 to B3</li> </ul> </li> <li>▪ Sensor adjustment</li> <li>▪ Process parameter <ul style="list-style-type: none"> <li>▪ Damping (flow, density, temperature)</li> <li>▪ Flow override</li> </ul> </li> <li>▪ Low flow cut off <ul style="list-style-type: none"> <li>▪ Assign process variable</li> <li>▪ Switch-on/switch-off point</li> <li>▪ Pressure shock suppression</li> </ul> </li> <li>▪ Empty pipe detection <ul style="list-style-type: none"> <li>▪ Assign process variable</li> <li>▪ Limit values</li> <li>▪ Response time</li> <li>▪ Max. damping</li> </ul> </li> <li>▪ Corrected volume flow calculation <ul style="list-style-type: none"> <li>▪ External reference density</li> <li>▪ Fixed reference density</li> <li>▪ Reference temperature</li> <li>▪ Linear expansion coefficient</li> <li>▪ Square expansion coefficient</li> </ul> </li> <li>▪ Measuring mode <ul style="list-style-type: none"> <li>▪ Medium</li> <li>▪ Gas type</li> <li>▪ Reference sound velocity</li> <li>▪ Temperature coefficient sound velocity</li> </ul> </li> <li>▪ External compensation <ul style="list-style-type: none"> <li>▪ Pressure compensation</li> <li>▪ Pressure value</li> <li>▪ External pressure</li> </ul> </li> <li>▪ Diagnostic settings</li> <li>▪ Diagnostic behavior for diverse diagnostic information</li> </ul>
-----------------------------	---

# Power supply

Terminal assignment

Overview: housing version and connection versions



A0016770

- A Housing version: compact, aluminum coated
- B Housing version: compact, stainless
- C Housing version: ultra-compact, stainless
- 1 Connection version: 4-20 mA HART, pulse/frequency/switch output
  - 1.1 Signal transmission: pulse/frequency/switch output
  - 1.2 Signal transmission: 4-20 mA HART
  - 1.3 Supply voltage
- 2 Connection version: Modbus RS485
  - 2.1 Signal transmission
  - 2.2 Supply voltage
- 3 Connection version: EtherNet/IP and PROFINET
  - 3.1 Signal transmission
  - 3.2 Supply voltage
- 4 Connection version: PROFIBUS DP
  - 4.1 Signal transmission
  - 4.2 Supply voltage

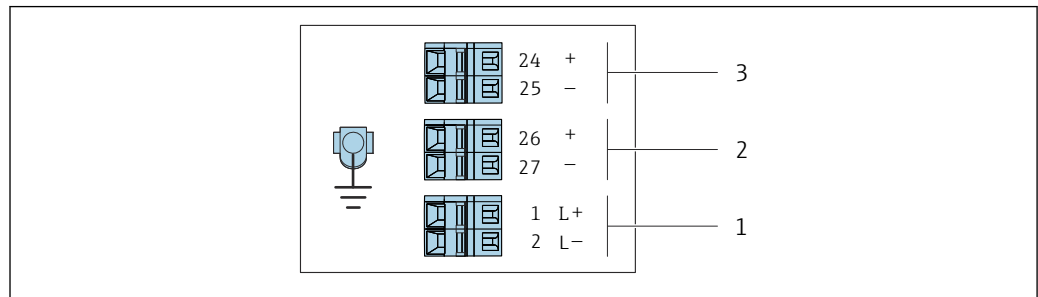
**Transmitter**

Connection version 4-20 mA HART with pulse/frequency/switch output

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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Outputs	Power supply	
Options A, B	Terminals	Terminals	<ul style="list-style-type: none"> <li>▪ Option A: coupling M20x1</li> <li>▪ Option B: thread M20x1</li> <li>▪ Option C: thread G ½"</li> <li>▪ Option D: thread NPT ½"</li> </ul>
Options A, B	Device plugs → 31	Terminals	<ul style="list-style-type: none"> <li>▪ Option L: plug M12x1 + thread NPT ½"</li> <li>▪ Option N: plug M12x1 + coupling M20</li> <li>▪ Option P: plug M12x1 + thread G ½"</li> <li>▪ Option U: plug M12x1 + thread M20</li> </ul>
Options A, B, C	Device plugs → 31	Device plugs → 31	Option Q: 2 x plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> <li>▪ Option A: compact, coated aluminum</li> <li>▪ Option B: compact, stainless</li> <li>▪ Option C: ultra-compact, stainless</li> </ul>			



A0016888

2 Terminal assignment 4-20 mA HART with pulse/frequency/switch output

- 1 Power supply: DC 24 V
- 2 Output 1: 4-20 mA HART (active)
- 3 Output 2: pulse/frequency/switch output (passive)

Order code "Output"	Terminal number					
	Power supply		Output 1		Output 2	
	2 (L-)	1 (L+)	27 (-)	26 (+)	25 (-)	24 (+)
Option B	DC 24 V		4-20 mA HART (active)		Pulse/frequency/switch output (passive)	
Order code for "Output": Option B: 4-20 mA HART with pulse/frequency/switch output						






PROFIBUS DP connection version

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

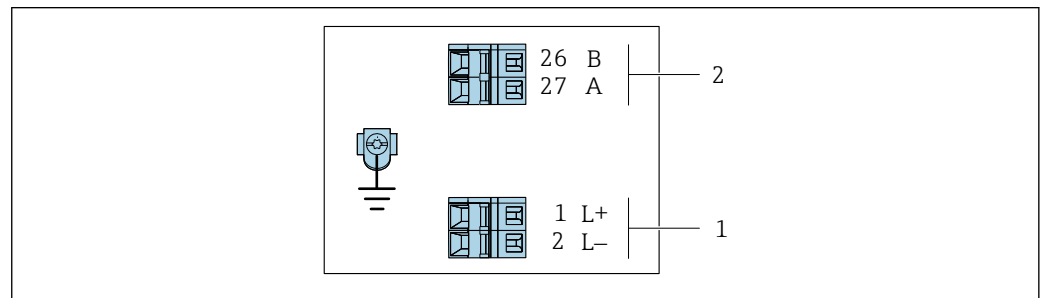
Order code for "Output", option **L**

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options <b>A, B</b>	Terminals	Terminals	<ul style="list-style-type: none"> <li>▪ Option <b>A</b>: coupling M20x1</li> <li>▪ Option <b>B</b>: thread M20x1</li> <li>▪ Option <b>C</b>: thread G ½"</li> <li>▪ Option <b>D</b>: thread NPT ½"</li> </ul>
Options <b>A, B</b>	Device plug connectors →  31	Terminals	<ul style="list-style-type: none"> <li>▪ Option <b>L</b>: plug M12x1 + thread NPT ½"</li> <li>▪ Option <b>N</b>: plug M12x1 + coupling M20</li> <li>▪ Option <b>P</b>: plug M12x1 + thread G ½"</li> <li>▪ Option <b>U</b>: plug M12x1 + thread M20</li> </ul>
Options <b>A, B, C</b>	Device plug connectors →  31	Device plug connectors →  31	Option <b>Q</b> : 2 x plug M12x1

Order code for "Housing":

- Option **A**: compact, coated aluminum
- Option **B**: compact, stainless
- Option **C**: ultra-compact, stainless



A0022716

 3 PROFIBUS DP terminal assignment

- 1 Power supply: DC 24 V
- 2 PROFIBUS DP

Order code "Output"	Terminal number			
	Power supply		Output	
	2 (L-)	1 (L+)	26 (RxD/TxD-P)	27 (RxD/TxD-N)
Option <b>L</b>	DC 24 V		B	A




Order code for "Output":  
Option **L**: PROFIBUS DP, for use in non-hazardous areas and Zone 2/Div. 2

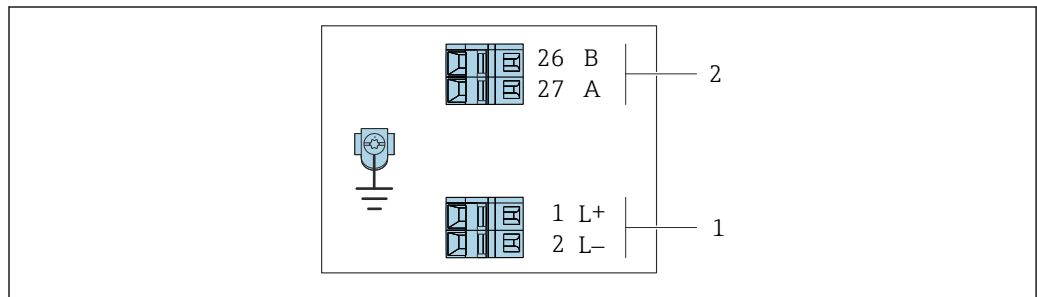
Modbus RS485 connection version


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

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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B	Terminals	Terminals	<ul style="list-style-type: none"> <li>▪ Option A: coupling M20x1</li> <li>▪ Option B: thread M20x1</li> <li>▪ Option C: thread G ½"</li> <li>▪ Option D: thread NPT ½"</li> </ul>
Options A, B	Device plugs →  31	Terminals	<ul style="list-style-type: none"> <li>▪ Option L: plug M12x1 + thread NPT ½"</li> <li>▪ Option N: plug M12x1 + coupling M20</li> <li>▪ Option P: plug M12x1 + thread G ½"</li> <li>▪ Option U: plug M12x1 + thread M20</li> </ul>
Options A, B, C	Device plugs →  31	Device plugs →  31	Option Q: 2 x plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> <li>▪ Option A: compact, coated aluminum</li> <li>▪ Option B: compact, stainless</li> <li>▪ Option C: ultra-compact, stainless</li> </ul>			



 4 Modbus RS485 terminal assignment, connection version for use in non-hazardous areas and Zone 2/Div. 2

- 1 Power supply: DC 24 V
- 2 Modbus RS485


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

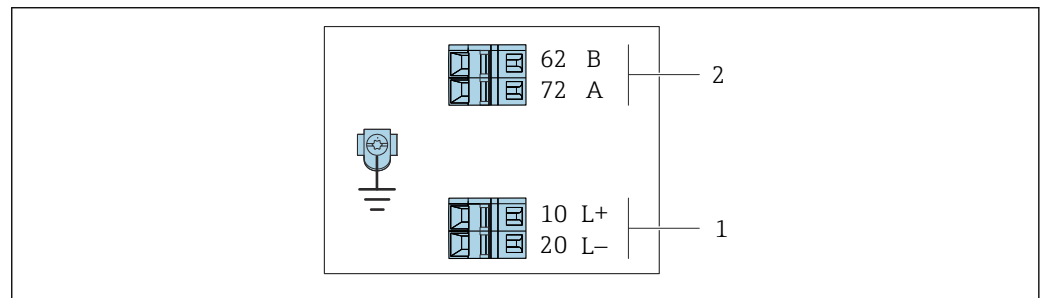
*Modbus RS485 connection version*

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


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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options A, B	Terminals	Terminals	<ul style="list-style-type: none"> <li>▪ Option A: coupling M20x1</li> <li>▪ Option B: thread M20x1</li> <li>▪ Option C: thread G ½"</li> <li>▪ Option D: thread NPT ½"</li> </ul>
A, B, C	Device plugs →  31		Option I: plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> <li>▪ Option A: compact, coated aluminum</li> <li>▪ Option B: compact, stainless</li> <li>▪ Option C: ultra-compact, stainless</li> </ul>			



A0030219

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

- 1 *Intrinsically safe power supply*
- 2 *Modbus RS485*

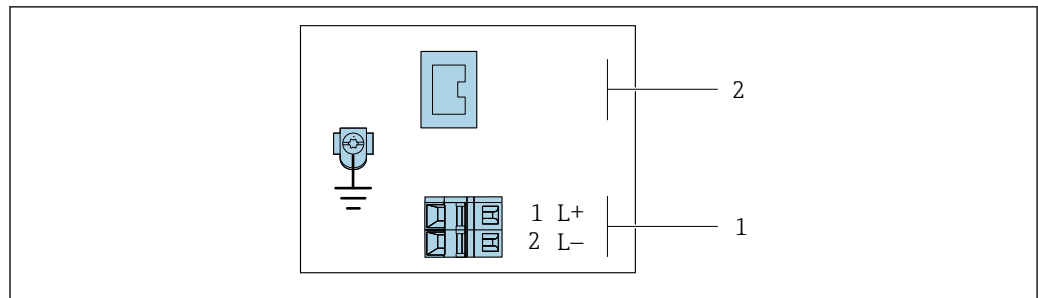
Order code "Output"	10 (L+)	20 (L-)	62 (B)	72 (A)
Option <b>M</b>	Intrinsically safe supply voltage		Modbus RS485 intrinsically safe	
Order code for "Output": Option <b>M</b> : Modbus RS485, for use in the intrinsically safe area (connection via Safety Barrier Promass 100)				

*EtherNet/IP connection version*

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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options <b>A, B</b>	Device plug connectors → 32	Terminals	<ul style="list-style-type: none"> <li>▪ Option <b>L</b>: plug M12x1 + thread NPT ½"</li> <li>▪ Option <b>N</b>: plug M12x1 + coupling M20</li> <li>▪ Option <b>P</b>: plug M12x1 + thread G ½"</li> <li>▪ Option <b>U</b>: plug M12x1 + thread M20</li> </ul>
Options <b>A, B, C</b>	Device plug connectors → 32	Device plug connectors → 32	Option <b>Q</b> : 2 x plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> <li>▪ Option <b>A</b>: compact, coated aluminum</li> <li>▪ Option <b>B</b>: compact, stainless</li> <li>▪ Option <b>C</b>: ultra-compact, stainless</li> </ul>			



A0017054

6 EtherNet/IP terminal assignment




- 1 Power supply: DC 24 V
- 2 EtherNet/IP

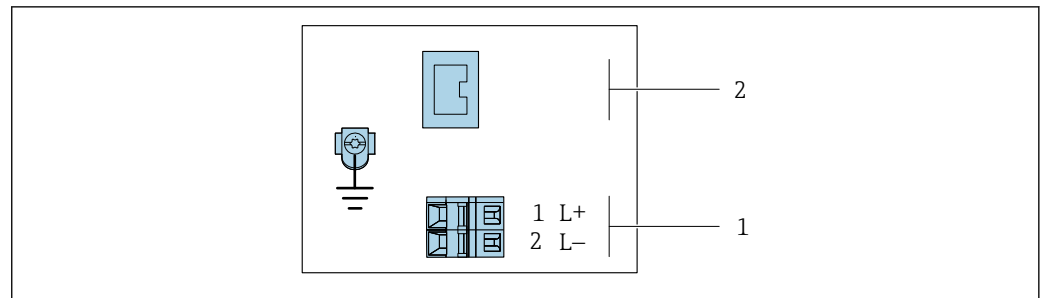
Order code "Output"	Terminal number		Output Device plug M12x1
	Power supply 2 (L-)	1 (L+)	
Option <b>N</b>	DC 24 V		EtherNet/IP
Order code for "Output": Option <b>N</b> : EtherNet/IP			

*PROFINET connection version*


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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options <b>A, B</b>	Device plug connectors →  30	Terminals	<ul style="list-style-type: none"> <li>▪ Option <b>L</b>: plug M12x1 + thread NPT 1/2"</li> <li>▪ Option <b>N</b>: plug M12x1 + coupling M20</li> <li>▪ Option <b>P</b>: plug M12x1 + thread G 1/2"</li> <li>▪ Option <b>U</b>: plug M12x1 + thread M20</li> </ul>
Options <b>A, B, C</b>	Device plug connectors →  30	Device plug connectors →  30	Option <b>Q</b> : 2 x plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> <li>▪ Option <b>A</b>: compact, coated aluminum</li> <li>▪ Option <b>B</b>: compact, stainless</li> <li>▪ Option <b>C</b>: ultra-compact, stainless</li> </ul>			



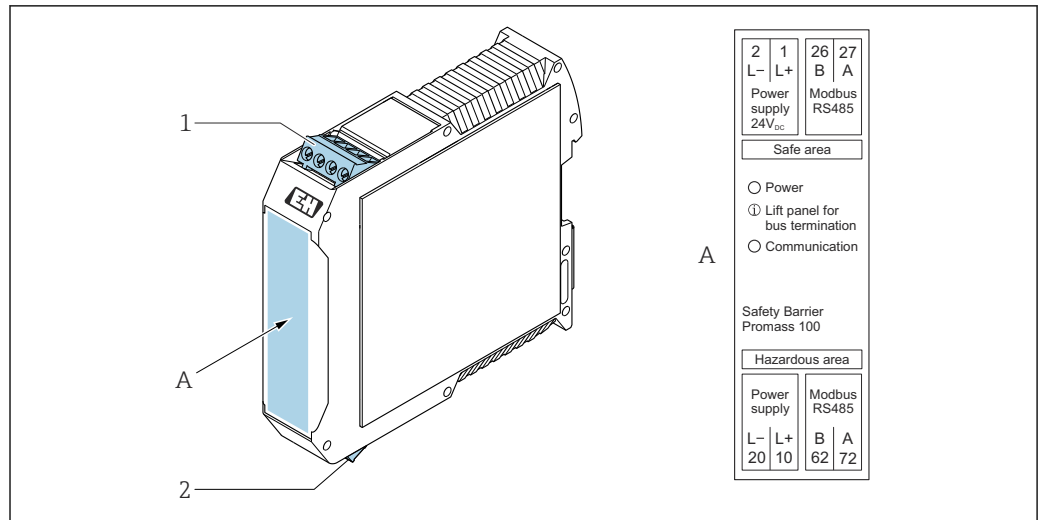
A0017054

 7 *PROFINET terminal assignment*

- 1 Power supply: DC 24 V
- 2 PROFINET

Order code "Output"	Terminal number		Output Device plug M12x1
	Power supply 2 (L-)	1 (L+)	
Option <b>R</b>	DC 24 V		PROFINET
Order code for "Output": Option <b>R</b> : PROFINET			

Safety Barrier Promass 100



A0030220

8 Safety Barrier Promass 100 with terminals

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

Pin assignment, device plug

- i** Order codes for the M12x1 connectors, see the "Order code for **electrical connection**" column:
  - 4-20 mA HART, pulse/frequency/switch output → 23
  - PROFIBUS DP → 25
  - Modbus RS485 → 26
  - EtherNet/IP → 28
  - PROFINET → 29

Supply voltage

For all connection versions except MODBUS RS485 intrinsically safe (device side)

- i** Device plug MODBUS RS485 intrinsically safe with supply voltage → 31

<p style="text-align: center;">A0029042</p>	Pin	Assignment	
	1	L+	DC 24 V
	2		Not assigned
	3		Not assigned
	4	L-	DC 24 V
	5		Grounding/shielding <sup>1)</sup>
Coding		Plug/socket	
A		Plug	

1) Not assigned for order code for "Housing", option C "Ultra-compact, hygienic, stainless"

- i** The following is recommended as a socket:
  - Binder, series 763, part no. 79 3440 35 05
  - Alternatively: Phoenix part no. 1682951 SAC-5P-5.0-PUR/M12FS SH
    - With the order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
    - With the order code for "Output", option **N**: EtherNet/IP
  - When using the device in a hazardous location: Use a suitably certified socket.

**4-20 mA HART with pulse/frequency/switch output**

Device plug for signal transmission (device side)

	Pin		Assignment
	1	+	4-20 mA HART (active)
	2	-	4-20 mA HART (active)
	3	+	Pulse/frequency/switch output (passive)
	4	-	Pulse/frequency/switch output (passive)
	5		Grounding/shielding <sup>1)</sup>
Coding		Plug/socket	
A		Socket	

1) Not assigned for order code for "Housing", option C "Ultra-compact, hygienic, stainless"



- Recommended plug: Binder, series 763, part no. 79 3439 12 05
- When using the device in a hazardous location, use a suitably certified plug.

**PROFIBUS DP**



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

Device plug for signal transmission (device side)

	Pin		Assignment
	1		Not assigned
	2	A	PROFIBUS DP
	3		Not assigned
	4	B	PROFIBUS DP
	5		Grounding/shielding <sup>1)</sup>
Coding		Plug/socket	
B		Socket	

1) Not assigned for order code for "Housing", option C "Ultra-compact, hygienic, stainless"



- Recommended plug: Binder, series 763, part no. 79 4449 20 05
- When using the device in a hazardous location, use a suitably certified plug.

**MODBUS RS485**

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

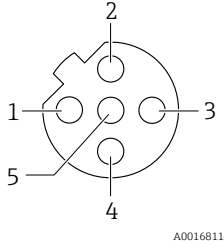
	Pin		Assignment
	1	L+	Supply voltage, intrinsically safe
	2	A	Modbus RS485 intrinsically safe
	3	B	
	4	L-	Supply voltage, intrinsically safe
	5		Grounding/shielding <sup>1)</sup>
Coding		Plug/socket	
A		Plug	

1) Not assigned for order code for "Housing", option C "Ultra-compact, hygienic, stainless"

- i** Recommended socket: Binder, series 763, part no. 79 3439 12 05
- When using the device in a hazardous location: Use a suitably certified socket.

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

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

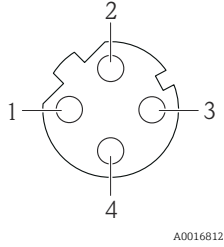
	Pin	Assignment	
	1		Not assigned
	2	A	Modbus RS485
	3		Not assigned
	4	B	Modbus RS485
	5		Grounding/shielding <sup>1)</sup>
Coding		Plug/socket	
B		Socket	

1) Not assigned for order code for "Housing", option C "Ultra-compact, hygienic, stainless"

- i** Recommended plug: Binder, series 763, part no. 79 4449 20 05
- When using the device in a hazardous location, use a suitably certified plug.

### Ethernet/IP

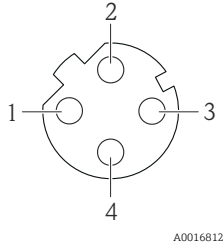
Device plug for signal transmission (device side)

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

- i** Recommended plug:
  - Binder, series 763, part no. 99 3729 810 04
  - Phoenix, part no. 1543223 SACC-M12MSD-4Q
  - When using the device in a hazardous location, use a suitably certified plug.

### PROFINET

Device plug for signal transmission (device side)

	Pin	Assignment	
	1	+	TD +
	2	+	RD +
	3	-	TD -
	4	-	RD -
	Coding		Plug/socket
D		Socket	

- i** Recommended plug:
  - Binder, series 763, part no. 99 3729 810 04
  - Phoenix, part no. 1543223 SACC-M12MSD-4Q
  - When using the device in a hazardous location, use a suitably certified plug.



**Supply voltage**

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

**Transmitter**

For device version with communication type:

- HART, PROFIBUS DP, EtherNet/IP: DC 20 to 30 V
- Modbus RS485, device version:
  - For use in the non-hazardous area and Zone 2/Div. 2: DC 20 to 30 V
  - For use in the intrinsically safe area: power supply via Safety Barrier Promass 100

**Promass 100 safety barrier**

DC 20 to 30 V

**Power consumption**

**Transmitter**

Order code for "Output"	Maximum Power consumption
Option <b>B</b> : 4-20 mA HART with pulse/frequency/switch output	3.5 W
Option <b>L</b> : PROFIBUS DP	3.5 W
Option <b>M</b> Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2	3.5 W
Option <b>M</b> : Modbus RS485, for use in intrinsically safe areas	2.45 W
Option <b>N</b> : EtherNet/IP	3.5 W
Option <b>R</b> : PROFINET	3.5 W

*Promass 100 safety barrier*

Order code for "Output"	Maximum Power consumption
Option <b>M</b> : Modbus RS485, for use in intrinsically safe areas	4.8 W

**Current consumption**

**Transmitter**

Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option <b>B</b> : 4-20mA HART, pul./freq./switch output	145 mA	18 A (< 0.125 ms)
Option <b>L</b> : PROFIBUS DP	145 mA	18 A (< 0.125 ms)
Option <b>M</b> Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2	90 mA	10 A (< 0.8 ms)
Option <b>M</b> : Modbus RS485, for use in intrinsically safe areas	145 mA	16 A (< 0.4 ms)
Option <b>N</b> : EtherNet/IP	145 mA	18 A (< 0.125 ms)
Option <b>R</b> : PROFINET	145 mA	18 A (< 0.125 ms)

**Promass 100 safety barrier**

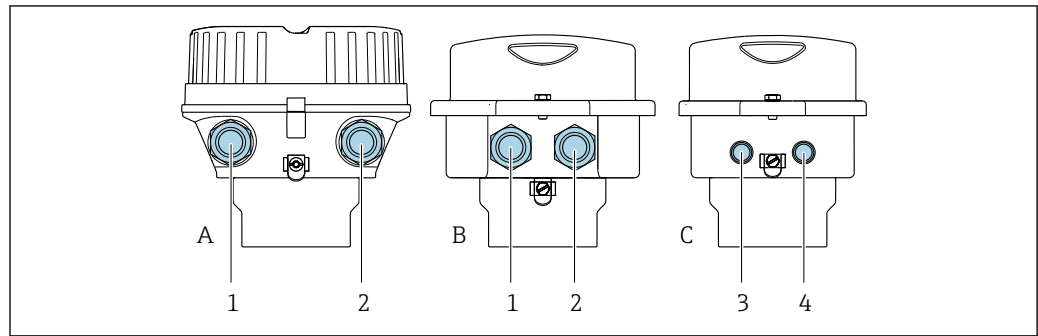
Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option <b>M</b> : Modbus RS485, for use in intrinsically safe areas	230 mA	10 A (< 0.8 ms)

**Power supply failure**

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

## Electrical connection

## Connecting the transmitter



A0016924

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



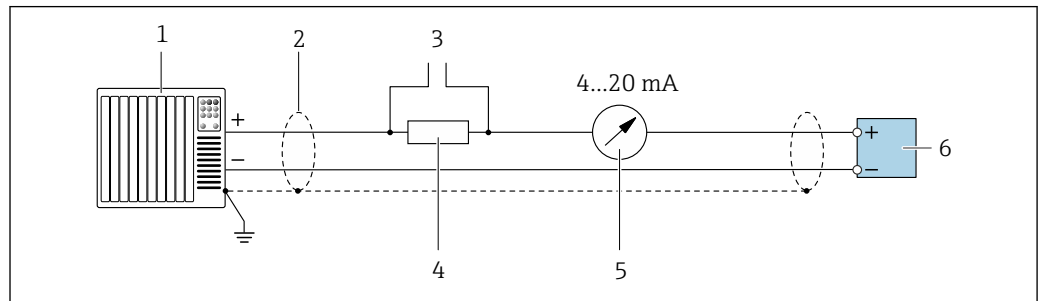
- Terminal assignment → 23
- Pin assignment, device plug → 30



In the case of device versions with a connector, the transmitter housing does not need to be opened to connect the signal cable or power supply cable.

## Connection examples

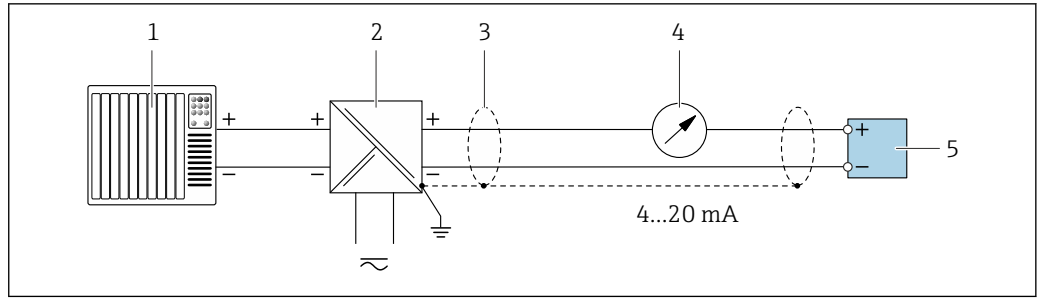
## Current output 4 to 20 mA HART



A0029055

9 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 → 39  
 3 Connection for HART operating devices → 66  
 4 Resistor for HART communication ( $\geq 250 \Omega$ ): observe maximum load  
 5 Analog display unit: observe maximum load  
 6 Transmitter

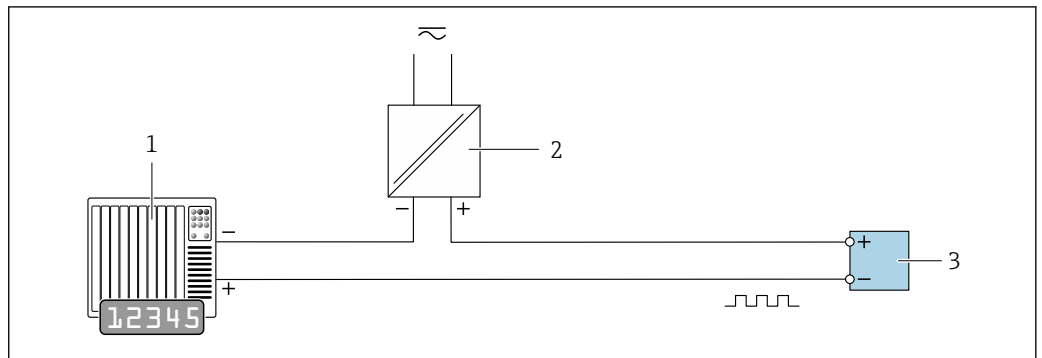


A0028762

10 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 → 39
- 4 Analog display unit: observe maximum load
- 5 Transmitter

Pulse/frequency output

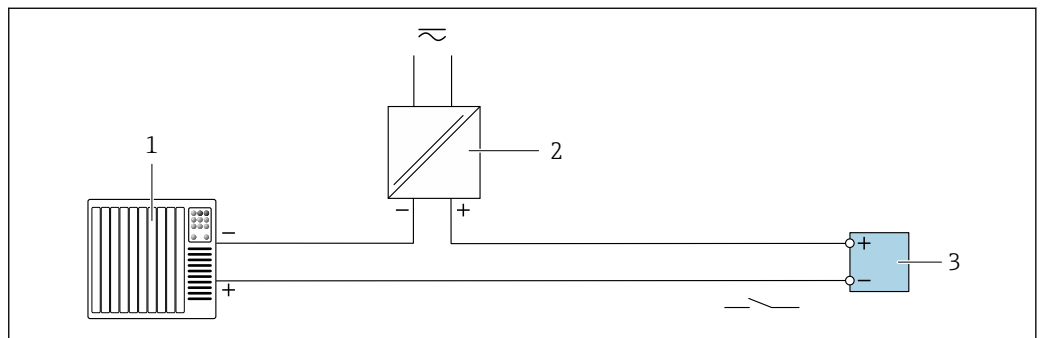


A0028761

11 Connection example for pulse/frequency output (passive)

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 9

Switch output

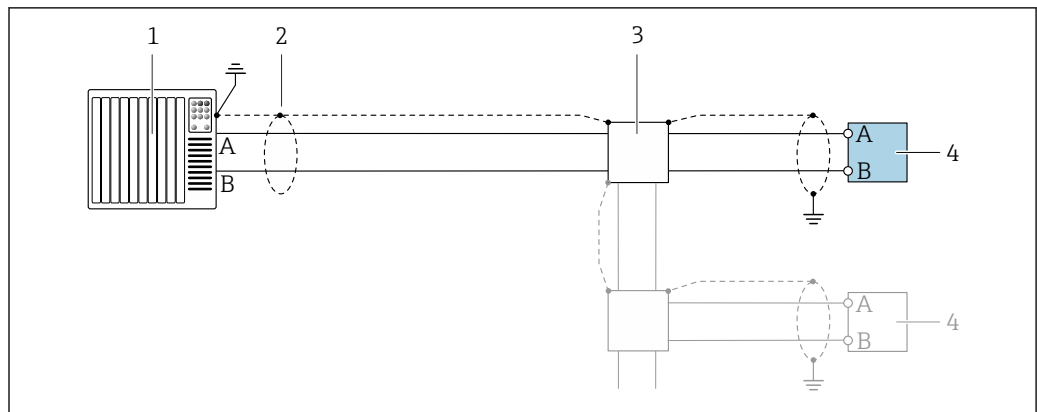


A0028760

12 Connection example for switch output (passive)

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values

PROFIBUS DP



A0028765

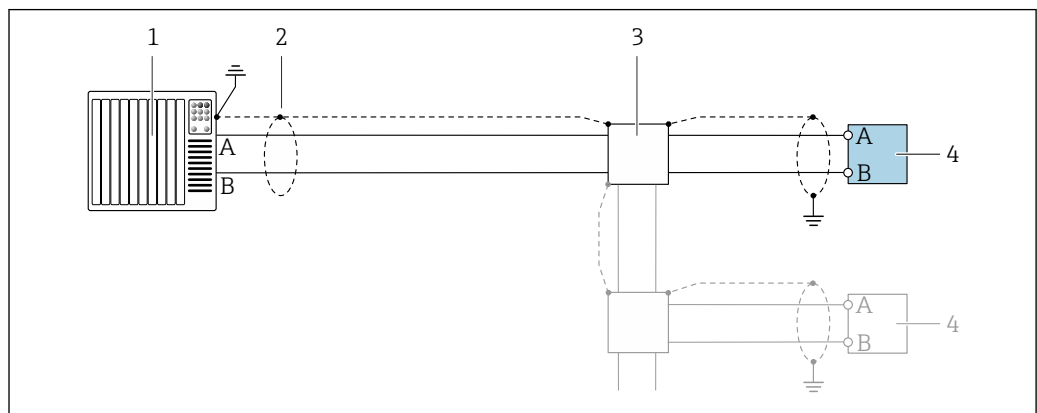
13 Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2

- 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

**i** 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.

Modbus RS485

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

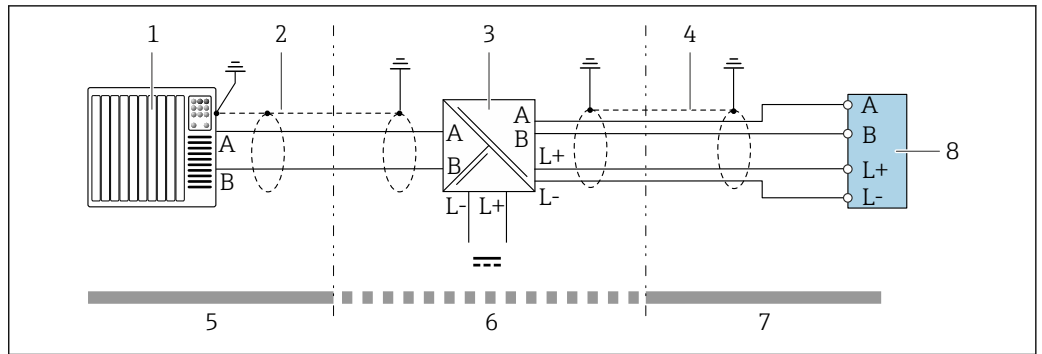


A0028765

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

- 1 Control system (e.g. PLC)
- 2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 39
- 3 Distribution box
- 4 Transmitter

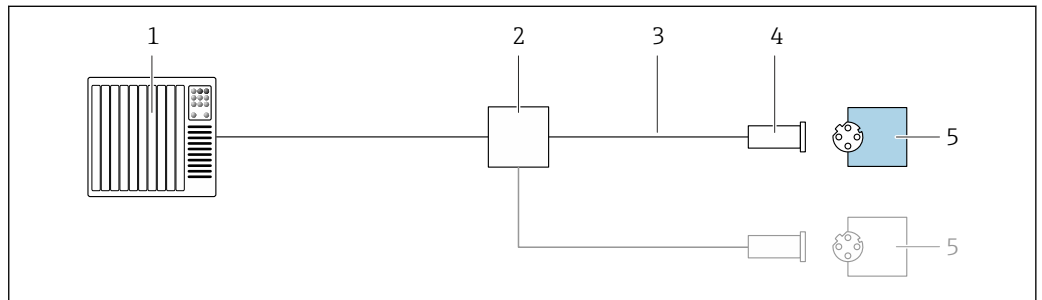
Modbus RS485 intrinsically safe



15 Connection example for Modbus RS485 intrinsically safe

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

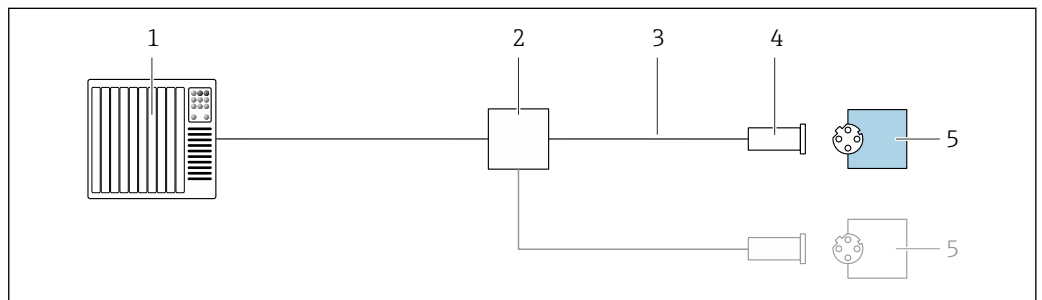
EtherNet/IP



16 Connection example for Ethernet/IP

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

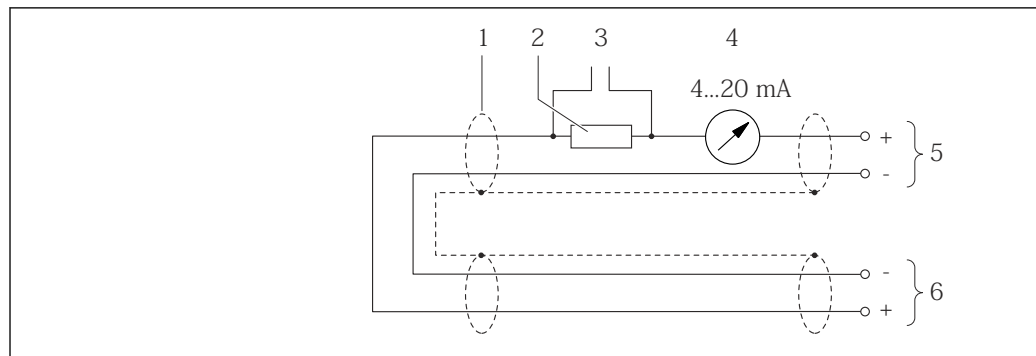
PROFINET



17 Connection example for PROFINET

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

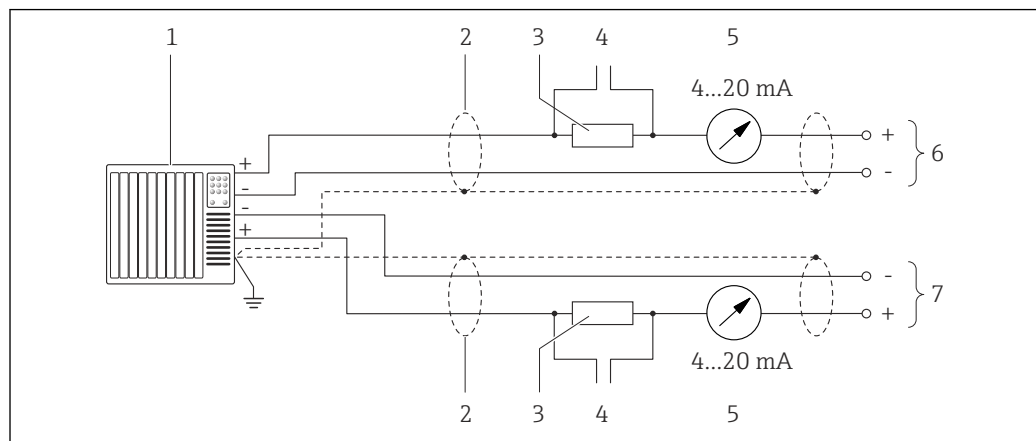
## HART input



A001982B

18 Connection example for HART input (burst mode) via current output (active)

- 1 Cable shield provided at one end. Observe cable specifications
- 2 Resistor for HART communication ( $\geq 250 \Omega$ ): observe maximum load
- 3 Connection for HART operating devices
- 4 Analog display unit
- 5 Transmitter
- 6 Sensor for external measured variable



A0019830

19 Connection example for HART input (master mode) via current output (active)

- 1 Automation system with current input (e.g. PLC).  
Prerequisite: automation system with HART version 6, HART commands 113 and 114 can be processed.
- 2 Cable shield provided at one end. Observe cable specifications
- 3 Resistor for HART communication ( $\geq 250 \Omega$ ): observe maximum load
- 4 Connection for HART operating devices
- 5 Analog display unit
- 6 Transmitter
- 7 Sensor for external measured variable

## Potential equalization

## Requirements

No special measures for potential equalization are required.

Please consider the following to ensure correct measurement:

- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts



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

## Terminals

## Transmitter

Spring terminals for wire cross-sections  $0.5$  to  $2.5 \text{ mm}^2$  (20 to 14 AWG)

## Promass 100 safety barrier

Plug-in screw terminals for wire cross-sections  $0.5$  to  $2.5 \text{ mm}^2$  (20 to 14 AWG)

**Cable entries**

- Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - M20
  - G ½"
  - NPT ½"

**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.

**Signal cable**

*Current output 4 to 20 mA HART*

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

*Pulse/frequency/switch output*

Standard installation cable is sufficient.

*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.

<b>Cable type</b>	A
<b>Characteristic impedance</b>	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
<b>Cable capacitance</b>	< 30 pF/m
<b>Wire cross-section</b>	> 0.34 mm <sup>2</sup> (22 AWG)
<b>Cable type</b>	Twisted pairs
<b>Loop resistance</b>	≤110 Ω/km
<b>Signal damping</b>	Max. 9 dB over the entire length of the cable cross-section
<b>Shield</b>	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)

*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.

<b>Cable type</b>	A
<b>Characteristic impedance</b>	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
<b>Cable capacitance</b>	< 30 pF/m
<b>Wire cross-section</b>	> 0.34 mm <sup>2</sup> (22 AWG)
<b>Cable type</b>	Twisted pairs
<b>Loop resistance</b>	≤110 Ω/km
<b>Signal damping</b>	Max. 9 dB over the entire length of the cable cross-section
<b>Shield</b>	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

### 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

### Connecting cable between Safety Barrier Promass 100 and measuring device

<b>Cable type</b>	Shielded twisted-pair cable with 2x2 wires. When grounding the cable shield, observe the grounding concept of the plant.
<b>Maximum cable resistance</b>	2.5 $\Omega$ , one side



Comply with the maximum cable resistance specifications to ensure the operational reliability of the measuring device.

The maximum cable length for individual wire cross-sections is specified in the table below. Observe the maximum capacitance and inductance per unit length of the cable and connection values for hazardous areas .

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

## Performance characteristics

### Reference operating conditions

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



To obtain measured errors, use the *Applicator* sizing tool → 75

### Maximum measured error

o.r. = of reading; 1 g/cm<sup>3</sup> = 1 kg/l; T = medium temperature

### Base accuracy



Design fundamentals → 43

### Mass flow and volume flow (liquids)

±0.05 % o.r. (PremiumCal, for mass flow)  
±0.10 %

### Mass flow (gases)

±0.35 % o.r.



Density (liquids)

Under reference operating conditions		Standard density calibration <sup>1)</sup>		Wide-range density specification <sup>2) 3)</sup>	
[g/cm <sup>3</sup> ]	[lbs/in <sup>3</sup> ]	[g/cm <sup>3</sup> ]	[lbs/in <sup>3</sup> ]	[g/cm <sup>3</sup> ]	[lbs/in <sup>3</sup> ]
±0.0005	±0.00097	±0.01	±0.019	±0.001	±0.0019

- 1) Valid over the entire temperature and density range
- 2) Valid range for special density calibration: 0 to 2 g/cm<sup>3</sup>, +5 to +80 °C (+41 to +176 °F)
- 3) Order code for "Application package", option EF "Special density and concentration "

Temperature

$$\pm 0.5 \text{ °C} \pm 0.005 \cdot T \text{ °C} (\pm 0.9 \text{ °F} \pm 0.003 \cdot (T - 32) \text{ °F})$$

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
80	3	9.0	0.330
100	4	14.0	0.514
150	6	32.0	1.17

Flow values

Flow values as turndown parameter depending on nominal diameter.


SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
80	180 000	18 000	9 000	3 600	1 800	360
100	350 000	35 000	17 500	7 000	3 500	700
150	800 000	80 000	40 000	16 000	8 000	1 600

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
3	6 615	661.5	330.8	132.3	66.15	13.23
4	12 860	1 286	643.0	257.2	128.6	25.72
6	29 400	2 940	1 470	588	294	58.80

Accuracy of outputs

 In the case of analog outputs, the output accuracy must also be considered for the measured error; in contrast, this need not be considered in the case of fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

The outputs have the following base accuracy specifications.


Current output

Accuracy	Max. ±5 µA
----------	------------

*Pulse/frequency output*

o.r. = of reading

<b>Accuracy</b>	Max. $\pm 50$ ppm o.r. (across the entire ambient temperature range)
-----------------	--

**Repeatability**o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature**Base repeatability****Mass flow and volume flow (liquids)** $\pm 0.025$  % o.r. (PremiumCal, for mass flow) $\pm 0.05$  % o.r.**Mass flow (gases)** $\pm 0.25$  % o.r. Design fundamentals →  43**Density (liquids)** $\pm 0.00025 \text{ g/cm}^3$ **Temperature** $\pm 0.25 \text{ }^\circ\text{C} \pm 0.0025 \cdot T \text{ }^\circ\text{C}$  ( $\pm 0.45 \text{ }^\circ\text{F} \pm 0.0015 \cdot (T-32) \text{ }^\circ\text{F}$ )**Response time**

The response time depends on the configuration (damping).


**Influence of ambient temperature****Current output**

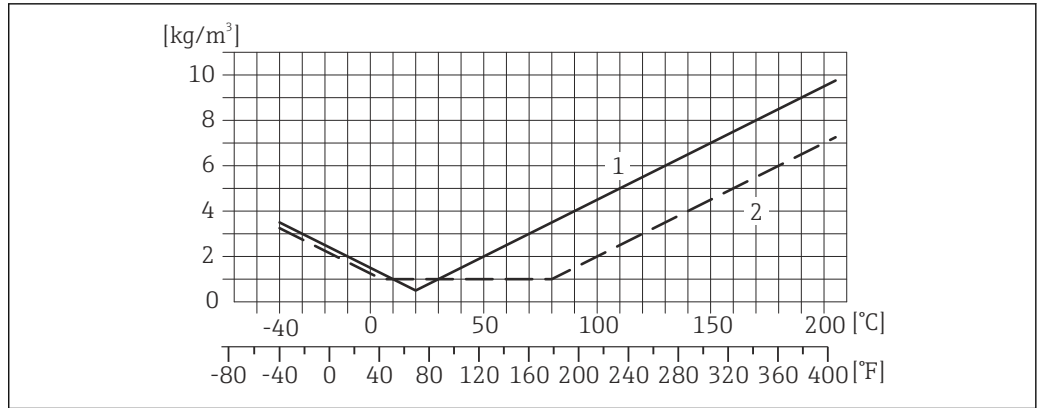
o.r. = of reading

<b>Temperature coefficient</b>	Max. $\pm 0.005\%$ o.r./ $^\circ\text{C}$
--------------------------------	---

**Pulse/frequency output**

<b>Temperature coefficient</b>	No additional effect. Included in accuracy.
--------------------------------	---

**Influence of medium temperature****Mass flow and volume flow**When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002$  % of the full scale value/ $^\circ\text{C}$  ( $\pm 0.0001$  % of the full scale value/ $^\circ\text{F}$ ).**Density**When there is a difference between the density calibration temperature and the process temperature, the typical measured error of the sensor is  $\pm 0.00005 \text{ g/cm}^3 \text{ }^\circ\text{C}$  ( $\pm 0.000025 \text{ g/cm}^3 \text{ }^\circ\text{F}$ ). Field density calibration is possible.**Wide-range density specification (special density calibration)**If the process temperature is outside the valid range (→  40) the measured error is  $\pm 0.00005 \text{ g/cm}^3 \text{ }^\circ\text{C}$  ( $\pm 0.000025 \text{ g/cm}^3 \text{ }^\circ\text{F}$ )



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

**Temperature**

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

**Influence of medium pressure**

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

*o.r.* = of reading

DN		[% o.r./bar]	[% o.r./psi]
[mm]	[in]		
80	3	-0.0055	-0.0004
100	4	-0.0035	-0.0002
150	6	-0.002	-0.0001

**Design fundamentals**

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

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

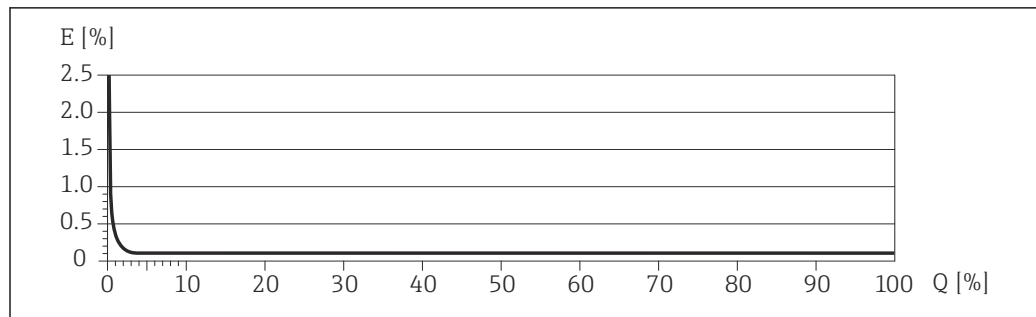
MeasValue = measured value; ZeroPoint = zero point stability

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

Flow rate	Maximum measured error in % <i>o.r.</i>
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021332</small>	$\pm \text{BaseAccu}$ <small>A0021339</small>
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021333</small>	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021334</small>

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

Flow rate	Maximum repeatability in % <i>o.r.</i>
$\geq \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021335</small>	$\pm \text{BaseRepeat}$ <small>A0021340</small>
$< \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021336</small>	$\pm 1/2 \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021337</small>

**Example for max. measured error**

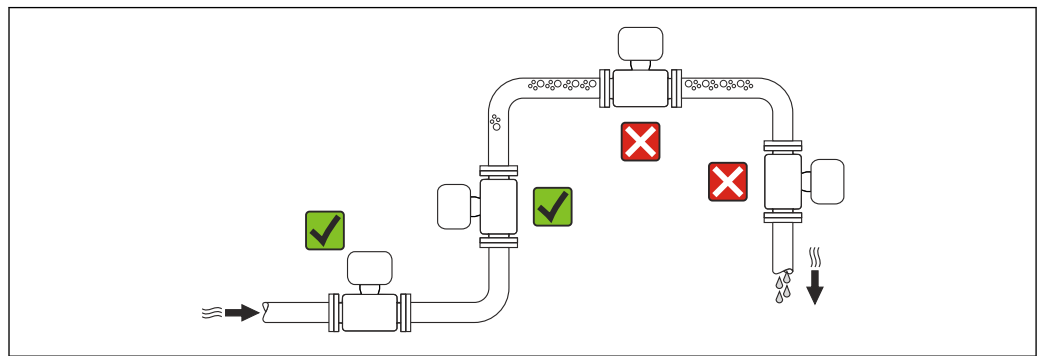
A0024063

*E* Error: Maximum measured error as % o.r. (example)

*Q* Flow rate as %

**Installation**

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

**Mounting location**

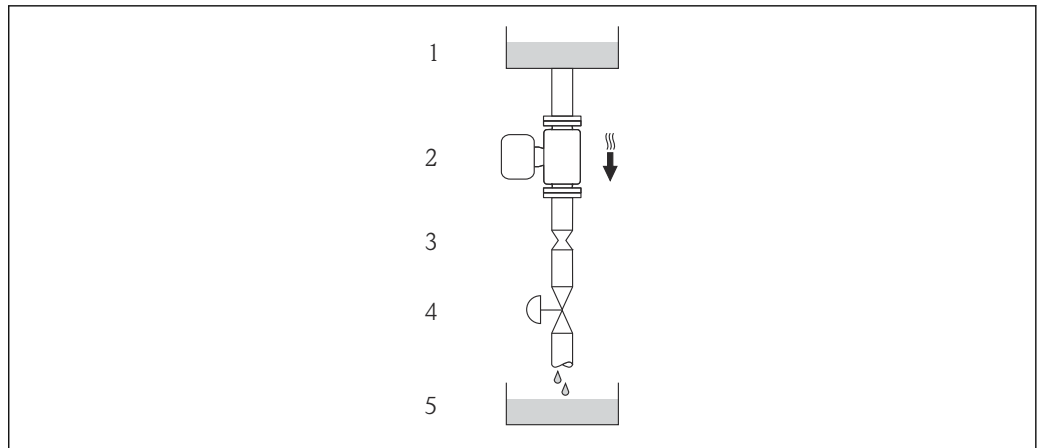
A0023344

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

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

**Installation in down pipes**

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



A0015596

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

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

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

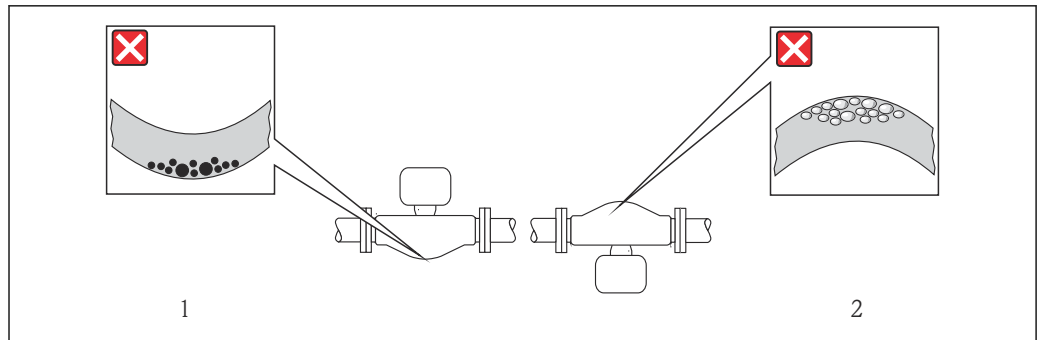
**Orientation**

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

Orientation		Recommendation
<b>A</b>	Vertical orientation	 A0015591
<b>B</b>	Horizontal orientation, transmitter head up	 A0015589
<b>C</b>	Horizontal orientation, transmitter head down	 A0015590
<b>D</b>	Horizontal orientation, transmitter head at side	 A0015592

- 1) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
- 2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

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



A0014057

21 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 → 53.

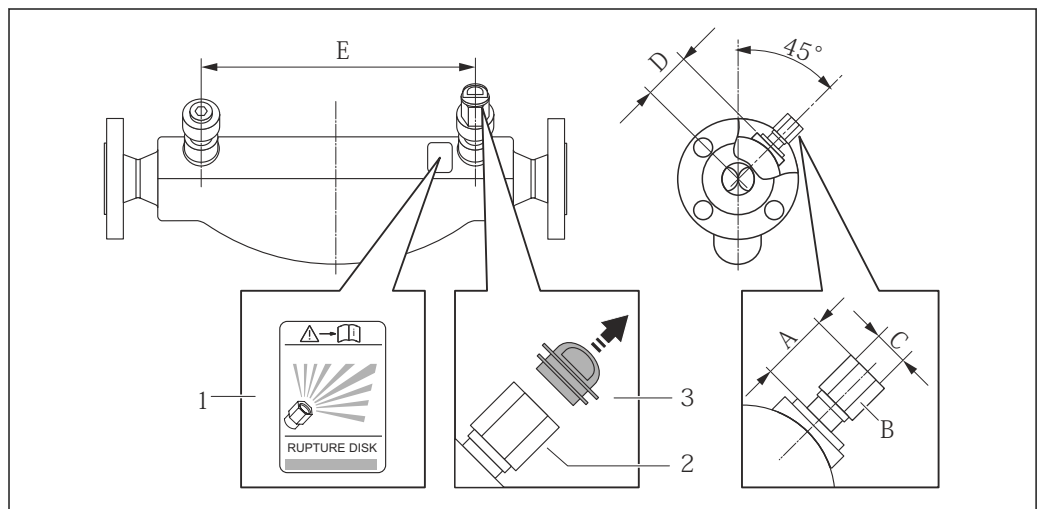
**Special mounting instructions**

**Rupture disk**

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

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

In the internal thread of the rupture disk a discharge device can be screwed to drain the leaking medium in case of a failure of the rupture disk.



A0008361

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

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

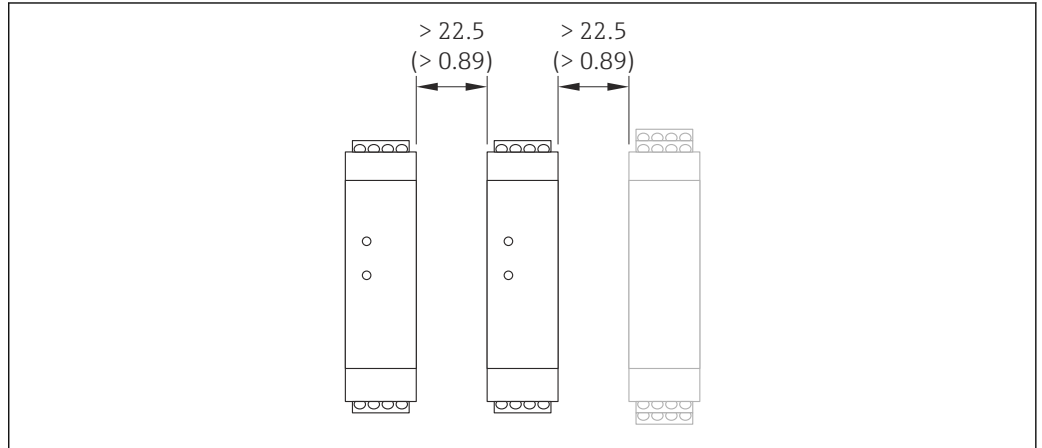
**Zero point adjustment**

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 40. Therefore, a zero point adjustment in the field is generally not required.

Experience shows that zero point adjustment is advisable only in special cases:

- To achieve maximum measuring accuracy even with low flow rates
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

**Mounting Safety Barrier Promass 100**



A0016894


22 Minimum distance between additional Safety Barrier Promass 100 or other modules. Engineering unit mm (in)

**Environment**

**Ambient temperature range**

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

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

 Weather protection covers can be ordered from Endress+Hauser: see "Accessories" section

**Temperature tables**

In the following tables, the following interdependencies between the maximum medium temperature  $T_m$  for T6 to T1 and the maximum ambient temperature  $T_a$  apply when operating the device in hazardous areas.

**Ex ia, cCSA<sub>US</sub> IS***SI units*

Order code for "Housing"	T <sub>a</sub> [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
Option A "Compact coated alu"	35	50	85	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150 <sup>2)</sup>
	50	–	85	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150 <sup>2)</sup>
Option B "Compact, stainless"	60	–	–	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150 <sup>2)</sup>
Option C "Ultra-compact, stainless"	35	50	85	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150 <sup>2)</sup>
	45	–	85	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150 <sup>2)</sup>
	50	–	–	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150 <sup>2)</sup>

- 1) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 205 °C: T<sub>m</sub> = 170 °C  
 2) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 205 °C: T<sub>m</sub> = 205 °C

*US units*

Order code for "Housing"	T <sub>a</sub> [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
Option A "Compact coated alu"	95	122	185	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302 <sup>2)</sup>
	122	–	185	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302 <sup>2)</sup>
Option B "Compact, stainless"	140	–	–	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302 <sup>2)</sup>
Option C "Ultra-compact, stainless"	95	122	185	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302 <sup>2)</sup>
	113	–	185	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302 <sup>2)</sup>
	122	–	–	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302 <sup>2)</sup>

- 1) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 401 °F: T<sub>m</sub> = 338 °F  
 2) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 401 °F: T<sub>m</sub> = 401 °F

**Ex nA, cCSA<sub>US</sub> NI***SI units*

Order code for "Housing"	T <sub>a</sub> [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
Option A "Compact coated alu"	35	50	85	120	150 <sup>1)</sup>	150 <sup>2)</sup>	150
	50	–	85	120	150	150	150
Option B "Compact, stainless"	60	–	–	120	150	150	150
Option C "Ultra-compact, stainless"	50	–	85	120	150	150	150
	60	–	–	120	150	150	150

- 1) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 205 °C: T<sub>m</sub> = 170 °C  
 2) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 205 °C: T<sub>m</sub> = 205 °C

*US units*

Order code for "Housing"	T <sub>a</sub> [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
Option A "Compact coated alu"	95	122	185	248	302 <sup>1)</sup>	302 <sup>2)</sup>	302
	122	–	185	248	302	302	302
Option B "Compact, stainless"	140	–	–	248	302	302	302



Order code for "Housing"	T <sub>a</sub> [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
Option C "Ultra-compact, stainless"	122	-	185	248	302	302	302
	140	-	-	248	302	302	302

- 1) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 401 °F: T<sub>m</sub> = 338 °F
- 2) The following applies for specified sensors with a maximum medium temperature T<sub>m</sub> = 401 °F: T<sub>m</sub> = 401 °F

*Explosion hazards arising from gas and dust*

**Determining the temperature class and surface temperature with the temperature table**

- In the case of gas: Determine the temperature class as a function of the ambient temperature T<sub>a</sub> and the medium temperature T<sub>m</sub>.
- In the case of dust: Determine the maximum surface temperature as a function of the maximum ambient temperature T<sub>a</sub> and the maximum medium temperature T<sub>m</sub>.

**Example**

- Measured maximum ambient temperature: T<sub>ma</sub> = 47 °C
- Measured maximum medium temperature: T<sub>mm</sub> = 108 °C

	T <sub>a</sub> [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
	35	50	85	120	140	140	140
	50	-	85	120	140	140	140
	60	-	-	120	140	140	140
	35	50	85	120	140	140	140
	45	-	85	120	140	140	140
	50	-	-	120	140	140	140

A0019758

**23 Procedure for determining the maximum surface temperature**

1. Select device (optional).
2. In the column for the maximum ambient temperature T<sub>a</sub> select the temperature that is immediately greater than or equal to the measured maximum ambient temperature T<sub>ma</sub> that is present.
  - ↳ T<sub>a</sub> = 50 °C.  
The row showing the maximum medium temperature is determined.
3. Select the maximum medium temperature T<sub>m</sub> of this row, which is larger or equal to the measured maximum medium temperature T<sub>mm</sub>.
  - ↳ The column with the temperature class for gas is determined: 108 °C ≤ 120 °C → T4.
4. The maximum temperature of the temperature class determined corresponds to the maximum surface temperature for dust: T4 = 135 °C

**Storage temperature**

-40 to +80 °C (-40 to +176 °F), preferably at +20 °C (+68 °F) (standard version)  
 -50 to +80 °C (-58 to +176 °F) (Order code for "Test, certificate", option JM)

**Climate class**



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

**Degree of protection**

**Transmitter and sensor**

- As standard: IP66/67, type 4X enclosure
- With the order code for "Sensor options", option **CM**: IP69K can also be ordered
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

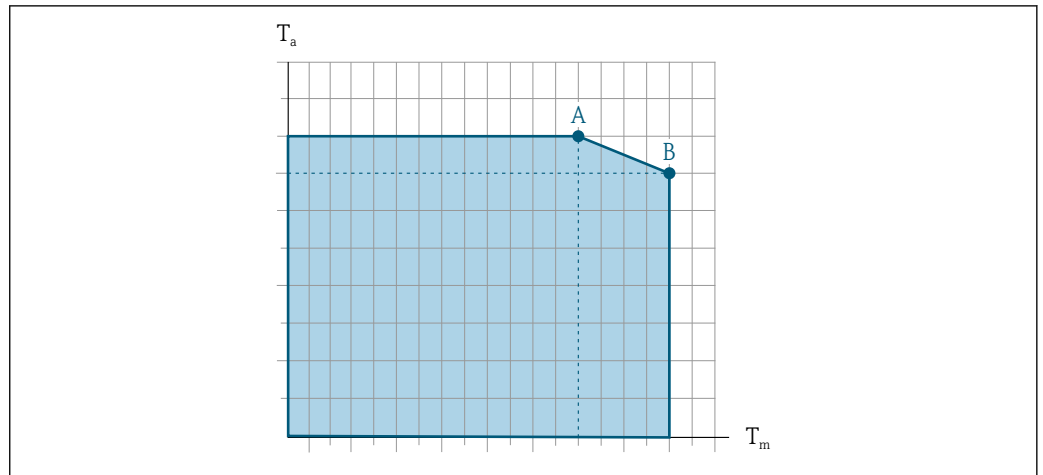
**Safety Barrier Promass 100**  
 IP20

<b>Vibration resistance</b>	<p><b>Compact version</b></p> <ul style="list-style-type: none"> <li>■ Vibration, sinusoidal according to IEC 60068-2-6 <ul style="list-style-type: none"> <li>■ 2 to 8.4 Hz, 3.5 mm peak</li> <li>■ 8.4 to 2 000 Hz, 1 g peak</li> </ul> </li> <li>■ Vibration broad-band random, according to IEC 60068-2-64 <ul style="list-style-type: none"> <li>■ 10 to 200 Hz, 0.003 g<sup>2</sup>/Hz</li> <li>■ 200 to 2 000 Hz, 0.001 g<sup>2</sup>/Hz</li> <li>■ Total: 1.54 g rms</li> </ul> </li> </ul>
<b>Shock resistance</b>	<p><b>Compact version</b></p> <p>Shock, half-sine according to IEC 60068-2-27 6 ms 30 g</p>
<b>Shock resistance</b>	<p><b>Compact version</b></p> <p>Rough handling shocks according to IEC 60068-2-31</p>
<b>Electromagnetic compatibility (EMC)</b>	<ul style="list-style-type: none"> <li>■ Depends on the communication protocol: <ul style="list-style-type: none"> <li>■ HART, PROFIBUS DP, Modbus RS485, EtherNet/IP: As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)</li> <li>■ PROFINET: as per IEC/EN 61326</li> </ul> </li> <li>■ Complies with emission limits for industry as per EN 55011 (Class A)</li> <li>■ Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784</li> </ul> <p> The following applies for PROFIBUS DP: If baud rates &gt; 1.5 MBaud, an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.</p> <p> For details, refer to the Declaration of Conformity.</p>

## Process

<b>Medium temperature range</b>	-40 to +205 °C (-40 to +401 °F)
---------------------------------	---------------------------------

Dependency of ambient temperature on medium temperature



A0031121

24 Exemplary representation, values in the table below.

$T_a$  Ambient temperature range

$T_m$  Medium temperature

A Maximum permitted medium temperature  $T_m$  at  $T_{a\max} = 60\text{ °C}$  (140 °F); higher medium temperatures  $T_m$  require a reduced ambient temperature  $T_a$

B Maximum permitted ambient temperature  $T_a$  for the maximum specified medium temperature  $T_m$  of the sensor



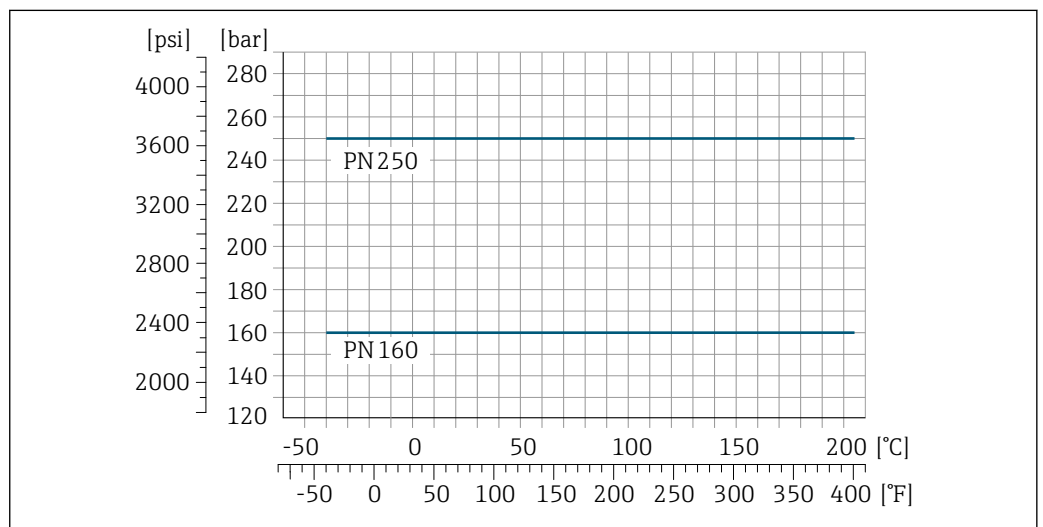
Values for devices used in the hazardous area:  
Separate Ex documentation (XA) for the device .

**Density** 0 to 5 000 kg/m<sup>3</sup> (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.

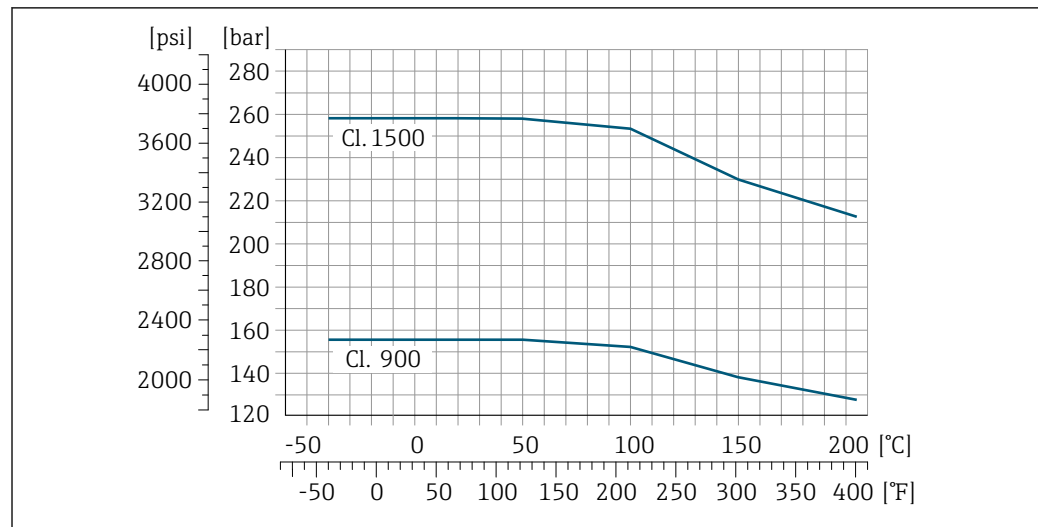
**Flange connection according to EN 1092-1 (DIN 2501)**



A002779-EN

25 With flange material stainless steel, 1.4410/F53 25Cr Duplex (Super Duplex)

### Flange connection according to ASME B16.5



A0027780-EN

26 With flange material stainless steel, 1.4410/F53 25Cr Duplex (Super Duplex)

### Sensor housing

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

**i** 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.

If there is a need to drain the leaking medium into a discharge device, the sensor should be fitted with a rupture disk. Connect the discharge to the additional threaded connection.

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

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

Maximum pressure:

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

### Burst pressure of the sensor housing

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

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

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

The sensor housing burst pressure refers to a typical internal pressure which is reached prior to mechanical failure of the sensor housing and which was determined during type testing. The

corresponding type test declaration can be ordered with the device (order code for "Additional approval", option LN "Sensor housing burst pressure, type test").

DN		Sensor housing burst pressure	
[mm]	[in]	[bar]	[psi]
80	3	120	1740
100	4	95	1370
150	6	75	1080
250	10	50	720

For information on the dimensions: see the "Mechanical construction" section

**Rupture disk**

To increase the level of safety, a device version with a rupture disk with a trigger pressure of 10 to 15 bar (145 to 217.5 psi) can be used (order code for "Sensor option", option CA "rupture disk").  
 For information on the dimensions: see the "Mechanical construction" section (accessories) → 59

**Flow limit**

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

- i** For an overview of the full scale values for the measuring range, see the "Measuring range" section → 8
- 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 → 8
- i** To calculate the flow limit, use the *Applicator* sizing tool → 75

**Pressure loss**

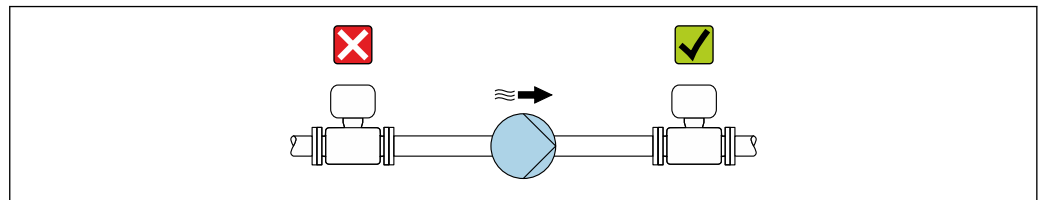
- i** To calculate the pressure loss, use the *Applicator* sizing tool → 75

**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)



A0028777

**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.

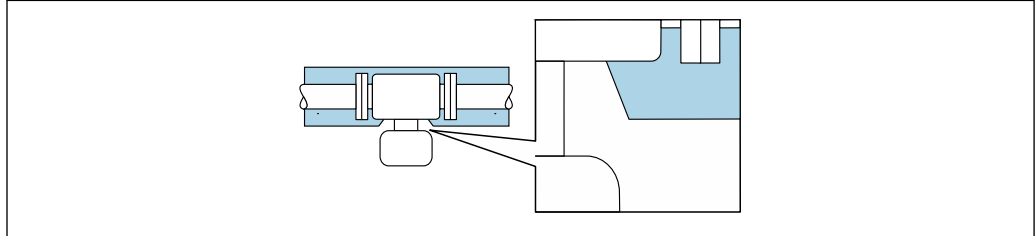
The following device versions are recommended for versions with thermal insulation:

Version with extended neck:

Order code for "Measuring tube material", option FA with an extended neck length of 105 mm (4.13 in).

**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 °C (176 °F)
- ▶ Thermal insulation with extended neck free: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.



A0034391

 27 Thermal insulation with extended neck free

**Heating**

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

**Heating options**

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

**NOTICE****Danger of overheating when heating**

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

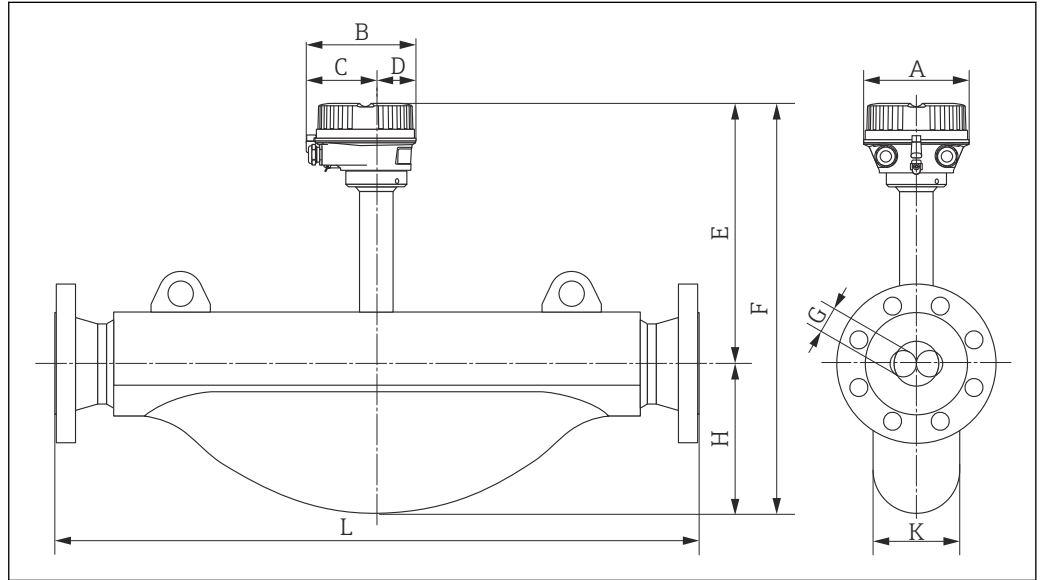
The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

## Mechanical construction

Dimensions in SI units

Compact version

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



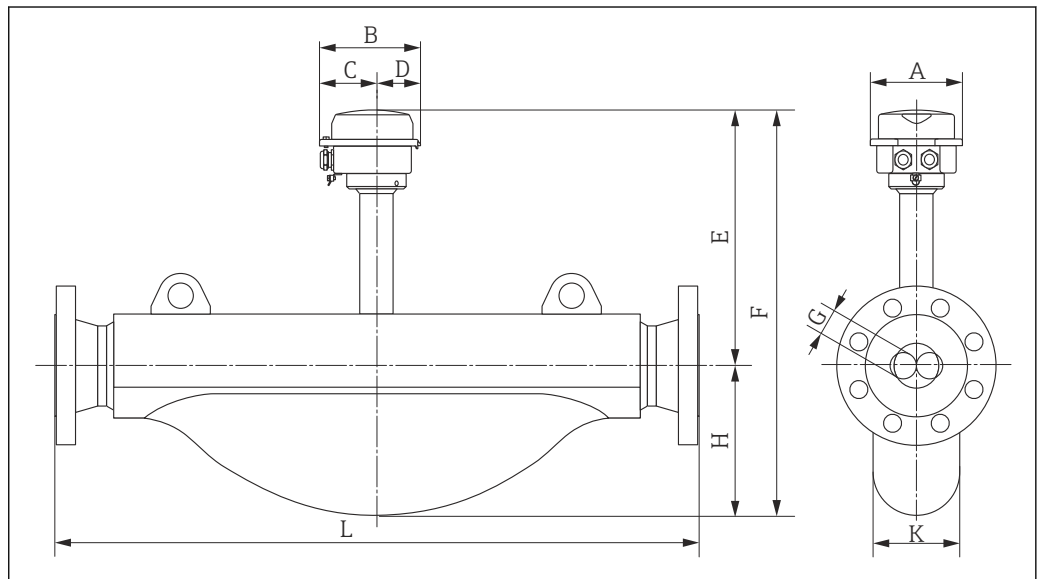
A0019454

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E <sup>1)</sup> [mm]	F <sup>1)</sup> [mm]	G [mm]	H [mm]	K [mm]	L [mm]
80	136	147.5	93.5	54	292	492	38.5	200	117	<sup>2)</sup>
100	136	147.5	93.5	54	308	562	49.0	254	138	<sup>2)</sup>
150	136	147.5	93.5	54	328	706	66.1	378	205	<sup>2)</sup>

1) If using a display, order code for "Display; Operation", option B: values + 28 mm

2) Dependent on the specific process connection

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

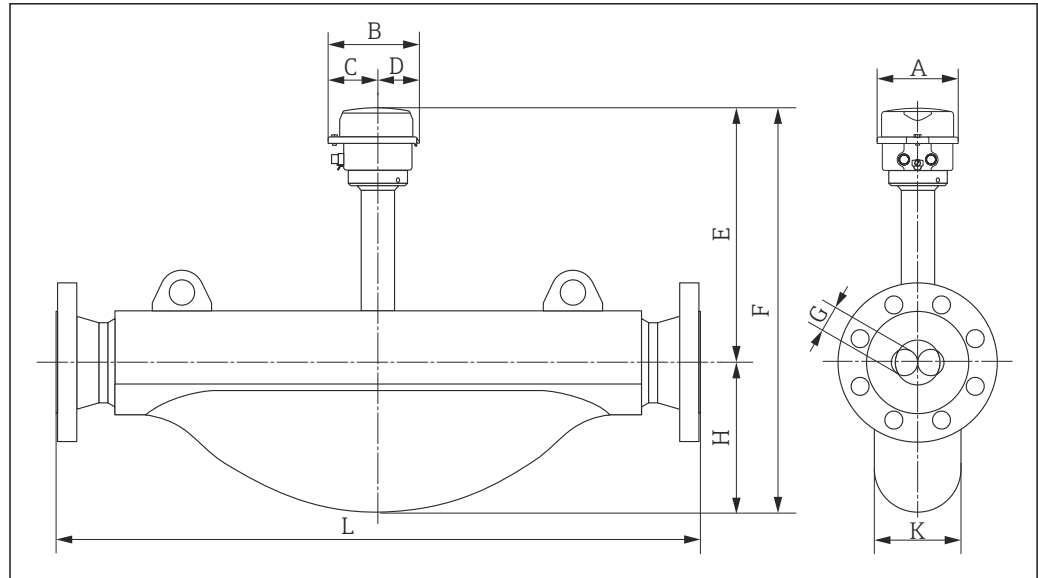


A0018769

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E <sup>1)</sup> [mm]	F <sup>1)</sup> [mm]	G [mm]	H [mm]	K [mm]	L [mm]
80	133.5	136.8	78	58.8	288	488	38.5	200	117	<sup>2)</sup>
100	133.5	136.8	78	58.8	304	548	49.0	254	138	<sup>2)</sup>
150	133.5	136.8	78	58.8	324	702	66.1	378	205	<sup>2)</sup>

- 1) If using a display, order code for "Display; Operation", option B: values + 14 mm  
 2) Dependent on the specific process connection

Order code for "Housing", option C "Ultra-compact hygienic, stainless"



A0018777

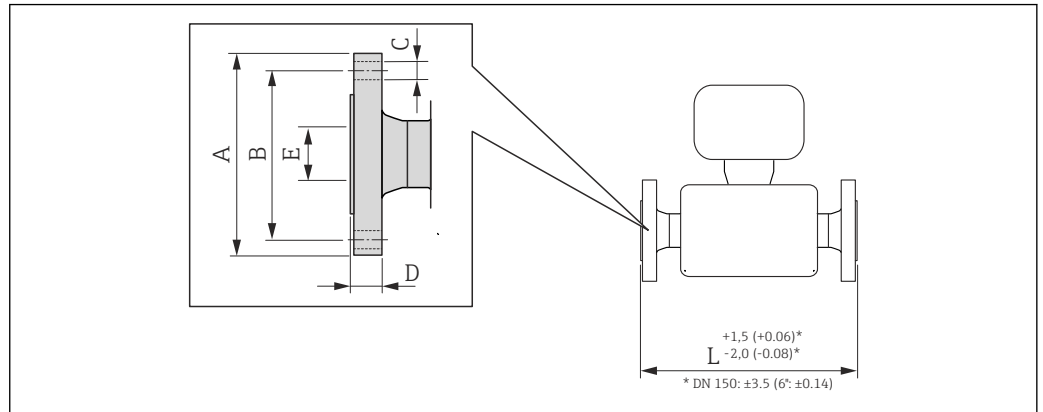
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E <sup>1)</sup> [mm]	F <sup>1)</sup> [mm]	G [mm]	H [mm]	K [mm]	L [mm]
80	114.4	123.6	67.7	55.9	287	487	38.5	200	117	<sup>2)</sup>
100	114.4	123.6	67.7	55.9	303	547	49.0	254	138	<sup>2)</sup>
150	114.4	123.6	67.7	55.9	323	701	66.1	378	205	<sup>2)</sup>

- 1) If using a display, order code for "Display; Operation", option B: values + 14 mm  
 2) Dependent on the specific process connection



**Flange connections**

Fixed flange EN 1092-1, ASME B16.5



A0023178

28 Engineering unit mm (in)

**Flange according to EN 1092-1 Form B2 (DIN 2501): PN160**

25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option DAD

**Flange with groove according to EN 1092-1 Form D (DIN 2512N): PN160**

25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option DCD

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
80	230	180	8 × Ø26	36	80.9	916
100	265	210	8 × Ø30	40	104.3	1208
150	355	290	12 × Ø33	50	155.7	1476

**Flange according to EN 1092-1 Form B2 (DIN 2501): PN250**

25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option DBD

**Flange with groove according to EN 1092-1 Form D (DIN 2512N): PN250**

25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option DDD

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
80	255	200	8 × Ø30	46	77.7	948
100	300	235	8 × Ø33	54	100.3	1248
150	390	320	12 × Ø36	68	148.3	1540

**Flange according to ASME B16.5: Class 900 Sched 40**

25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option ADD

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
80	240	190.5	8 × Ø25.4	45.1	78.0	962
100	290	235	8 × Ø31.8	51.4	102.4	1251
150	380	317.5	12 × Ø31.8	62.6	154.1	1513

Flange according to ASME B16.5: Class 1500 Schedule 80 25Cr Duplex (Super Duplex), 1.4410 (F53) Order code for "Process connection", option AFD						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
80	265	203.2	8 × Ø31.8	54.8	73.7	993
100	310	241.3	8 × Ø35.1	60.8	97.3	1270
150	395	317.5	12 × Ø38.1	89.6	146.3	1577

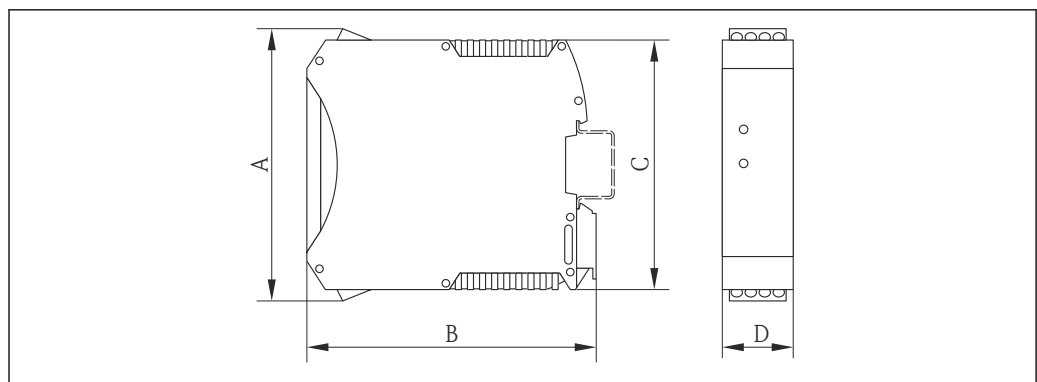
RTJ flange according to ASME B16.5: Class 900 Sched 40 1.4410 (F53) Order code for "Process connection", option AED						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
80	240	190.5	8 × Ø25.4	46.0	78.0	963
100	290	235	8 × Ø31.8	52.3	102.4	1252
150	380	317.5	12 × Ø31.8	63.5	154.1	1515

RTJ flange according to ASME B16.5: Class 1500 Sched 80 1.4410 (F53) Order code for "Process connection", option AGD						
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
80	265	203.2	8 × Ø31.8	55.7	73.7	995
100	310	241.3	8 × Ø35.1	61.7	97.3	1272
150	395	317.5	12 × Ø38.1	92.1	146.3	1582

**Safety Barrier Promass 100**

Top-hat rail EN 60715:

- TH 35 x 7.5
- TH 35 x 15



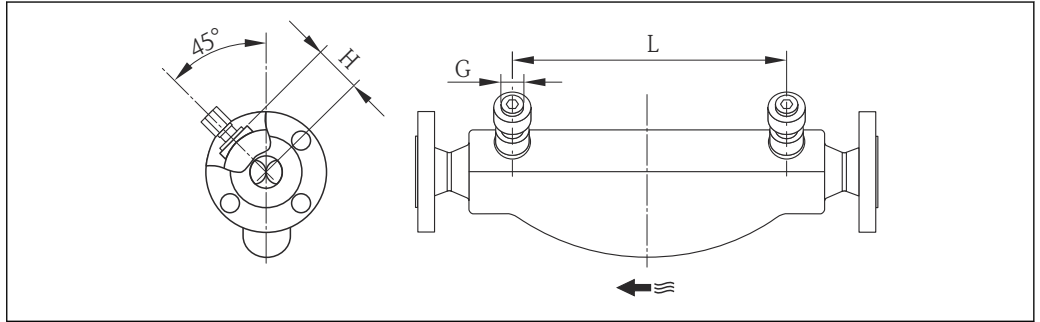
A0016777

A [mm]	B [mm]	C [mm]	D [mm]
108	114.5	99	22.5

**Accessories**

*Purge connections / secondary containment monitoring*

Order code for "Sensor options", option CH



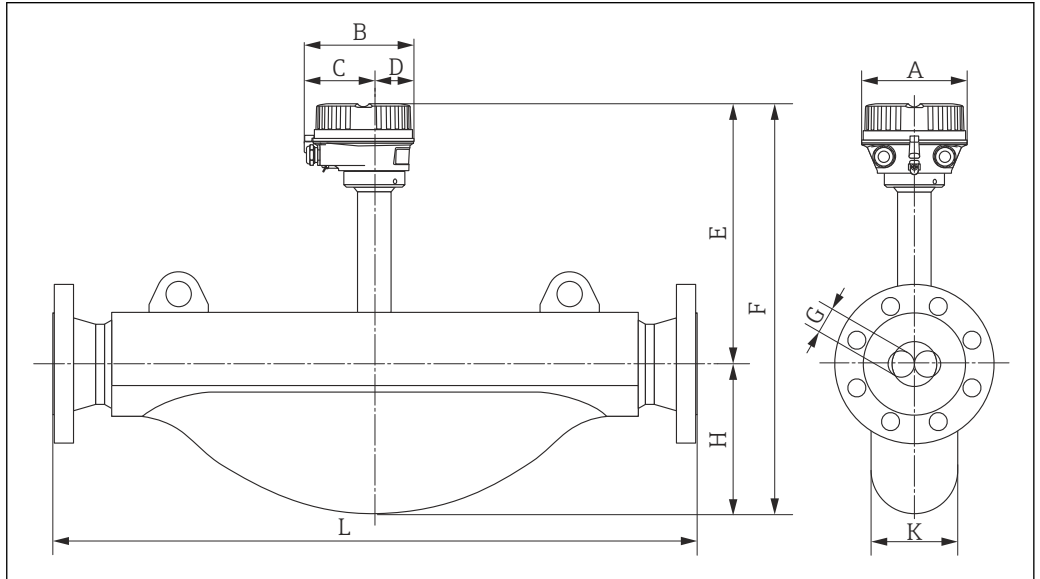
A0002537

DN [mm]	G [in]	H [mm]	L [mm]
80	½ NPT	101	560
100	½ NPT	120	684
150	½ NPT	141	880

**Dimensions in US units**

**Compact version**

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

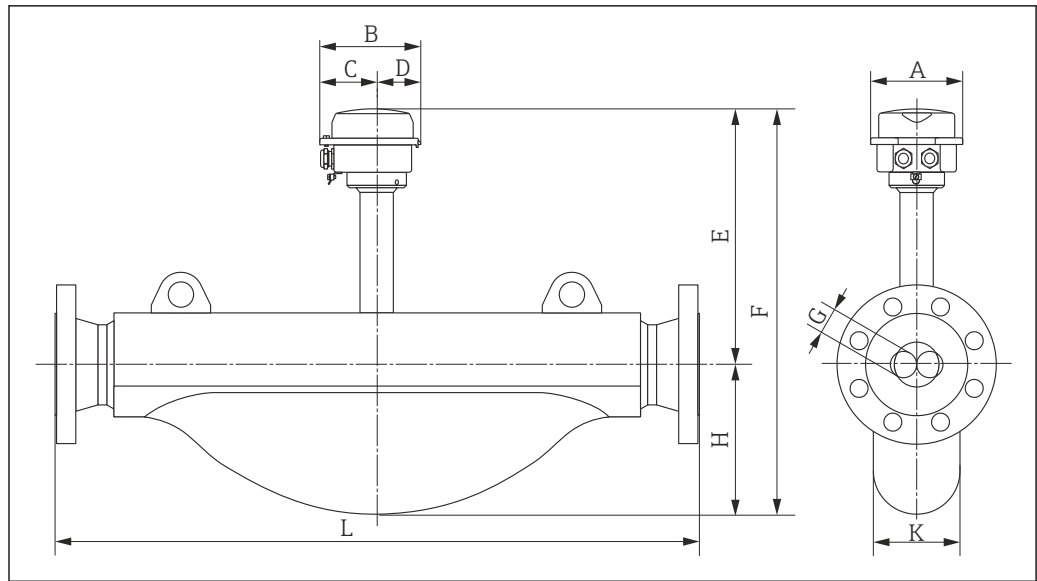


A0019454

DN [in]	A [in]	B [in]	C [in]	D [in]	E <sup>1)</sup> [in]	F <sup>1)</sup> [in]	J [in]	H [in]	K [in]	L [in]
3	5.35	5.81	3.68	2.13	11.5	19.4	1.52	7.87	4.61	<sup>2)</sup>
4	5.35	5.81	3.68	2.13	12.1	22.1	1.93	10	5.43	<sup>2)</sup>
6	5.35	5.81	3.68	2.13	12.9	27.8	2.60	14.88	8.07	<sup>2)</sup>

- 1) If using a display, order code for "Display; Operation", option B: values + 1.1 in
- 2) Dependent on the specific process connection

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

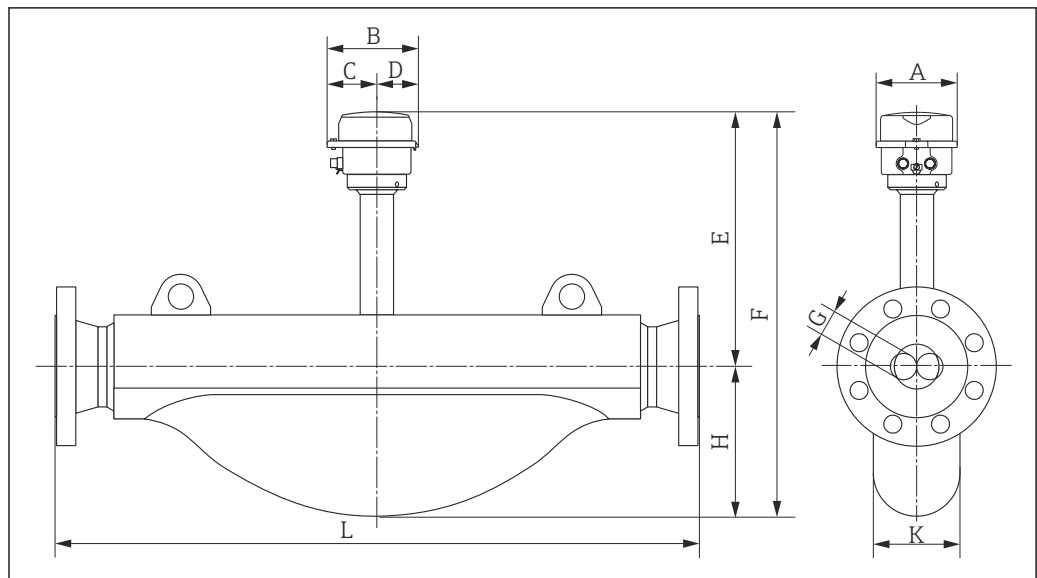


A0018769

DN [in]	A [in]	B [in]	C [in]	D [in]	E <sup>1)</sup> [in]	F <sup>1)</sup> [in]	G [in]	H [in]	K [in]	L [in]
3	5.26	5.39	3.07	2.31	11.3	19.2	1.52	7.87	4.61	<sup>2)</sup>
4	5.26	5.39	3.07	2.31	12.0	21.6	1.93	10	5.43	<sup>2)</sup>
6	5.26	5.39	3.07	2.31	12.8	27.6	2.60	14.88	8.07	<sup>2)</sup>

- 1) If using a display, order code for "Display; Operation", option B: values + 0.55 in
- 2) Dependent on the specific process connection

Order code for "Housing", option C "Ultra-compact hygienic, stainless"



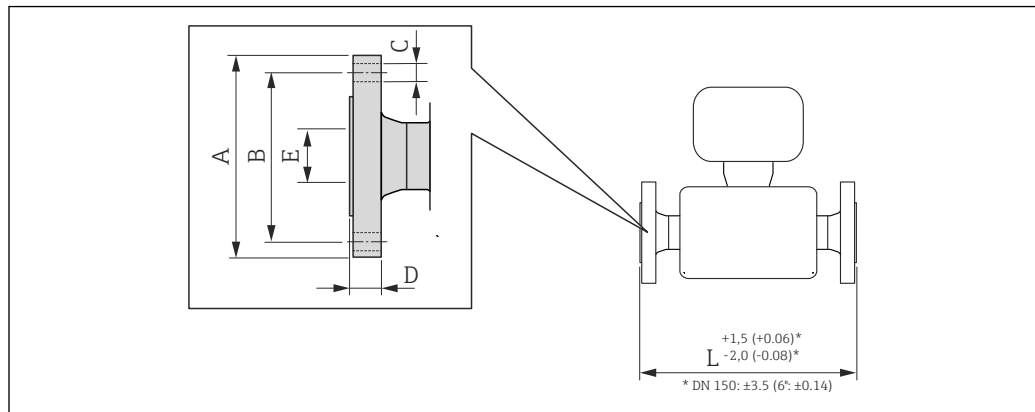
A0018777

DN [in]	A [in]	B [in]	C [in]	D [in]	E <sup>1)</sup> [in]	F <sup>1)</sup> [in]	G [in]	H [in]	K [in]	L [in]
3	4.39	4.87	2.67	2.2	11.3	19.2	1.52	7.87	4.61	<sup>2)</sup>
4	4.39	4.87	2.67	2.2	11.9	21.5	1.93	10	5.43	<sup>2)</sup>
6	4.39	4.87	2.67	2.2	12.7	27.6	2.60	14.88	8.07	<sup>2)</sup>

- 1) If using a display, order code for "Display; Operation", option B: values + 0.55 in  
 2) Dependent on the specific process connection

## Flange connections

### Fixed flange ASME B16.5



A0023178

29 Engineering unit mm (in)

#### Flange according to ASME B16.5: Class 900 Sched 40

##### 25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option ADD

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
3	9.45	7.5	8 × Ø1.0	1.78	3.07	37.87
4	11.42	9.25	8 × Ø1.25	2.02	4.03	49.25
6	14.96	12.5	12 × Ø1.25	2.46	6.07	59.57

#### Flange according to ASME B16.5: Class 1500 Schedule 80

##### 25Cr Duplex (Super Duplex), 1.4410 (F53)

Order code for "Process connection", option AFD

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
3	10.43	8	8 × Ø1.0	2.16	2.90	39.09
4	12.20	9.5	8 × Ø1.38	2.39	3.83	50.00
6	15.55	12.5	12 × Ø1.50	3.53	5.76	62.09

#### RTJ flange according to ASME B16.5: Class 900 Sched 40

##### 1.4410 (F53)

Order code for "Process connection", option AED

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
3	9.45	7.5	8 × Ø1.0	1.81	3.07	37.91
4	11.42	9.25	8 × Ø1.25	2.06	4.03	49.29
6	14.96	12.5	12 × Ø1.25	2.50	6.07	59.65

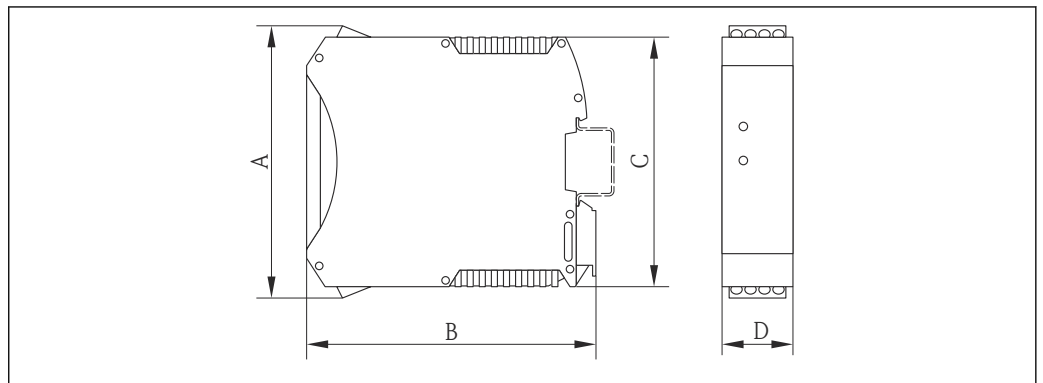
**RTJ flange according to ASME B16.5: Class 1500 Sched 80**  
**1.4410 (F53)**  
*Order code for "Process connection", option AGD*

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
3	10.43	8	8 × Ø1.0	2.19	2.90	39.17
4	12.20	9.5	8 × Ø1.38	2.43	3.83	50.08
6	15.55	12.5	12 × Ø1.50	3.63	5.76	62.28

**Safety Barrier Promass 100**

Top-hat rail EN 60715:

- TH 35 x 7.5
- TH 35 x 15



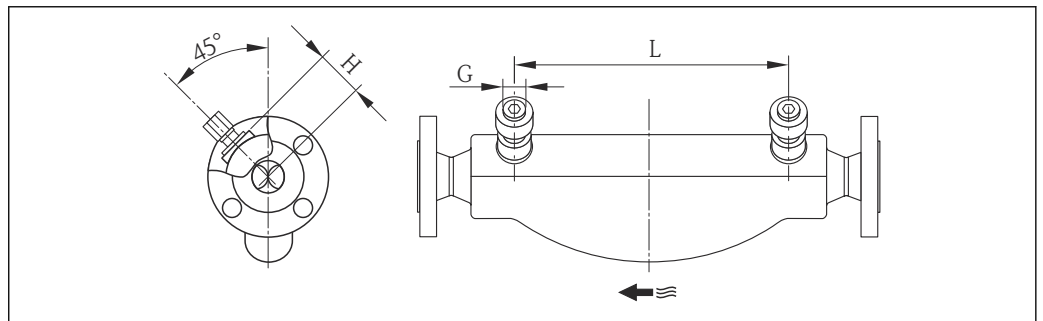
A0016777

A [in]	B [in]	C [in]	D [in]
4.25	4.51	3.9	0.89

**Accessories**

*Purge connections / secondary containment monitoring*

Order code for "Sensor options", option CH



A0002537

DN [in]	G [in]	H [in]	L [in]
3	½ NPT	3.98	22.0
4	½ NPT	4.72	27.0
6	½ NPT	5.55	34.6

**Weight****Compact version**

*Weight in SI units*

All values (weight) refer to devices with Class 900 flanges. Weight information in [kg].

DN [mm]	Weight [kg]
80	73
100	139
150	244

*Weight in US units*


All values (weight) refer to devices with Class 900 flanges. Weight information in [lbs].

DN [in]	Weight [lbs]
3	161
4	306
6	538

**Safety Barrier Promass 100**

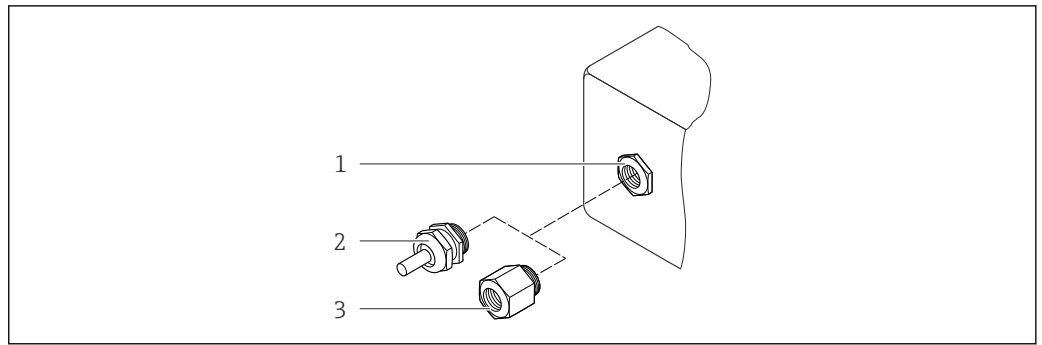
49 g (1.73 ounce)

**Materials****Transmitter housing**

- Order code for "Housing", option **A** "Compact, aluminum coated":  
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **B** "Compact, stainless":  
Stainless steel 1.4404 (316L)
- Order code for "Housing", option **C** "Ultra-compact, stainless":  
Stainless steel 1.4404 (316L)
- Window material for optional local display (→  66):
  - For order code for "Housing", option **A**: glass
  - For order code for "Housing", option **B** and **C**: plastic



**Cable entries/cable glands**



A0020640

☑ 30 Possible cable entries/cable glands

- 1 Cable entry in transmitter housing with internal thread M20 x 1.5
- 2 Cable gland M20 x 1.5
- 3 Adapter for cable entry with internal thread G 1/2" or NPT 1/2"

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

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

Cable entry/cable gland	Material
Cable gland M20 x 1.5	Nickel-plated brass
Adapter for cable entry with internal thread G 1/2"	
Adapter for cable entry with internal thread NPT 1/2"	

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

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

Cable entry/cable gland	Material
Cable gland M20 x 1.5	Stainless steel, 1.4404 (316L)
Adapter for cable entry with internal thread G 1/2"	
Adapter for cable entry with internal thread NPT 1/2"	

**Device plug**

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

**Sensor housing**

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

**Measuring tubes**

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

**Process connections**

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

**Safety Barrier Promass 100**

Housing: Polyamide

**Process connections**

Fixed flange connections:

- EN 1092-1 (DIN 2512N) flange
- ASME B16.5 flange



For information on the different materials used in the process connections → 64

**Surface roughness**All data relate to parts in contact with fluid.  
Not polished

## Human interface

**Operating concept****Operator-oriented menu structure for user-specific tasks**

- Commissioning
- Operation
- Diagnostics
- Expert level

**Quick and safe commissioning**

- Individual menus for applications
- Menu guidance with brief explanations of the individual parameter functions

**Reliable operation**

- Operation in the following languages:
  - Via "FieldCare", "DeviceCare" operating tool:  
English, German, French, Spanish, Italian, Chinese, Japanese
  - Via integrated Web browser (only available for device versions with HART, PROFIBUS DP, PROFINET and EtherNet/IP):  
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish, Korean
- Uniform operating philosophy applied to operating tools and Web browser
- If replacing the electronic module, transfer the device configuration via the plug-in memory (HistoROM DAT) which contains the process and measuring device data and the event logbook. No need to reconfigure.  
For devices with Modbus RS485, the data recovery function is implemented without the plug-in memory (HistoROM DAT).

**Efficient diagnostics increase measurement availability**

- Troubleshooting measures can be called up via the operating tools and web browser
- Diverse simulation options
- Status indicated by several light emitting diodes (LEDs) on the electronic module in the housing compartment

**Local display**A local display is only available for device versions with the following communication protocols:  
HART, PROFIBUS-DP, PROFINET, EtherNet/IP

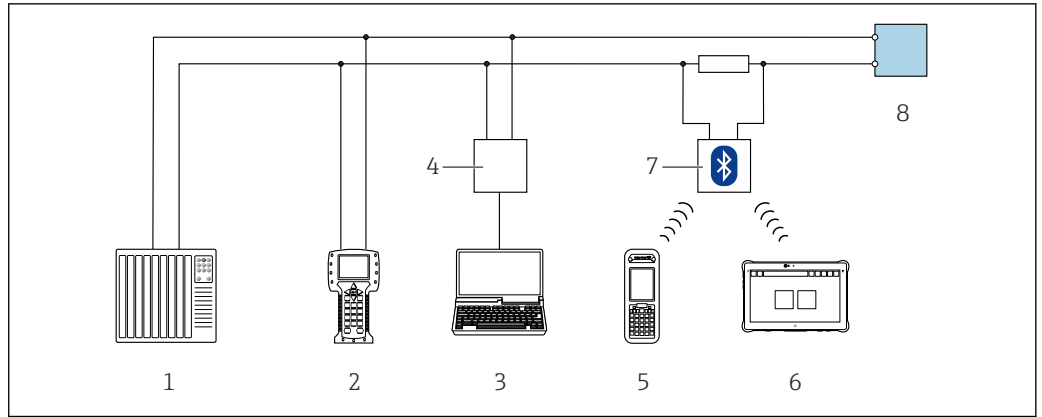
The local display is only available with the following device order code:

Order code for "Display; operation", option **B**: 4-line; illuminated, via communication**Display element**

- 4-line liquid crystal display with 16 characters per line.
- 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 °C (-4 to +140 °F). The readability of the display may be impaired at temperatures outside the temperature range.

**Remote operation****Via HART protocol**

This communication interface is available in device versions with a HART output.



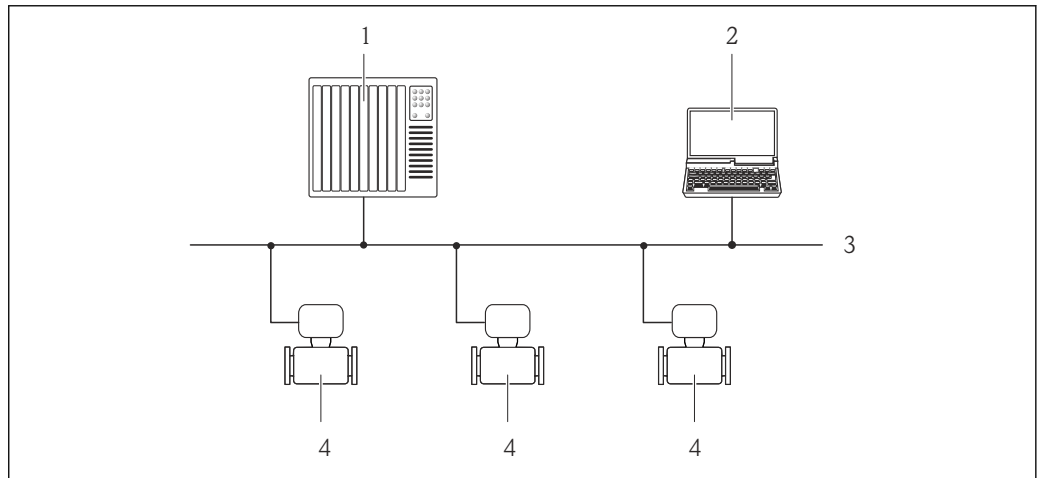
A0028747

31 Options for remote operation via HART protocol

- 1 Control system (e.g. PLC)
- 2 Field Communicator 475
- 3 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
- 4 Commubox FXA195 (USB)
- 5 Field Xpert SFX350 or SFX370
- 6 Field Xpert SMT70
- 7 VIATOR Bluetooth modem with connecting cable
- 8 Transmitter

**Via PROFIBUS DP network**

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



A0020903

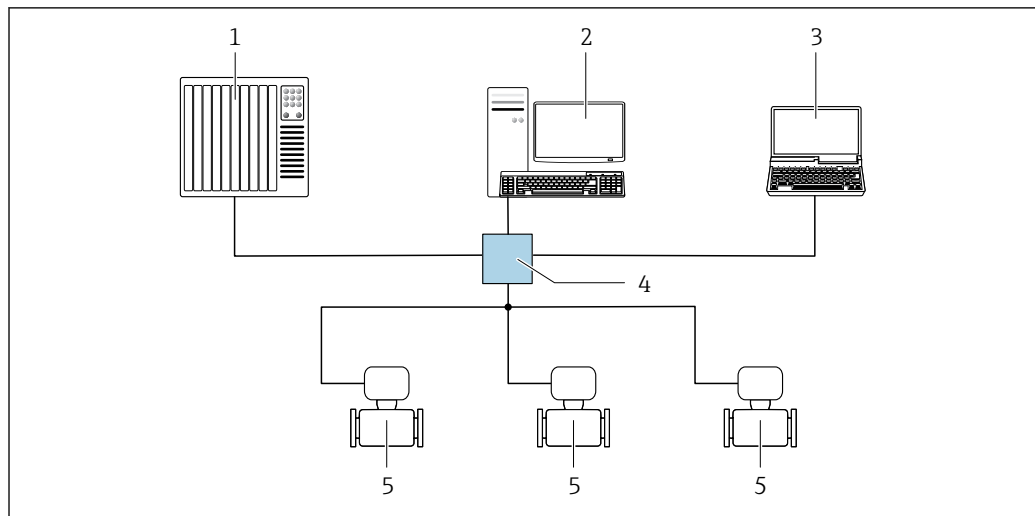
32 Options for remote operation via PROFIBUS DP network

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

**Via EtherNet/IP network**

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

## Star topology



A0032078

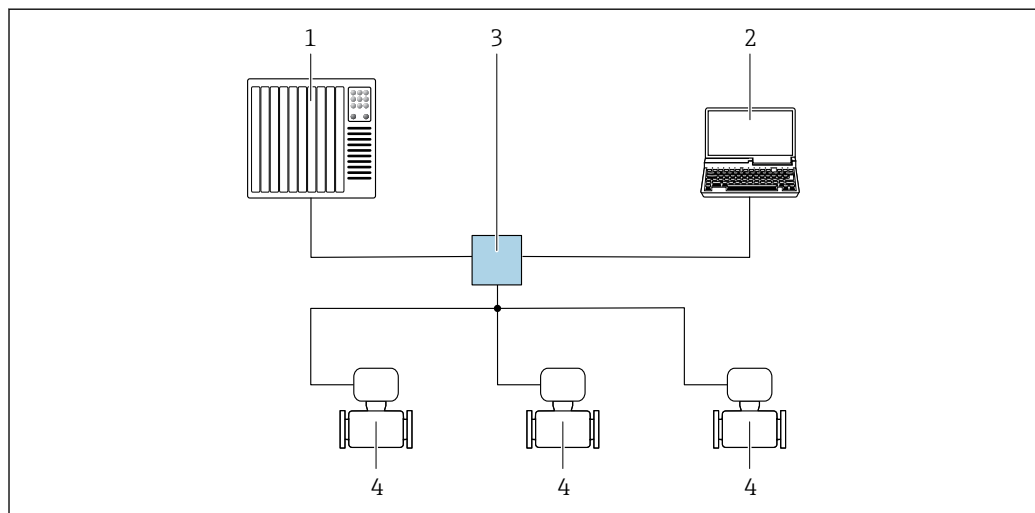
33 Options for remote operation via EtherNet/IP network: star topology

- 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 device Web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"
- 4 Ethernet switch
- 5 Measuring device

## Via PROFINET network

This communication interface is available in device versions with PROFINET.

## Star topology



A0026545

34 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 device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 3 Switch, e.g. Scalance X204 (Siemens)
- 4 Measuring device

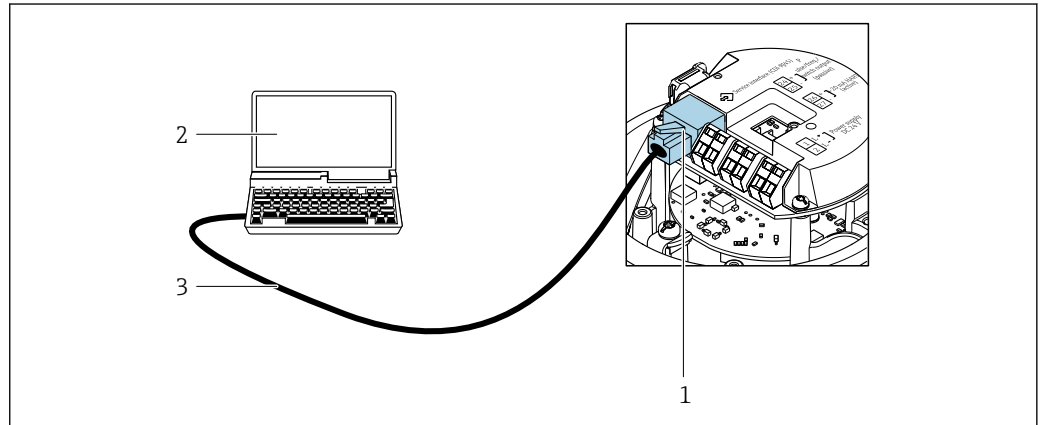
**Service interface**

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

This communication interface is present in the following device version:

- Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
- Order code for "Output", option **L**: PROFIBUS DP
- Order code for "Output", option **N**: EtherNet/IP
- Order code for "Output", option **R**: PROFINET

*HART*

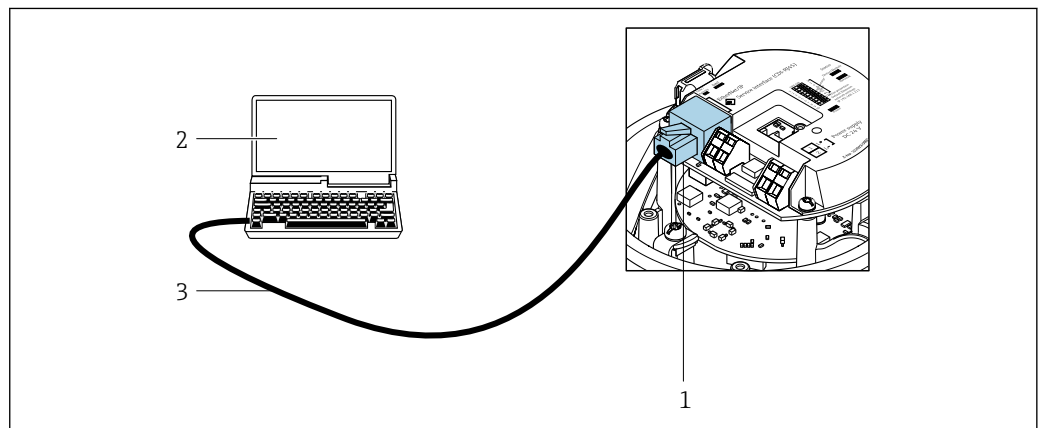


A0016926

35 Connection for the order code for "Output", option B: 4-20 mA HART, pulse/frequency/switch output

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

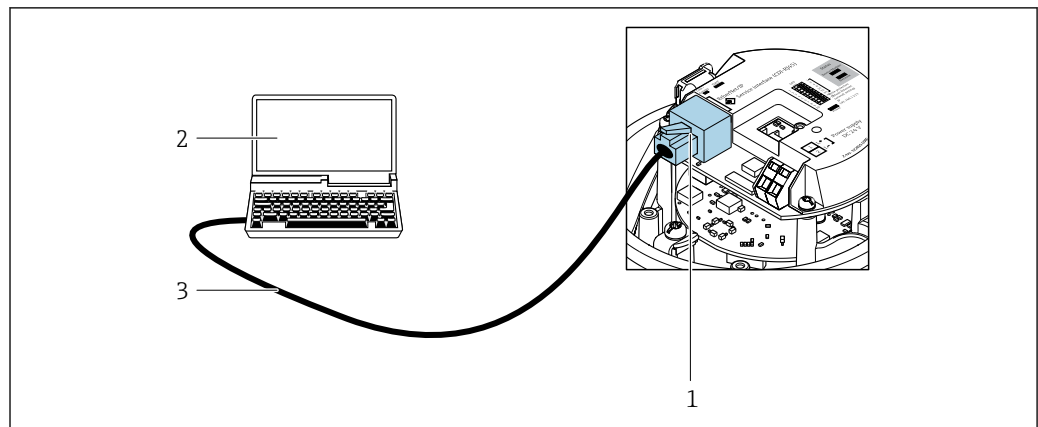
*PROFIBUS DP*



A0021270

36 Connection for order code for "Output", option L: PROFIBUS DP

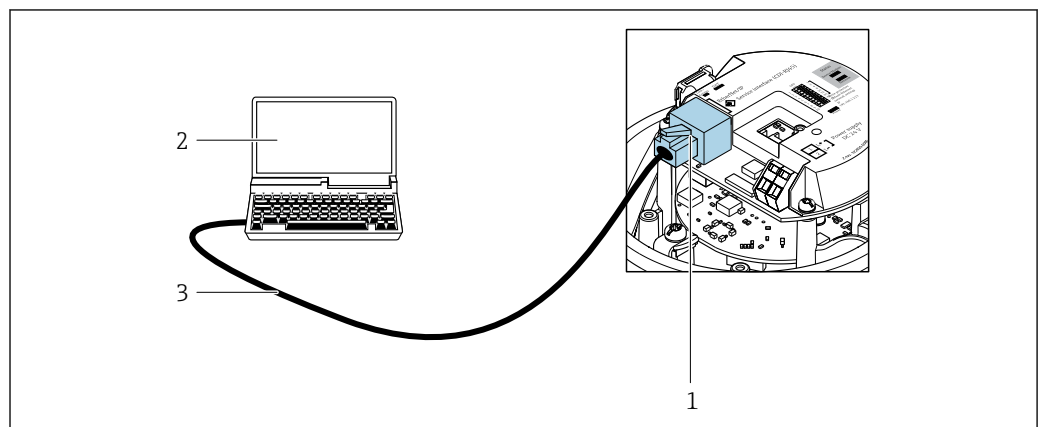
- 1 Service interface (CDI -RJ45) of the measuring device with access to the integrated Web server
- 2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"
- 3 Standard Ethernet connecting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

*EtherNet/IP*

A0016940

37 Connection for order code for "Output", option N: EtherNet/IP

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

*PROFINET*

A0016940

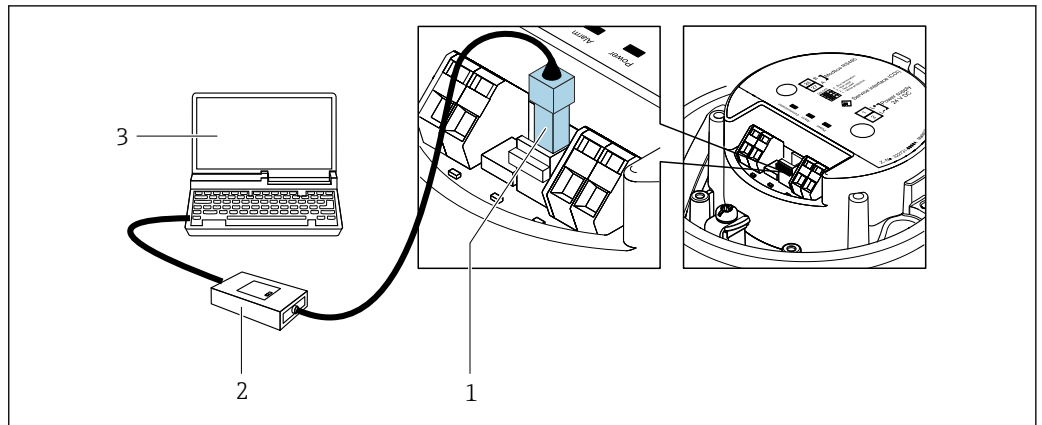
38 Connection for order code for "Output", option R: PROFINET

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

**Via service interface (CDI)**

This communication interface is present in the following device version:  
Order code for "Output", option **M**: Modbus RS485

Modbus RS485



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

A0030216

## Certificates and approvals

 Currently available certificates and approvals can be called up via the product configurator.

**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.

**C-Tick symbol**

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.

 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 ia*

Category (ATEX)	Type of protection
II1/2G	Ex ia IIC T6...T1 Ga/Gb or Ex ia IIB T6...T1 Ga/Gb
II2G	Ex ia IIC T6...T1 Gb or Ex ia IIB T6...T1 Gb
III1/2G, II2D	Ex ia IIC T6...T1 Ga/Gb or Ex ia IIB T6...T1 Ga/Gb Ex tb IIIC Txx °C Db
II2G, II2D	Ex ia IIC T6...T1 Gb or Ex ia IIB T6...T1 Gb Ex tb IIIC Txx °C Db

*Ex nA*

Category (ATEX)	Type of protection
II3G	Ex nA IIC T6...T1 Gc or Ex nA IIC T5-T1 Gc

**cCSA<sub>US</sub>**

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

*IS (Ex i)*

- Class I Division 1 Groups ABCD
- Class II Division 1 Groups EFG and Class III

*NI (Ex nA)*

Class I Division 2 Groups ABCD

**HART certification****HART interface**

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:

- Certified according to HART 7
- The device can also be operated with certified devices of other manufacturers (interoperability)

**Certification PROFIBUS****PROFIBUS interface**

The measuring device is certified and registered by the PNO (PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:

- Certified in accordance with PROFIBUS PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

**Certification PROFINET****PROFINET interface**

The measuring device is certified and registered by the PNO (PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:

- Certified according to:
  - Test specification for PROFINET devices
  - PROFINET Security Level 1 – Netload Class
- 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:

- Certified in accordance with the ODVA Conformance Test
- EtherNet/IP Performance Test
- EtherNet/IP PlugFest compliance
- The device can also be operated with certified devices of other manufacturers (interoperability)

**Modbus RS485 certification**

The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.

**Pressure Equipment Directive**

The devices can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order.

- With the identification PED/G1/x (x = category) on the sensor nameplate, Endress+Hauser confirms conformity with the "Essential Safety Requirements" specified in Appendix I of the Pressure Equipment Directive 2014/68/EU.
- Devices bearing this marking (PED) are suitable for the following types of medium:
  - Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to 0.5 bar (7.3 psi)
  - Unstable gases
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Article 4 paragraph 3 of the Pressure Equipment Directive 2014/68/EU. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU.

**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  
Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21  
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32  
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43  
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53  
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 80  
The application of the pressure equipment directive to process control devices
- NAMUR NE 105  
Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107  
Self-monitoring and diagnosis of field devices
- NAMUR NE 131  
Requirements for field devices for standard applications
- NAMUR NE 132  
Coriolis mass meter
- NACE MR0103  
Materials resistant to sulfide stress cracking in corrosive petroleum refining environments.
- NACE MR0175/ISO 15156-1  
Materials for use in H<sub>2</sub>S-containing Environments in Oil and Gas Production.

## Ordering information

Detailed ordering information is available for your nearest sales organization [www.addresses.endress.com](http://www.addresses.endress.com) or in the Product Configurator under [www.endress.com](http://www.endress.com) :

1. Click Corporate
2. Select the country
3. Click Products
4. Select the product using the filters and search field
5. Open the product page

The Configuration button to the right of the product image opens the Product Configurator.



### 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](http://www.endress.com).



Detailed information on the application packages:

- Special Documentation for the device
- Special Documentation for the device

### Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	<p><b>Heartbeat Monitoring</b> 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:</p> <ul style="list-style-type: none"> <li>■ Draw conclusions - using these data and other information - about the impact process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time.</li> <li>■ Schedule servicing in time.</li> <li>■ Monitor the process or product quality, e.g. gas pockets.</li> </ul> <p><b>Heartbeat Verification</b> Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".</p> <ul style="list-style-type: none"> <li>■ Functional testing in the installed state without interrupting the process.</li> <li>■ Traceable verification results on request, including a report.</li> <li>■ Simple testing process via local operation or other operating interfaces.</li> <li>■ Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications.</li> <li>■ Extension of calibration intervals according to operator's risk assessment.</li> </ul>



### Concentration







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

## 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](http://www.endress.com).



### Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	<p>For intrinsically safe HART communication with FieldCare via the USB interface.</p> <p> For details, see "Technical Information" TI00404F</p>
Commubox FXA291	<p>Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.</p> <p> For details, see the "Technical Information" document TI405C/07</p>



HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.  For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.  For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser.  For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser.  For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the <b>non-Ex area</b> .  For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the <b>non-Ex area</b> and the <b>Ex area</b> .  For details, see Operating Instructions BA01202S

Service-specific accessories


Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: <ul style="list-style-type: none"> <li>▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections.</li> <li>▪ Graphic illustration of the calculation results</li> </ul> Administration, documentation and access to all project-related data and parameters throughout the entire life cycle of a project. Applicator is available: <ul style="list-style-type: none"> <li>▪ Via the Internet: <a href="https://wapps.endress.com/applicator">https://wapps.endress.com/applicator</a></li> <li>▪ On CD-ROM for local PC installation.</li> </ul>
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: <ul style="list-style-type: none"> <li>▪ Via the Internet: <a href="http://www.endress.com/lifecyclemanagement">www.endress.com/lifecyclemanagement</a></li> <li>▪ On CD-ROM for local PC installation.</li> </ul>
FieldCare	FDT-based plant asset management tool from Endress+Hauser. 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.  For details, see Operating Instructions BA00027S and BA00059S

DeviceCare	Tool for connecting and configuring Endress+Hauser field devices.  For details, see Innovation brochure IN01047S
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.  For details, see "Technical Information" TI00405C

## System components


Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.  For details, see "Technical Information" TI00133R and Operating Instructions BA00247R
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 fluid temperature.  For details, see "Fields of Activity", FA00006T

## Supplementary documentation

-  For an overview of the scope of the associated Technical Documentation, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer))
  - The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

## Standard documentation

### Brief Operating Instructions

-  Brief Operating Instructions containing the most important information for standard commissioning are supplied with the device.

### Operating Instructions

Measuring device	Documentation code				
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP	PROFINET
Promass O 100	BA01191D	BA01252D	BA01180D	BA01185D	BA01430D

### Description of device parameters

Measuring device	Documentation code				
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP	PROFINET
Promass 100	GP01033D	GP01034D	GP01035D	GP01036D	GP01037D

## Supplementary device-dependent documentation

### Safety Instructions

Content	Documentation code
ATEX/IECEX Ex i	XA00159D
ATEX/IECEX Ex nA	XA01029D
cCSAus IS	XA00160D
INMETRO Ex i	XA01219D

Content	Documentation code
INMETRO Ex nA	XA01220D
NEPSI Ex i	XA01249D
NEPSI Ex nA	XA01262D

### Special Documentation

Content	Documentation code
Information on the Pressure Equipment Directive	SD00142D
Modbus RS485 Register Information	SD00154D
Concentration Measurement	SD01152D
Heartbeat Technology	SD01153D

### Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Specified for each individual accessory

## Registered trademarks

### **HART®**

Registered trademark of the HART Communication Foundation, Austin, USA

### **PROFIBUS®**

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

### **Modbus®**

Registered trademark of SCHNEIDER AUTOMATION, INC.

### **EtherNet/IP™**

Trademark of ODVA, Inc.

### **PROFINET®**

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

### **Microsoft®**

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

### **TRI-CLAMP®**

Registered trademark of Ladish & Co., Inc., Kenosha, USA

### **Applicator®, FieldCare®, DeviceCare®, Field Xpert™, HistoROM®, Heartbeat Technology™**

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

---

---



[www.addresses.endress.com](http://www.addresses.endress.com)

---