

## Technical Information

# Proline Promass 80F, 83F

## Coriolis Mass Flow Measuring System

The universal and multivariable flowmeter for liquids and gases



### Application

The Coriolis measuring principle operates independently of the physical fluid properties, such as viscosity and density.

- Extremely accurate measurement of liquids and gases such as oils, lubricants, fuels, liquefied gases, solvents, foodstuffs and compressed gases
- Fluid temperatures up to +350 °C (+662°F)
- Process pressures up to 100 bar (1450 psi)
- Mass flow measurement up to 2200 t/h (80840 lb/min)

Approvals for hazardous area:

- ATEX, FM, CSA, TIIS, IECEx, NEPSI

Approvals in the food industry/hygiene sector:

- 3A, FDA, EHEDG

Connection to all common process control systems:

- HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, MODBUS

Relevant safety aspects:

- Secondary containment up to 40 bar (580 psi), Pressure Equipment Directive, AD 2000 SIL-2
- Purge connections or rupture disk (optional)

### Your benefits

The Promass measuring devices make it possible to simultaneously record several process variables (mass/density/temperature) for various process conditions during measuring operation.

The **Proline transmitter concept** comprises:

- Modular device and operating concept resulting in a higher degree of efficiency
- Software options for batching and concentration measurement for extended range of application
- Diagnostic ability and data back-up for increased process quality

The **Promass sensors**, tried and tested in over 100000 applications, offer:

- Best performance due to PremiumCal
- Multivariable flow measurement in compact design
- Insensitivity to vibrations thanks to balanced two-tube measuring system
- Immune from external piping forces due to robust design
- Easy installation without taking inlet and outlet runs into consideration

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## Function and system design

### Measuring principle

The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present 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

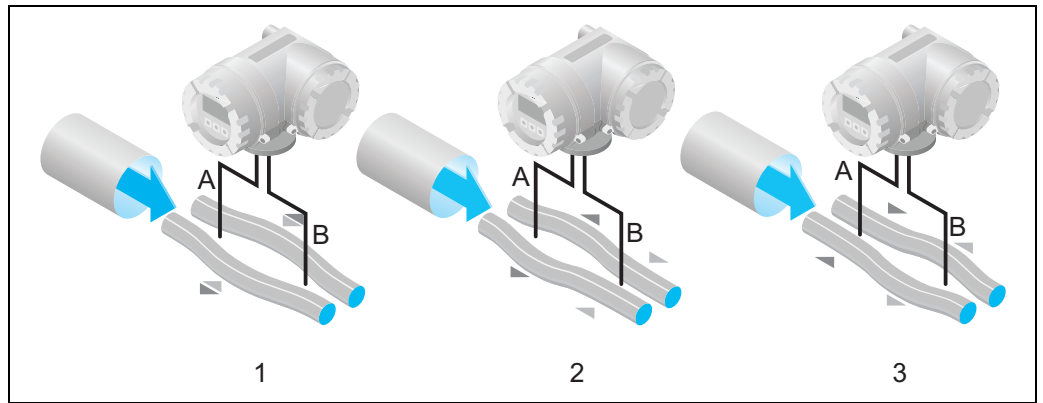
$\omega$  = rotational velocity

$v$  = 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 angular velocity  $\omega$ , the Promass sensor uses oscillation.

The measuring tubes through which the measured material flows are brought into oscillation. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):

- At zero flow, in other words 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).



a0003385

The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet.

System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

### Density measurement

The measuring tubes are continuously excited at their resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tubes and fluid) results in a corresponding, automatic adjustment in the oscillation frequency. Resonance frequency is thus a function of fluid density. The microprocessor utilizes this relationship to obtain a density signal.

### Temperature measurement

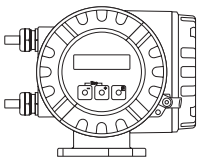
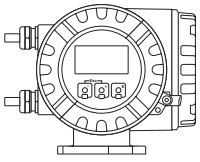
The temperature of the measuring tubes is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output.

**Measuring system**

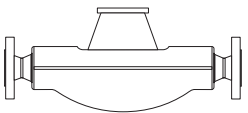
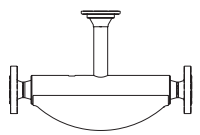
The measuring system consists of a transmitter and a sensor. Two versions are available:

- Compact version: transmitter and sensor form a mechanical unit
- Remote version: transmitter and sensor are mounted physically separate from one another

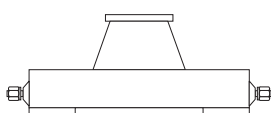
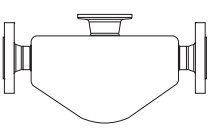
**Transmitter**

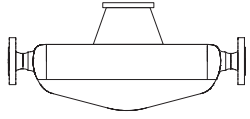
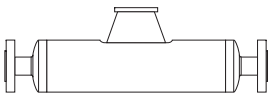
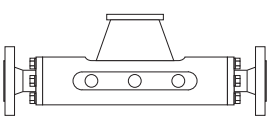
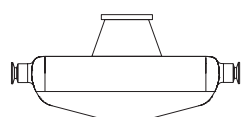
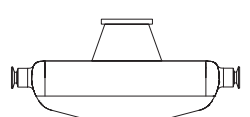
<p><b>Promass 80</b></p>  <p style="text-align: right; font-size: small;">a0003671</p>	<ul style="list-style-type: none"> <li>■ Two-line liquid-crystal display</li> <li>■ Operation with push buttons</li> </ul>
<p><b>Promass 83</b></p>  <p style="text-align: right; font-size: small;">a0003672</p>	<ul style="list-style-type: none"> <li>■ Four-line liquid-crystal display</li> <li>■ Operation with "Touch control"</li> <li>■ Application-specific Quick Setup</li> <li>■ Mass flow, volume flow, density and temperature measurement as well as calculated variables (e.g. fluid concentrations)</li> </ul>

**Sensor**

<p><b>F</b></p>  <p style="text-align: right; font-size: small;">a0003673</p>	<ul style="list-style-type: none"> <li>■ Universal sensor for fluid temperatures up to +200 °C (+392 °F).</li> <li>■ Nominal diameters DN 8 to 250 (3/8" to 10").</li> <li>■ Material: Stainless Steel EN 1.4539/ASTM 904L, EN 1.4404/ASTM 316L, Alloy C-22 DIN 2.4602</li> </ul>	<p>Documentation No. TI101D</p>
<p><b>F (High-temperature)</b></p>  <p style="text-align: right; font-size: small;">a0003675</p>	<ul style="list-style-type: none"> <li>■ Universal high-temperature sensor for fluid temperatures up to +350 °C (+662 °F).</li> <li>■ Nominal diameters DN 25, 50, 80 (1", 2", 3")</li> <li>■ Material: Alloy C-22, DIN 2.4602, EN 1.4404/ASTM 316L</li> </ul>	

**Other sensors can be found in the separate documentation**

<p><b>A</b></p>  <p style="text-align: right; font-size: small;">a0003679</p>	<ul style="list-style-type: none"> <li>■ Single-tube system for highly accurate measurement of very small flows</li> <li>■ Nominal diameters DN 1 to 4 (1/24" to 1/8")</li> <li>■ Material: Stainless Steel EN 1.4539/ASTM 904L, EN 1.4404/ASTM 316L, Alloy C-22 DIN 2.4602 (process connection)</li> </ul>	<p>Documentation No. TI054D</p>
<p><b>E</b></p>  <p style="text-align: right; font-size: small;">a0002271</p>	<ul style="list-style-type: none"> <li>■ General purpose sensor, ideal replacement for volumetric flowmeters.</li> <li>■ Nominal diameters DN DN 8 to 50 (3/8" to 2")</li> <li>■ Material: Stainless Steel EN 1.4539/ASTM 904L, EN 1.4404/ASTM 316L</li> </ul>	

<p><b>H</b></p>  <p>a0003677</p>	<ul style="list-style-type: none"> <li>■ Single bent tube. Low pressure loss and chemically resistant material</li> <li>■ Nominal diameters DN 8 to 50 (3/8" to 2")</li> <li>■ Material: Zirconium 702/R 60702, Tantalum 2.5W</li> </ul>	<p>Documentation No. TI074D</p>
<p><b>I</b></p>  <p>a0003678</p>	<ul style="list-style-type: none"> <li>■ Straight single-tube instrument. Minimal shear stress on fluid, hygienic design, low pressure loss</li> <li>■ Nominal diameters DN 8 to 80 (3/8" to 3")</li> <li>■ Material: Titanium, Ti Grade 2, Ti Grade 9</li> </ul>	<p>Documentation No. TI075D</p>
<p><b>M</b></p>  <p>a0003676</p>	<ul style="list-style-type: none"> <li>■ Robust sensor for extreme process pressures, high requirements for the secondary containment and fluid temperatures up to +150 °C (+302 °F)</li> <li>■ Nominal diameters DN 8 to 80 (3/8" to 3")</li> <li>■ Material: Titanium, Ti Grade 2, Ti Grade 9</li> </ul>	<p>Documentation No. TI102D</p>
<p><b>P</b></p>  <p>a0006828</p>	<ul style="list-style-type: none"> <li>■ Single bent tube, minimal shear stress on fluid. Hygienic design with documents for Life Science Industries applications, low pressure loss, for fluid temperatures up to +200 °C (+392 °F).</li> <li>■ Nominal diameters DN 8 to 50 (3/8" to 2")</li> <li>■ Material: Stainless Steel EN 1.4435/ASTM 316L</li> </ul>	<p>Documentation No. TI078D</p>
<p><b>S</b></p>  <p>a0006828</p>	<ul style="list-style-type: none"> <li>■ Single bent tube. Hygienic design, low pressure loss, for fluid temperatures up to +150 °C (+302 °F)</li> <li>■ Nominal diameters DN 8 to 50 (3/8" to 2")</li> <li>■ Material: Stainless Steel, EN 1.4539/ASTM 904L, EN 1.4435/ASTM 316L</li> </ul>	<p>Documentation No. TI076D</p>

## Input

### Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

### Measuring range

#### Measuring ranges for liquids

DN		Range for full scale values (liquids) $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
[mm]	[inch]	[kg/h]	[lb/min]
8	3/8"	0 to 2000	0 to 73.5
15	1/2"	0 to 6500	0 to 238
25	1"	0 to 18000	0 to 660
40	1 1/2"	0 to 45000	0 to 1650
50	2"	0 to 70000	0 to 2570
80	3"	0 to 180000	0 to 6600
100	4"	0 to 350000	0 to 12860
150	6"	0 to 800000	0 to 29400
250	10"	0 to 2200000	0 to 80840

#### Measuring ranges for gases

The full scale values depend on the density of the gas. Use the formula below to calculate the full scale values:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_{(G)} \div x \text{ [kg/m}^3 \text{ (lb/ft}^3\text{)]}$$

$$\dot{m}_{\max(G)} = \text{max. full scale value for gas [kg/h (lb/min)]}$$

$$\dot{m}_{\max(F)} = \text{max. full scale value for liquid [kg/h (lb/min)]}$$

$$\rho_{(G)} = \text{gas density in [kg/m}^3 \text{ (lb/ft}^3\text{)] under process conditions}$$

DN		X	DN		X
[mm]	[inch]		[mm]	[inch]	
8	3/8"	60	80	3"	110
15	1/2"	80	100	4"	130
25	1"	90	150	6"	200
40	1 1/2"	90	250	10"	200
50	2"	90			

Here,  $\dot{m}_{\max(G)}$  can never be greater than  $\dot{m}_{\max(F)}$

*Calculation example for gas:*

- Sensor type: Promass F, DN 50
- Gas: air with a density of 60.3 kg/m<sup>3</sup> (at 20 °C and 50 bar)
- Measuring range (liquid): 70000 kg/h
- x = 90 (for Promass F DN 50)

Max. possible full scale value:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_{(G)} \div x \text{ [kg/m}^3\text{]} = 70000 \text{ kg/h} \cdot 60.3 \text{ kg/m}^3 \div 90 \text{ kg/m}^3 = 46900 \text{ kg/h}$$

*Recommended measuring ranges:*

See information in the "Limiting flow" Section → 23

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<b>Operable flow range</b>	Greater than 1000 :1. Flow rates above the preset full scale value do not overload the amplifier, i.e. the totalizer values are registered correctly.
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**Input signal**

**Status input (auxiliary input)**

$U = 3$  to  $30$  V DC,  $R_i = 5$  k $\Omega$ , galvanically isolated.

Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start, batching start/stop (optional), totalizer reset for batching (optional).

**Status input (auxiliary input) with PROFIBUS DP**

$U = 3$  to  $30$  V DC,  $R_i = 3$  k $\Omega$ , galvanically isolated.

Switch level:  $\pm 3$  to  $\pm 30$  V DC, independent of polarity.

Configurable for: positive zero return, error message reset, zero point adjustment start, batching start/stop (optional), totalizer reset for batching (optional).

**Status input (auxiliary input) with MODBUS RS485**

$U = 3$  to  $30$  V DC,  $R_i = 3$  k $\Omega$ , galvanically isolated.

Switch level:  $\pm 3$  to  $\pm 30$  V DC, independent of polarity.

Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start.

**Current input (only Promass 83)**

Active/passive selectable, galvanically isolated, resolution: 2  $\mu$ A

- Active: 4 to 20 mA,  $R_L < 700$   $\Omega$ ,  $U_{out} = 24$  V DC, short-circuit proof
- Passive: 0/4 to 20 mA,  $R_i = 150$   $\Omega$ ,  $U_{max} = 30$  V DC

## Output

### Output signal

#### Promass 80

##### *Current output*

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% o.f.s./°C, resolution: 0.5  $\mu$ A

- Active: 0/4 to 20 mA,  $R_L < 700 \Omega$  (for HART:  $R_L \geq 250 \Omega$ )
- Passive: 4 to 20 mA; supply voltage  $U_S$  18 to 30 V DC;  $R_i \geq 150 \Omega$

##### *Pulse/frequency output*

Passive, open collector, 30 V DC, 250 mA, galvanically isolated.

- Frequency output: full scale frequency 2 to 1000 Hz ( $f_{max} = 1250$  Hz), on/off ratio 1:1, pulse width max. 2 s
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.5 to 2000 ms)

##### *PROFIBUS PA interface*

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Profile Version 3.0
- Current consumption: 11 mA
- Permitted supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: 31.25 kBit/s
- Signal encoding: Manchester II
- Function blocks: 4  $\times$  Analog Input, 2  $\times$  Totalizer
- Output data: Mass flow, Volume flow, Density, Temperature, Totalizer
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Totalizer control
- Bus address can be configured via miniature switches or via the local display (optional)

#### Promass 83

##### *Current output*

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% o.f.s./°C, resolution: 0.5  $\mu$ A


- Active: 0/4 to 20 mA,  $R_L < 700 \Omega$  (for HART:  $R_L \geq 250 \Omega$ )
- Passive: 4 to 20 mA; supply voltage  $U_S$  18 to 30 V DC;  $R_i \geq 150 \Omega$

##### *Pulse/frequency output*

active/passive selectable, galvanically isolated


- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms),  $R_L > 100 \Omega$
- Passive: open collector, 30 V DC, 250 mA
- Frequency output:
  - full scale frequency 2 to 10000 Hz ( $f_{max} = 12500$  Hz), on/off ratio 1:1, pulse width max. 2 s
- Pulse output:
  - pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

##### *PROFIBUS DP interface*


- PROFIBUS DP in accordance with EN 50170 Volume 2
- Profile Version 3.0
- Data transmission rate: 9.6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Signal encoding: NRZ Code
- Function blocks: 6  $\times$  Analog Input, 3  $\times$  Totalizer
- Output data: Mass flow, Volume flow, Corrected volume flow, Density, Reference density, Temperature, Totalizers 1 to 3
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Totalizer control
- Bus address can be configured via miniature switches or via the local display (optional)
- Available output combination  $\rightarrow$   12



*PROFIBUS PA interface*

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Data transmission rate: 31.25 kBit/s
- Current consumption: 11 mA
- Permitted supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Signal encoding: Manchester II
- Function blocks: 6 × Analog Input, 3 × Totalizer
- Output data: Mass flow, Volume flow, Corrected volume flow, Density, Reference density, Temperature, Totalizers 1 to 3
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Totalizer control
- Bus address can be configured via miniature switches or via the local display (optional)
- Available output combination →  12

*MODBUS interface*

- MODBUS device type: slave
- Address range: 1 to 247
- Supported function codes: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Physical interface: RS485 in accordance with EIA/TIA-485 standard
- Supported baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Transmission mode: RTU or ASCII
- Response times:
  - Direct data access = typically 25 to 50 ms
  - Auto-scan buffer (data range) = typically 3 to 5 ms
- Possible output combinations →  12

*FOUNDATION Fieldbus interface*

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Data transmission rate: 31.25 kBit/s
- Current consumption: 12 mA
- Permitted supply voltage: 9 to 32 V
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Bus connection with integrated reverse polarity protection
- Signal encoding: Manchester II
- ITK Version 5.01
- Function blocks:
  - 8 × Analog Input (Execution time: each 18 ms)
  - 1 × Digital Output (18 ms)
  - 1 × PID (25 ms)
  - 1 × Arithmetic (20 ms)
  - 1 × Input Selector (20 ms)
  - 1 × Signal Characterizer (20 ms)
  - 1 × Integrator (18 ms)
- Number of VCRs: 38
- Number of link objects in VFD: 40
- Output data: Mass flow, Volume flow, Corrected volume flow, Density, Reference density, Temperature, Totalizers 1 to 3
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Reset totalizer
- Link Master (LM) function is supported

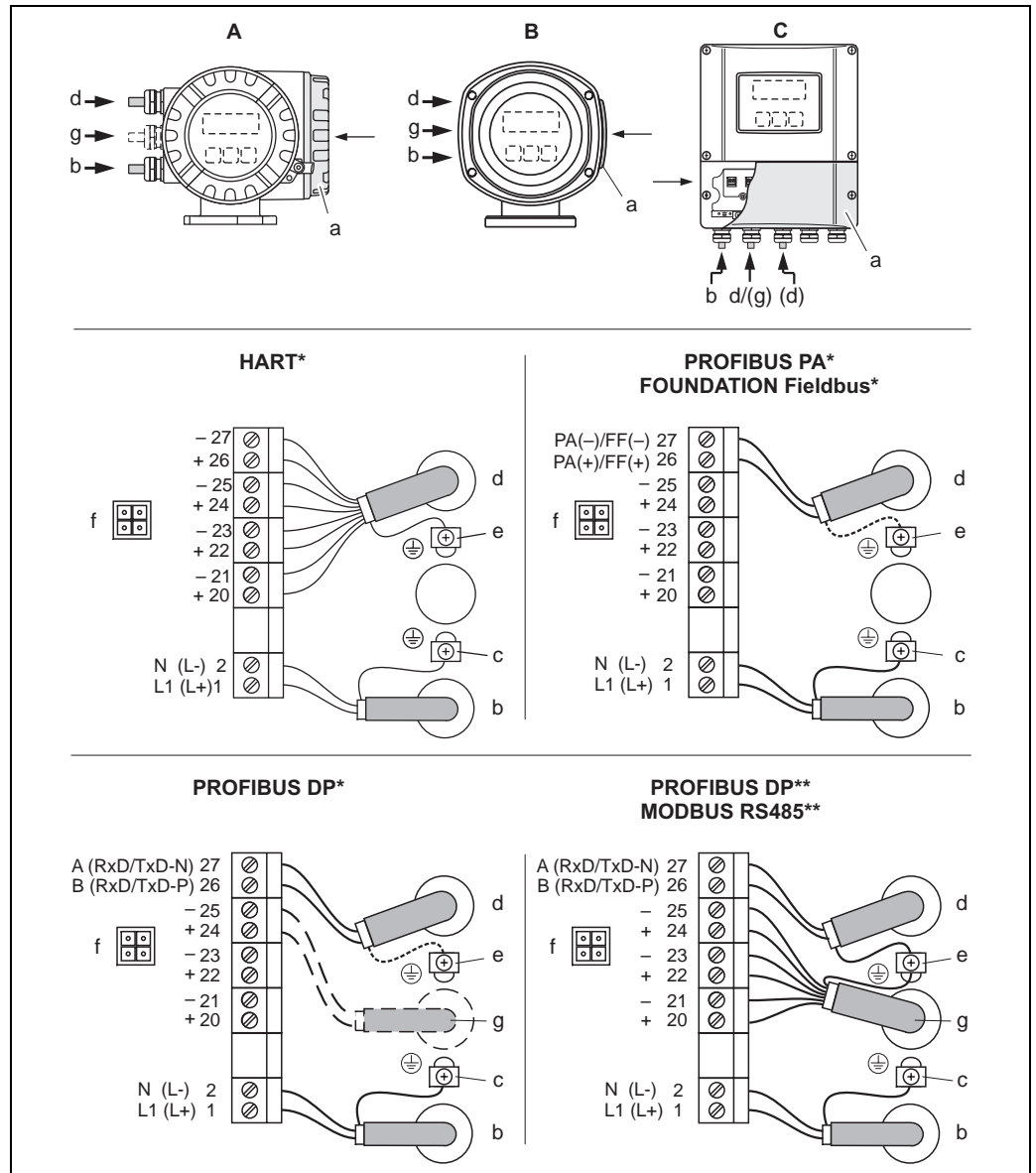
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<b>Signal on alarm</b>	<p><b>Current output</b> Failsafe mode selectable (e.g. in accordance with NAMUR Recommendation NE 43)</p> <p><b>Pulse/frequency output</b> Failsafe mode selectable</p> <p><b>Status output (Promass 80)</b> Nonconductive in the event of a fault or if the power supply fails</p> <p><b>Relay output (Promass 83)</b> Dead in the event of a fault or if the power supply fails</p>
<b>Load</b>	see "Output signal"
<b>Low flow cutoff</b>	Switch points for low flow are selectable.
<b>Galvanic isolation</b>	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.
<b>Switching output</b>	<p><b>Status output (Promass 80)</b></p> <ul style="list-style-type: none"> <li>■ Open collector</li> <li>■ max. 30 V DC / 250 mA</li> <li>■ galvanically isolated</li> <li>■ Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values</li> </ul> <p><b>Relay output (Promass 83)</b></p> <ul style="list-style-type: none"> <li>■ max. 30 V / 0.5 A AC; 60 V / 0.1 A DC</li> <li>■ galvanically isolated</li> <li>■ Normally closed (NC or break) or normally open (NO or make) contacts available (factory setting: relay 1 = NO, relay 2 = NC)</li> </ul>

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## Power supply

Electrical connection  
Measuring unit



Connecting the transmitter, cable cross-section: max. 2.5 mm<sup>2</sup>

- A View A (field housing)
- B View B (Stainless Steel field housing)
- C View C (wall-mount housing)

\*) fixed communication board

\*\*) flexible communication board

a Connection compartment cover

b Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC

Terminal No. 1: L1 for AC, L+ for DC

Terminal No. 2: N for AC, L- for DC

c Ground terminal for protective ground

d Signal cable: see Terminal assignment → 12

Fieldbus cable:

Terminal No. 26: DP (B) / PA (+) / FF (+) / MODBUS RS485 (B) / (PA, FF: with reverse polarity protection)

Terminal No. 27: DP (A) / PA (-) / FF (-) / MODBUS RS485 (A) / (PA, FF: with reverse polarity protection)

e Ground terminal for signal cable shield / fieldbus cable / RS485 line

f Service adapter for connecting service interface FXA 193 (Fieldcheck, FieldCare)

g Signal cable: see Terminal assignment → 12

g Cable for external termination (only for PROFIBUS DP with permanent assignment communication board):

Terminal No. 24: +5 V

Terminal No. 25: DGND

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Electrical connection,  
terminal assignment

## Promass 80

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
80***_*****A	-	-	Frequency output	Current output, HART
80***_*****D	Status input	Status output	Frequency output	Current output, HART
80***_*****H	-	-	-	PROFIBUS PA
80***_*****S	-	-	Frequency output Ex i, passive	Current output Ex i Active, HART
80***_*****T	-	-	Frequency output Ex i, passive	Current output Ex i Passive, HART
80***_*****8	Status input	Frequency output	Current output 2	Current output 1, HART

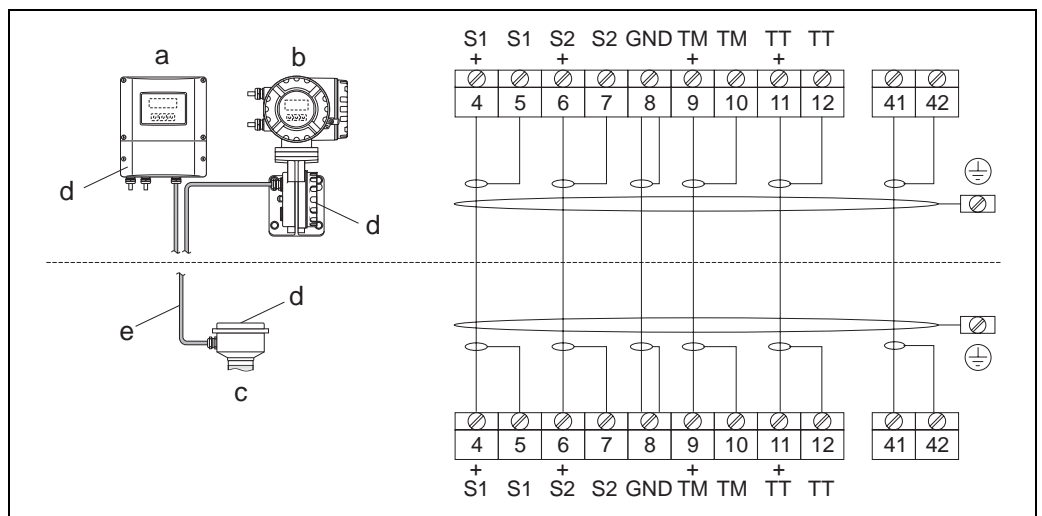
## Promass 83

The inputs and outputs on the communication board can be either permanently assigned (fixed) or variable (flexible), depending on the version ordered (see table). Replacements for modules which are defective or which have to be replaced can be ordered as accessories.

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
<i>Fixed communication boards (permanent assignment)</i>				
83***_*****A	-	-	Frequency output	Current output, HART
83***_*****B	Relay output	Relay output	Frequency output	Current output, HART
83***_*****F	-	-	-	PROFIBUS PA, Ex i
83***_*****G	-	-	-	FOUNDATION Fieldbus Ex i
83***_*****H	-	-	-	PROFIBUS PA
83***_*****J	-	-	+5V (ext. termination)	PROFIBUS DP
83***_*****K	-	-	-	FOUNDATION Fieldbus
83***_*****Q	-	-	Status input	MODBUS RS485
83***_*****R	-	-	Current output 2 Ex i, active	Current output 1 Ex i active, HART
83***_*****S	-	-	Frequency output Ex i, passive	Current output Ex i Active, HART
83***_*****T	-	-	Frequency output Ex i, passive	Current output Ex i Passive, HART
83***_*****U	-	-	Current output 2 Ex i, passive	Current output 1 Ex i passive, HART
<i>Flexible communication boards</i>				
83***_*****C	Relay output 2	Relay output 1	Frequency output	Current output, HART
83***_*****D	Status input	Relay output	Frequency output	Current output, HART
83***_*****E	Status input	Relay output	Current output 2	Current output, HART
83***_*****L	Status input	Relay output 2	Relay output 1	Current output, HART
83***_*****M	Status input	Frequency output 2	Frequency output 1	Current output, HART
83***_*****N	Current output	Frequency output	Status input	MODBUS RS485
83***_*****P	Current output	Frequency output	Status input	PROFIBUS DP

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
83***_*****V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
83***_*****W	Relay output	Current output 3	Current output 2	Current output 1, HART
83***_*****0	Status input	Current output 3	Current output 2	Current output 1, HART
83***_*****2	Relay output	Current output 2	Frequency output	Current output 1, HART
83***_*****3	Current input	Relay output	Current output 2	Current output 1, HART
83***_*****4	Current input	Relay output	Frequency output	Current output, HART
83***_*****5	Status input	Current input	Frequency output	Current output, HART
83***_*****6	Status input	Current input	Current output 2	Current output 1, HART
83***_*****7	Relay output 2	Relay output 1	Status input	MODBUS RS485

**Electrical connection**  
**Remote version**



Connecting the remote version

- a Wall-mount housing: non-hazardous area and ATEX II3G / zone 2 → see separate "Ex documentation"
- b Wall-mount housing: ATEX II2G / Zone 1 / FM/CSA → see separate "Ex documentation"
- c Remote version, flanged version
- d Cover for connection compartment or connection housing
- e Connecting cable

Terminal No.: 4/5 = gray; 6/7 = green; 8 = yellow; 9/10 = pink; 11/12 = white; 41/42 = brown

**Supply voltage** 85 to 260 V AC, 45 to 65 Hz  
20 to 55 V AC, 45 to 65 Hz  
16 to 62 V DC

**Cable entries** *Power-supply and signal cables (inputs/outputs):*

- Cable entry M20 × 1.5 (8 to 12 mm) (0.31" to 0.47")
- Thread for cable entries, 1/2" NPT, G 1/2"

*Connecting cable for remote version:*

- Cable entry M20 × 1.5 (8 to 12 mm) (0.31" to 0.47")
- Thread for cable entries, 1/2" NPT, G 1/2"

**Remote version cable specification**

- $6 \times 0.38 \text{ mm}^2$  (PVC cable with common shield and individually shielded cores)
- Conductor resistance:  $\leq 50 \text{ } \Omega/\text{km}$
- Capacitance: core/shield:  $\leq 420 \text{ pF/m}$
- Cable length: max. 20 m (65 ft)
- Permanent operating temperature: max.  $+105 \text{ } ^\circ\text{C}$  ( $+221 \text{ } ^\circ\text{F}$ )

Operation in zones of severe electrical interference:

The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR recommendation NE 21/43.

**Power consumption**

AC:  $<15 \text{ VA}$  (including sensor)

DC:  $<15 \text{ W}$  (including sensor)

*Switch-on current:*

- Max. 13.5 A ( $<50 \text{ ms}$ ) at 24 V DC
- Max. 3 A ( $<5 \text{ ms}$ ) at 260 V AC

**Power supply failure****Promass 80**

Lasting min. 1 power cycle:

- EEPROM saves measuring system data if the power supply fails
- HistoROM/S-DAT: exchangeable data storage chip with sensor specific data (nominal diameter, serial number, calibration factor, zero point, etc.)

**Promass 83**

Lasting min. 1 power cycle:

- EEPROM and T-DAT save the measuring system data if the power supply fails.
- HistoROM/S-DAT: exchangeable data storage chip with sensor specific data (nominal diameter, serial number, calibration factor, zero point, etc.)

**Potential equalization**


No special measures for potential equalization are required. For instruments for use in hazardous areas, observe the corresponding guidelines in the specific Ex documentation.

## Performance characteristics

### Reference operating conditions

- Error limits following ISO/DIS 11631
- Water, typically +20 to +30 °C (+68 to +86 °F); 2 to 4 bar (30 to 60 psi)
- Data according to calibration protocol  $\pm 5$  °C ( $\pm 9$  °F) and  $\pm 2$  bar ( $\pm 30$  psi)
- Accuracy based on accredited calibration rigs according to ISO 17025

### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5$   $\mu$ A. Design fundamentals →  17.

o.r. = of reading

#### Masse flow and volume flow (liquid)

Promass 83F:

- $\pm 0.05\%$  o.r. (PremiumCal, for mass flow)
- $\pm 0.10\%$  o.r.

Promass 80F:

- $\pm 0.10\%$  o.r. (optional)
- $\pm 0.15\%$  o.r.

#### Mass flow (gas)

Promass 83F, 80F:  $\pm 0.35\%$  o.r.

#### Density (liquid)

- $\pm 0.0005$  g/cc (under reference conditions)
- $\pm 0.0005$  g/cc (after field density calibration under process conditions)
- $\pm 0.001$  g/cc (after special density calibration)
- $\pm 0.01$  g/cc (over the entire measuring range of the sensor)

1 g/cc = 1 kg/l

Special density calibration (optional):

- Calibration range: 0.8 to 1.8 g/cc, +5 to +80 °C (+41 to +176 °F)
- Operation range: 0.0 to 5.0 g/cc, -50 to +200 °C (-58 to +392 °F)

#### Temperature

$\pm 0.5$  °C  $\pm 0.005 \cdot T$  °C

( $\pm 1$  °F  $\pm 0.003 \cdot (T - 32)$  °F)

T = medium temperature

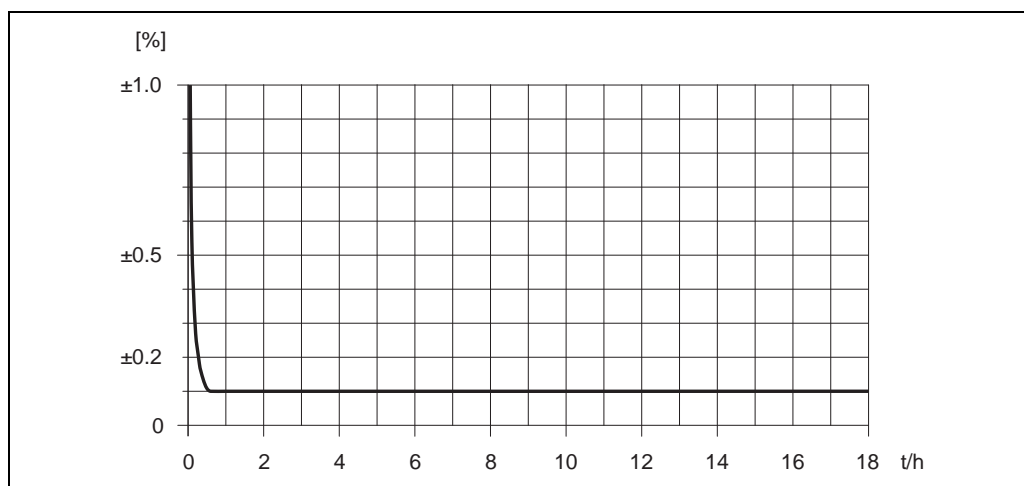
#### Zero point stability

*Promass F (Standard)*

DN		Zero point stability	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]
8	3/8"	0.030	0.001
15	1/2"	0.200	0.007
25	1"	0.540	0.019
40	1 1/2"	2.25	0.083
50	2"	3.50	0.129
80	3"	9.00	0.330
100	4"	14.00	0.514
150	6"	32.00	1.17
250	10"	88.00	3.23

*Promass F (high-temperature version)*

DN		Zero point stability	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]
25	1"	1.80	0.0661
50	2"	7.00	0.2572
80	3"	18.0	0.6610

**Example for max. measured error**

Max. measured error in % o.r. (example: Promass 83F / DN 25)

*Flow values (example)*

Design fundamentals → 17

Turn down	Flow		Max. measured error [% o.r.]
	[kg/h] bzw. [l/h]	[lb/min]	
500 : 1	36	1.323	1.5
100 : 1	180	6.615	0.3
25 : 1	720	26.46	0.1
10 : 1	1800	66.15	0.1
2 : 1	9000	330.75	0.1

o.r. = of reading

**Repeatability**

Design fundamentals → 17.

o.r. = of reading

**Mass flow and volume flow (liquids)**

Promass 83F:

- ±0.025% o.r. (PremiumCal, for mass flow)
- ±0.05% o.r.

Promass 80F: ±0.05% o.r.

**Mass flow (gases)**

Promass 80F, 83F: ±0.25% o.r.



**Density (liquid)**

±0.00025 g/cc

1 g/cc = 1 kg/l

**Temperature**

±0.25 °C ± 0.0025 · T °C

(±1 °F ± 0.003 · (T - 32) °F)

T = medium temperature

**Influence of medium temperature**

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is ±0.0002% of the full scale value/°C (±0.0001% of the full scale value / °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.

DN		Promass F	Promass F High-temperature version
[mm]	[inch]	[% o.r./bar]	[% o.r./bar]
8	3/8"	no influence	-
15	1/2"	no influence	-
25	1"	no influence	no influence
40	1 1/2"	-0.003	-
50	2"	-0.008	-0.008
80	3"	-0.009	-0.009
100	4"	-0.007	-
150	6"	-0.009	-
250	10"	-0.009	-

o.r. = of reading

**Design fundamentals**

Dependent on the flow:

- Flow ≥ Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability: ± 1/2 · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Grundgenauigkeit ÷ 100)
  - Max. measured error: ± (zero point stability ÷ measured value) · 100% o.r.
  - Repeatability: ± 1/2 · (zero point stability ÷ measured value) · 100% o.r.

o.r. = of reading

Design fundamentals for	Promass 83F	Promass 80F
Mass flow liquids, PremiumCal	0.05	-
Mass flow liquids	0.10	0.10 (optional); 0.15
Volume flow liquids	0.10	0.10 (optional); 0.15
Mass flow gases	0.35	0.35

## Operating conditions: Installation

### Installation instructions

Note the following points:

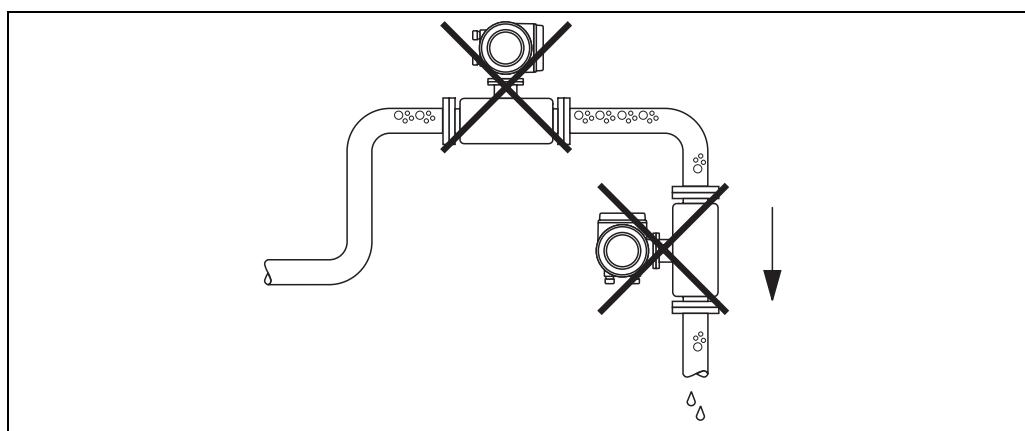
- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces, etc.), as long as no cavitation occurs.
- For mechanical reasons and to protect the pipe, support is recommended for heavy sensors.

### Mounting location

Entrained air or gas bubbles in the measuring tube can result in an increase in measuring errors.

**Avoid** the following mounting locations in the pipe:

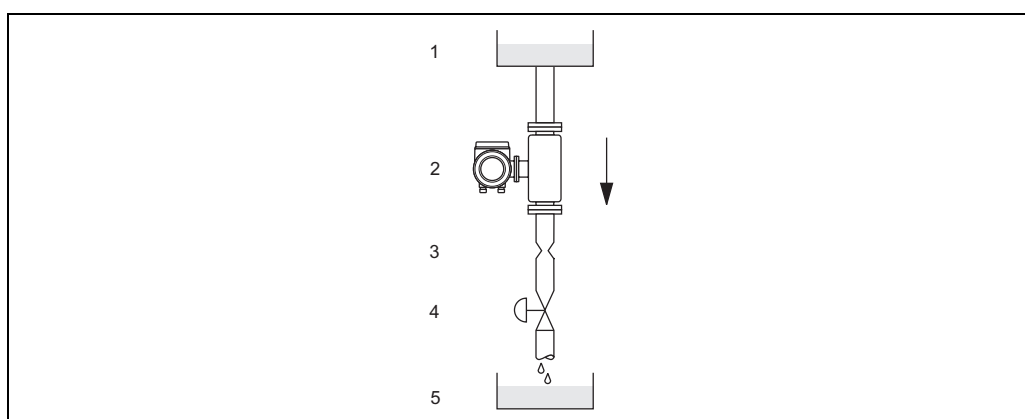
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream from a free pipe outlet in a vertical pipeline



a0003605

*Mounting location*

Notwithstanding the above, the installation proposal below permits 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.



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

- 1 Supply tank
- 2 Sensor
- 3 Orifice plate, pipe restriction (see table on following page)
- 4 Valve
- 5 Batching tank

DN		Ø Orifice plate, pipe restriction	
[mm]	[inch]	mm	inch
8	3/8"	6	0.24
15	1/2"	10	0.40
25	1"	14	0.55
40	1 1/2"	22	0.87
50	2"	28	1.10
80	3"	50	2.00
100	4"	65	2.60
150	6"	90	3.54
250	10"	150	5.91

**Orientation**

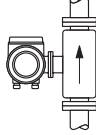
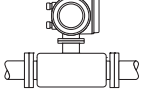
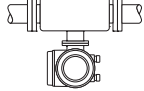
Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

*Vertical (View V)*

Recommended orientation with upward direction of flow (View V). When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids build-up.

*Horizontal (Views H1/H2)*

The measuring tubes must be horizontal and beside each other. When installation is correct the transmitter housing is above or below the pipe (Views H1/H2). Always avoid having the transmitter housing in the same horizontal plane as the pipe. Please note the special installation instructions → 20.

Orientation	Vertical	Horizontal, Transmitter head up	Horizontal, Transmitter head down
	 View V <span style="float: right;">a0004572</span>	 View H1 <span style="float: right;">a0004576</span>	 View H2 <span style="float: right;">a0004580</span>
Standard, Compact version	✓✓	✓✓	✓✓ ①
Standard, Remote version	✓✓	✓✓	✓✓ ①
High-temperature, Compact version	✓✓	✗ <sup>②</sup> TM > 200 °C (> 392°F)	✓✓ ①
High-temperature, Remote version	✓✓	✗ <sup>②</sup> TM > 200 °C (> 392°F)	✓✓ ①

✓✓ = Recommended orientation; ✓ = Orientation recommended in certain situations; ✗ = Impermissible orientation

In order to ensure that the maximum permissible ambient temperature for the transmitter is not exceeded, we recommend the following orientations:

① = For fluids with low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (View H1) or the vertical orientation (View V).

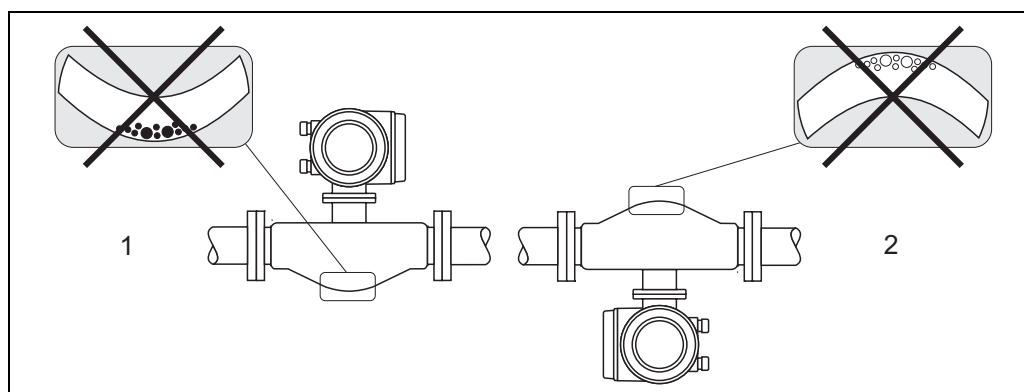
② = For fluids with high-temperatures, >200 °C (>392 °F), we recommend the horizontal orientation with the transmitter head pointing downwards (View H2) or the vertical orientation (View V).

### Special installation instructions



#### Caution!

Both measuring tubes are slightly curved. The position of the sensor, therefore, has to be matched to the fluid properties when the sensor is installed horizontally.



#### Horizontal installation

- 1 Not suitable for fluids with entrained solids. Risk of solids accumulating.
- 2 Not suitable for outgassing fluids. Risk of air accumulating.

### Heating

Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper or heating jackets.



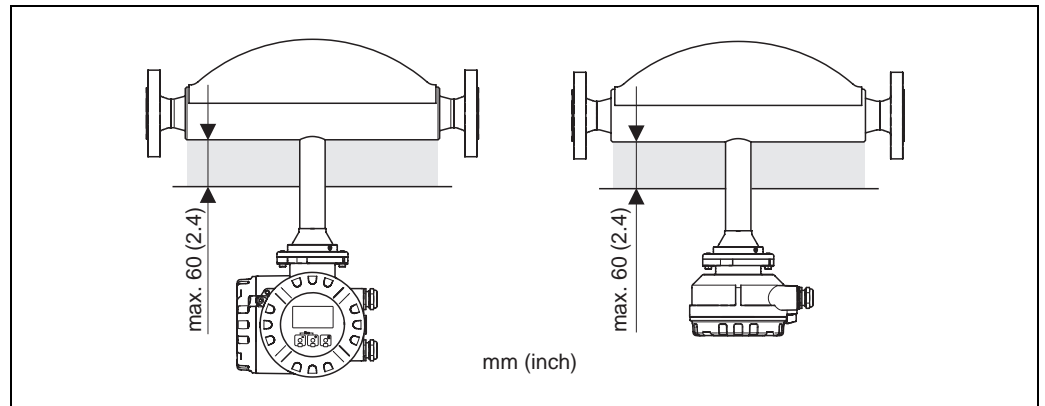
#### Caution!

- Risk of electronics overheating! Make sure that the maximum permissible ambient temperature for the transmitter is not exceeded. Consequently, make sure that the adapter between sensor and transmitter and the connection housing of the remote version always remain free of insulating material. Note that a certain orientation might be required, depending on the fluid temperature → 19.
- With a fluid temperature between +200 °C to +350 °C (+392 °F to +662 °F) the remote version of the high-temperature version is preferable.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, (i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such cases, the sensor must be magnetically shielded (except for Promass M).  
The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:
  - Relative magnetic permeability  $\mu_r \geq 300$
  - Plate thickness  $d \geq 0.35 \text{ mm}$  ( $d \geq 0.01''$ )
- Information on permissible temperature ranges → 22

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for the sensors.

### Thermal insulation

Some fluids require suitable measures to avoid loss of heat at the sensor. A wide range of materials can be used to provide the required thermal insulation.



*High-temperature version: maximum insulation thickness of 60 mm (2.4") in the area of the electronics/neck*

If the Promass F high-temperature version is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm (0.4") is recommended to reduce convection. The maximum insulation thickness of 60 mm (2.4") must be observed.

### Zero point adjustment

All devices are calibrated to state-of-the-art technology. The zero point determined in this way is imprinted on the nameplate of the device.

Calibration takes place under reference conditions. → [15](#)

Promass therefore does **not** require zero point adjustment!

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

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

### Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs.

### Length of connecting cable

max. 20 m (65 ft), remote version

### System pressure

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.

In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapor pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.




For this reason, the following mounting locations are preferred:

- Downstream from pumps (no risk of partial vacuum)
- At the lowest point in a vertical pipe


## Operating conditions: Environment

<b>Ambient temperature range</b>	<p>Sensor and transmitter</p> <ul style="list-style-type: none"> <li>■ Standard: -20 to +60 °C (-4 to +140 °F)</li> <li>■ Optional: -40 to +60 °C (-40 to +140 °F)</li> </ul> <p>Note!</p> <ul style="list-style-type: none"> <li>■ Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.</li> <li>■ At ambient temperatures below -20 °C (-4 °F) the readability of the display may be impaired.</li> </ul>
<b>Storage temperature</b>	-40 to +80 °C (-40 to +175 °F), preferably +20 °C (+68 °F)
<b>Degree of protection</b>	Standard: IP 67 (NEMA 4X) for transmitter and sensor
<b>Shock resistance</b>	In accordance with IEC 68-2-31
<b>Vibration resistance</b>	Acceleration up to 1 g, 10 to 150 Hz, following IEC 68-2-6
<b>Electromagnetic compatibility (EMC)</b>	To IEC/EN 61326 and NAMUR Recommendation NE 21


## Operating conditions: Process

<b>Medium temperature range</b>	<p><b>Sensor</b></p> <ul style="list-style-type: none"> <li>■ Standard: -50 to +200 °C (-58 to +392 °F)</li> <li>■ High-temperature version: -50 to +350 °C (-58 to +662 °F)</li> </ul>
<b>Medium pressure range (nominal pressure)</b>	<p><b>Flanges</b></p> <ul style="list-style-type: none"> <li>■ Standard: <ul style="list-style-type: none"> <li>- according to DIN PN 16 to 100</li> <li>- according to ASME B16.5 Cl 150, Cl 300, Cl 600</li> <li>- JIS 10K, 20K, 40K, 63K</li> </ul> </li> <li>■ High temperature version: <ul style="list-style-type: none"> <li>- according to DIN PN 40, 64, 100</li> <li>- according to ASME B16.5 Cl 150, Cl 300, Cl 600</li> <li>- JIS 10K, 20K, 63K</li> </ul> </li> </ul> <p><b>Pressure ranges of secondary containment</b></p> <ul style="list-style-type: none"> <li>■ DN 8 to 50 (3/8" to 2"): 40 bar (580 psi)</li> <li>■ DN 80 (3"): 25 bar (362 psi)</li> <li>■ DN 100 to 150 (4" to 6"): 16 bar (232 psi)</li> <li>■ DN 250 (10"): 10 bar (145 psi)</li> </ul> <p> Warning!</p> <p>In case a danger of measuring tube failure exists due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose secondary containment is equipped with special pressure monitoring connections (ordering option). With the help of these connections, fluid collected in the secondary containment in the event of tube failure can be bled off. This is especially important in high pressure gas applications. These connections can also be used for gas circulation and/or gas detection (dimensions →  25).</p>
<b>Rupture disk</b>	Further informationen →  52

**Limiting flow**

See information in the "Measuring range" Section →  6

Select nominal diameter by optimizing between required flow range and permissible pressure loss. An overview of max. possible full scale values can be found in the "Measuring range" Section.

- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as fluids with entrained solids (flow velocity <1 m/s (<3 ft/s)).
- For gas measurement the following rules apply:
  - Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula →  6

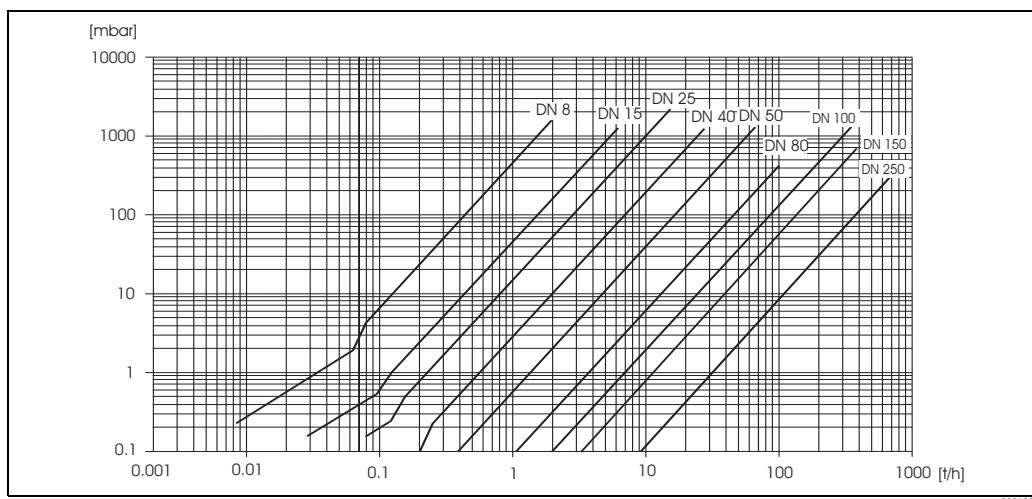
**Pressure loss**

Pressure loss depends on the fluid properties and on the flow rate. The following formulae can be used to approximately calculate the pressure loss:

Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ <small style="float: right;">a0004623</small>		
Re ≥ 2300 <sup>1)</sup>	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$ <small style="float: right;">a0004626</small>		
	Promass F DN 250  $\Delta p = K \cdot \left[ 1 - a + \frac{a}{e^{b \cdot (\nu - 10^6)}} \right] \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$ <small style="float: right;">a0012135</small>		
Re < 2300	$\Delta p = K1 \cdot \nu \cdot \dot{m} + \frac{K2 \cdot \nu^{0.25} \cdot \dot{m}^2}{\rho}$ <small style="float: right;">a0004628</small>		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <math>\Delta p</math> = pressure loss [mbar]  <math>\nu</math> = kinematic viscosity [m<sup>2</sup>/s]  <math>\dot{m}</math> = Mass flow [kg/s]  <math>\rho</math> = fluid density [kg/m<sup>3</sup>]                             </td> <td style="width: 50%; border: none;"> <math>d</math> = inside diameter of measuring tubes [m]  <math>K...K2</math> = constants (depending on nominal diameter)  <math>a = 0.3</math>  <math>b = 91000</math> </td> </tr> </table> <p><sup>1)</sup> To compute the pressure loss for gases, always use the formula for Re ≥ 2300.</p>		$\Delta p$ = pressure loss [mbar] $\nu$ = kinematic viscosity [m <sup>2</sup> /s] $\dot{m}$ = Mass flow [kg/s] $\rho$ = fluid density [kg/m <sup>3</sup> ]	$d$ = inside diameter of measuring tubes [m] $K...K2$ = constants (depending on nominal diameter) $a = 0.3$ $b = 91000$
$\Delta p$ = pressure loss [mbar] $\nu$ = kinematic viscosity [m <sup>2</sup> /s] $\dot{m}$ = Mass flow [kg/s] $\rho$ = fluid density [kg/m <sup>3</sup> ]	$d$ = inside diameter of measuring tubes [m] $K...K2$ = constants (depending on nominal diameter) $a = 0.3$ $b = 91000$		

**Pressure loss coefficient**

DN		d[m]	K	K1	K2
[mm]	[inch]				
8	3/8"	5.35 · 10 <sup>-3</sup>	5.70 · 10 <sup>7</sup>	9.60 · 10 <sup>7</sup>	1.90 · 10 <sup>7</sup>
15	1/2"	8.30 · 10 <sup>-3</sup>	5.80 · 10 <sup>6</sup>	1.90 · 10 <sup>7</sup>	10.60 · 10 <sup>5</sup>
25	1"	12.00 · 10 <sup>-3</sup>	1.90 · 10 <sup>6</sup>	6.40 · 10 <sup>6</sup>	4.50 · 10 <sup>5</sup>
40	1 1/2"	17.60 · 10 <sup>-3</sup>	3.50 · 10 <sup>5</sup>	1.30 · 10 <sup>6</sup>	1.30 · 10 <sup>5</sup>
50	2"	26.00 · 10 <sup>-3</sup>	7.00 · 10 <sup>4</sup>	5.00 · 10 <sup>5</sup>	1.40 · 10 <sup>4</sup>
80	3"	40.50 · 10 <sup>-3</sup>	1.10 · 10 <sup>4</sup>	7.71 · 10 <sup>4</sup>	1.42 · 10 <sup>4</sup>
100	4"	51.20 · 10 <sup>-3</sup>	3.54 · 10 <sup>3</sup>	3.54 · 10 <sup>4</sup>	5.40 · 10 <sup>3</sup>
150	6"	68.90 · 10 <sup>-3</sup>	1.36 · 10 <sup>3</sup>	2.04 · 10 <sup>4</sup>	6.46 · 10 <sup>2</sup>
250	10"	102.26 · 10 <sup>-3</sup>	3.00 · 10 <sup>2</sup>	6.10 · 10 <sup>3</sup>	1.33 · 10 <sup>2</sup>



Pressure loss diagram for water

### Pressure loss (US units)

Pressure loss is dependent on fluid properties nominal diameter. Consult Endress+Hauser for Applicator PC software to determine pressure loss in US units. All important instrument data is contained in the Applicator software program in order to optimize the design of measuring system. The software is used for following calculations:

- Nominal diameter of the sensor with fluid characteristics such as viscosity, density, etc.
- Pressure loss downstream of the measuring point.
- Converting mass flow to volume flow, etc.
- Simultaneous display of various meter size.
- Determining measuring ranges.

The Applicator runs on any IBM compatible PC with windows.

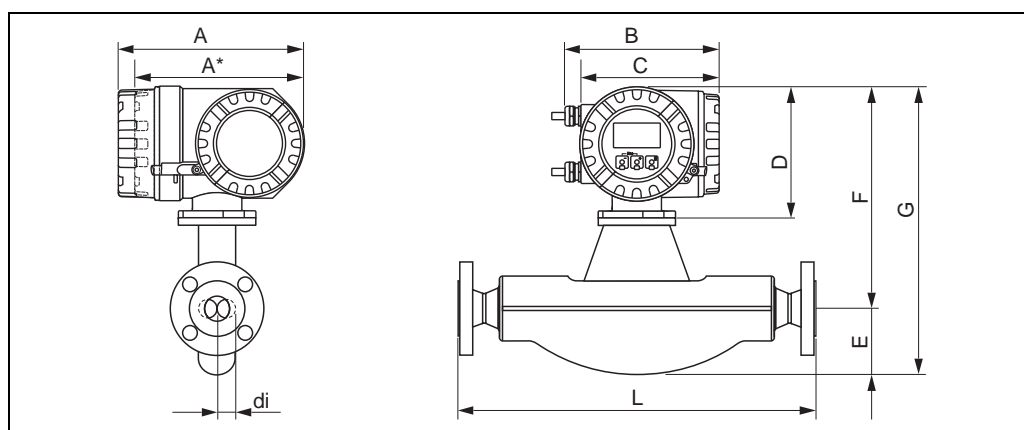


## Mechanical construction

### Design, dimensions

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## Field housing compact version, powder-coated die-cast aluminum



## Dimensions in SI units

DN	A	A*	B	C	D	E	F	G	L	di
8	227	207	187	168	160	75	266	341	1) <sup>1)</sup>	1) <sup>1)</sup>
15	227	207	187	168	160	75	266	341	1) <sup>1)</sup>	1) <sup>1)</sup>
25	227	207	187	168	160	75	266	341	1) <sup>1)</sup>	1) <sup>1)</sup>
40	227	207	187	168	160	105	271	376	1) <sup>1)</sup>	1) <sup>1)</sup>
50	227	207	187	168	160	141	283	424	1) <sup>1)</sup>	1) <sup>1)</sup>
80	227	207	187	168	160	200	305	505	1) <sup>1)</sup>	1) <sup>1)</sup>
100	227	207	187	168	160	254	324	578	1) <sup>1)</sup>	1) <sup>1)</sup>
150	227	207	187	168	160	378	362	740	1) <sup>1)</sup>	1) <sup>1)</sup>
250	227	207	187	168	160	548	390	938	1) <sup>1)</sup>	1) <sup>1)</sup>

\* Blind version (without local display)

<sup>1)</sup> dependent on respective process connection

All dimensions in [mm]

## Dimensions in US units

DN	A	A*	B	C	D	E	F	G	L	di
3/8"	8.94	8.15	7.68	6.61	6.30	2.95	10.5	13.4	1) <sup>1)</sup>	1) <sup>1)</sup>
1/2"	8.94	8.15	7.68	6.61	6.30	2.95	10.5	13.4	1) <sup>1)</sup>	1) <sup>1)</sup>
1"	8.94	8.15	7.68	6.61	6.30	2.95	10.5	13.4	1) <sup>1)</sup>	1) <sup>1)</sup>
1 1/2"	8.94	8.15	7.68	6.61	6.30	4.13	10.7	14.8	1) <sup>1)</sup>	1) <sup>1)</sup>
2"	8.94	8.15	7.68	6.61	6.30	5.55	11.1	16.7	1) <sup>1)</sup>	1) <sup>1)</sup>
3"	8.94	8.15	7.68	6.61	6.30	7.87	12.0	19.9	1) <sup>1)</sup>	1) <sup>1)</sup>
4"	8.94	8.15	7.68	6.61	6.30	10.0	12.8	22.8	1) <sup>1)</sup>	1) <sup>1)</sup>
6"	8.94	8.15	7.68	6.61	6.30	14.9	14.3	29.1	1) <sup>1)</sup>	1) <sup>1)</sup>
10"	8.94	8.15	7.68	6.61	6.30	21.6	15.4	36.9	1) <sup>1)</sup>	1) <sup>1)</sup>

\* Blind version (without local display)

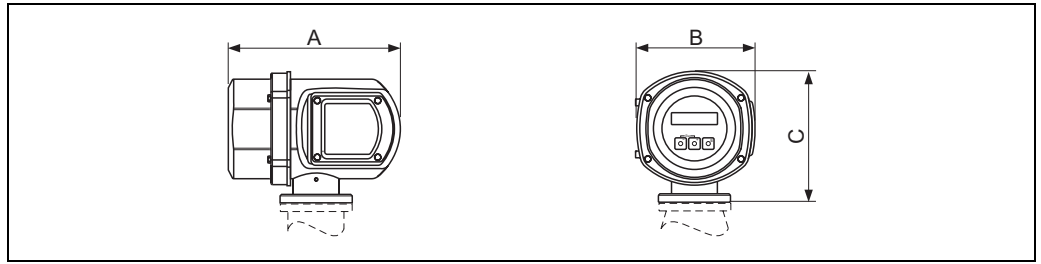
<sup>1)</sup> dependent on respective process connection

All dimensions in [inch]



Note!  
Dimensions for transmitters II2G/Zone 1 → 27.

**Transmitter compact version, stainless steel**

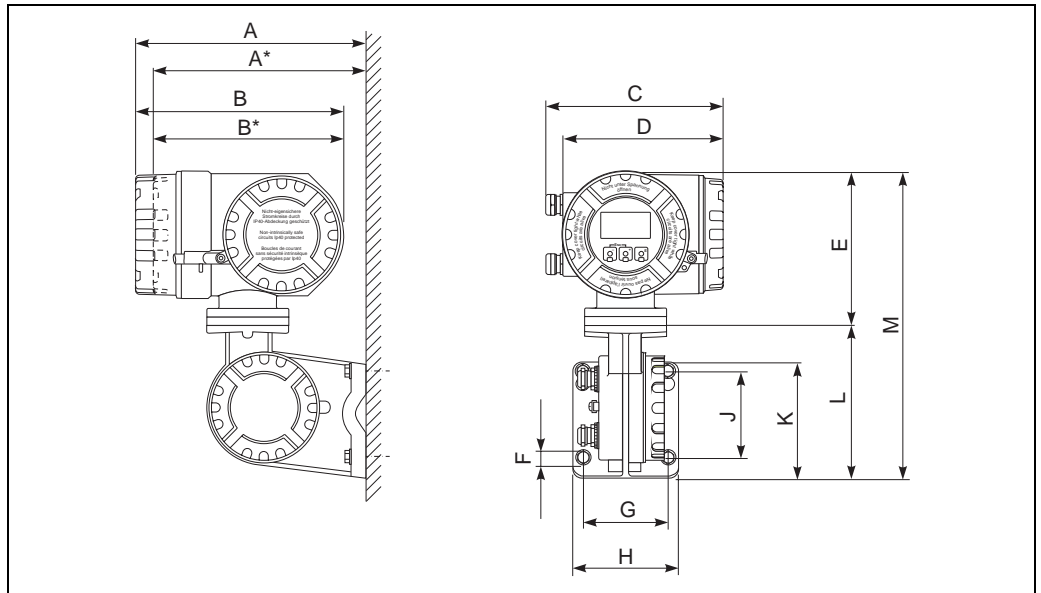


a0002245

*Dimensions in SI and US units*

A		B		C	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
225	8.86	153	6.02	168	6.61

**Transmitter remote version, connection housing (II2G/Zone 1)**



a0002128

*Dimensions in SI units*

A	A*	B	B*	C	D	E	F Ø	G	H	J	K	L	M
265	242	240	217	206	186	178	8.6 (M8)	100	130	100	144	170	348

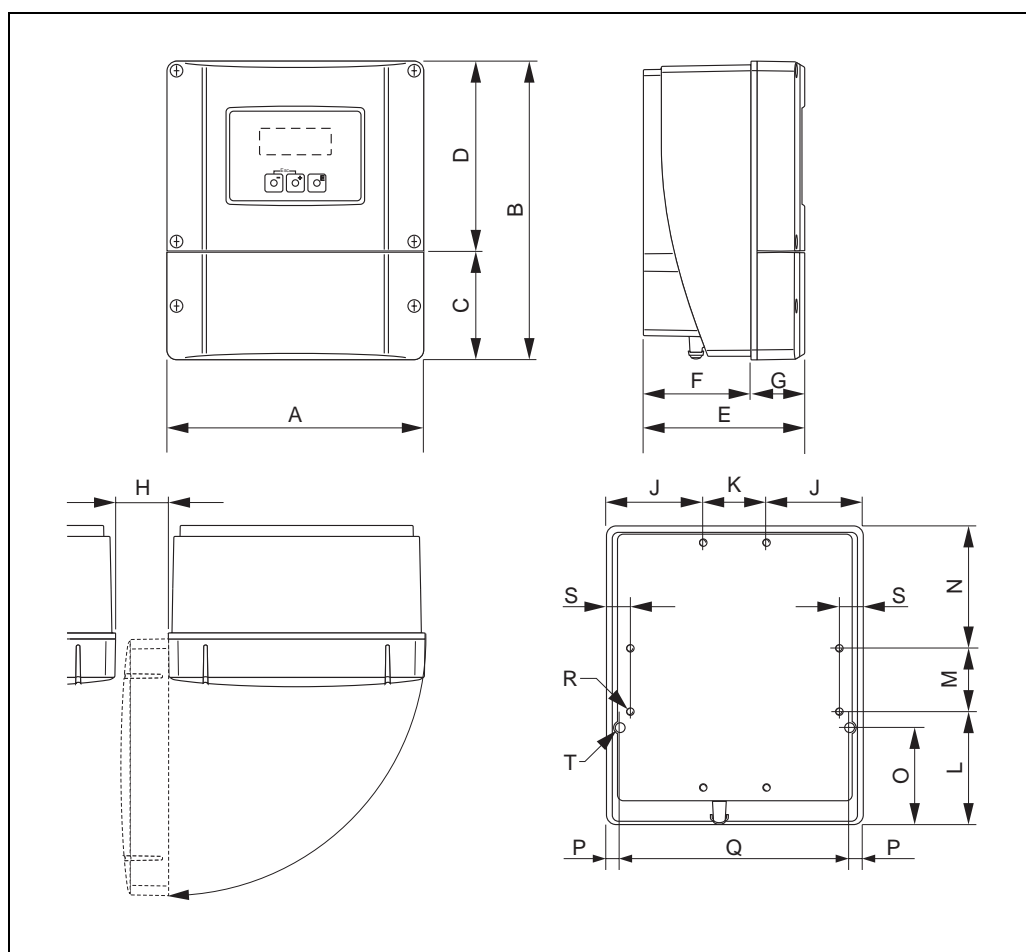
\* Blind version (without display)  
All dimensions in [mm]

*Dimensions in US units*

A	A*	B	B*	C	D	E	F Ø	G	H	J	K	L	M
10.4	9.53	9.45	8.54	8.11	7.32	7.01	0.34 (M8)	3.94	5.12	3.94	5.67	6.69	13.7

\* Blind version (without display)  
All dimensions in [inch]

## Transmitter remote version, wall-mount housing (non Ex-zone and II3G/Zone 2)



a0001150

*Dimensions in SI units*

A	B	C	D	E	F	G	H	J
215	250	90.5	159.5	135	90	45	>50	81
K	L	M	N	O	P	Q	R	S
53	95	53	102	81.5	11.5	192	8 × M5	20

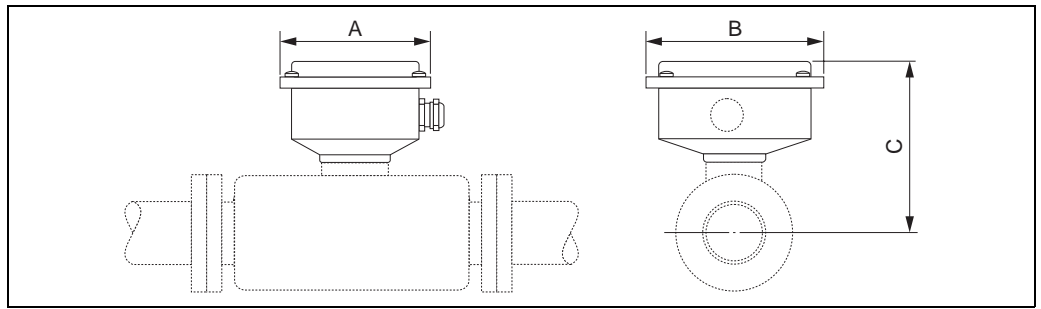
All dimensions in [mm]

*Dimensions in US units*

A	B	C	D	E	F	G	H	J
8.46	9.84	3.56	6.27	5.31	3.54	1.77	>1.97	3.18
K	L	M	N	O	P	Q	R	S
2.08	3.74	2.08	4.01	3.20	0.45	7.55	8 × M5	0.79

All dimensions in [inch]

**Sensor remote version, connection housing**



a0002516

*Dimensions in SI units*

DN	A	B	C
8	118.5	137.5	113
15	118.5	137.5	113
25	118.5	137.5	113
40	118.5	137.5	118
50	118.5	137.5	130
80	118.5	137.5	152
100	118.5	137.5	171
150	118.5	137.5	209
250	118.5	137.5	237

All dimensions in [mm]

*Dimensions in US units*

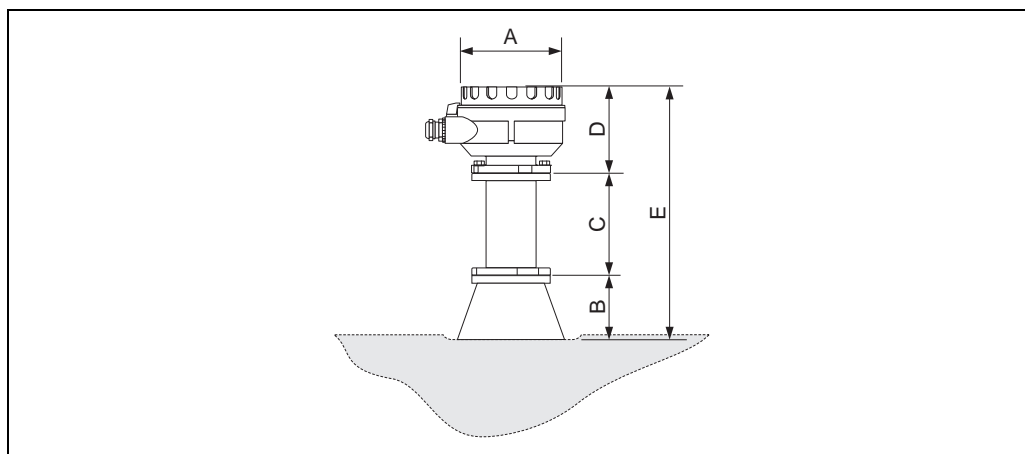
DN	A	B	C
3/8"	4.67	5.41	4.52
1/2"	4.67	5.41	4.52
1"	4.67	5.41	4.52
1 1/2"	4.67	5.41	4.72
2"	4.67	5.41	5.20
3"	4.67	5.41	6.08
4"	4.67	5.41	6.84
6"	4.67	5.41	8.36
10"	4.67	5.41	9.48

All dimensions in [inch]

**Sensor remote version, connection housing with an extended neck**

Note!

Use this version in case of insulation or application of heating jacket.

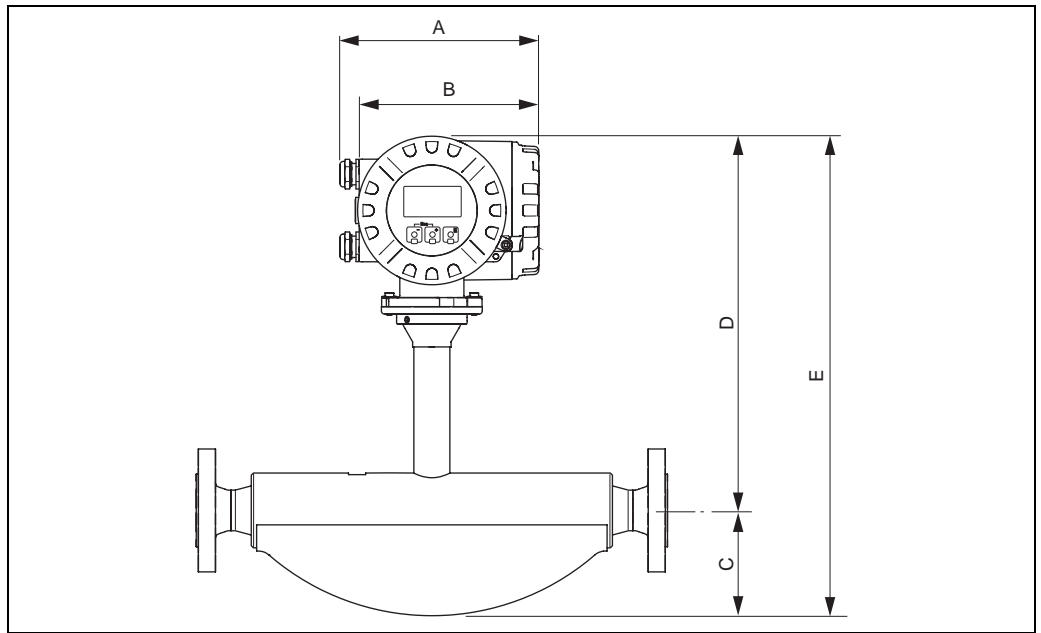


a0002517

*Dimensions in SI and US units*

A		B		C		D		E	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
129	5.08	80	3.15	110	4.33	102	4.02	292	11.5

**High-temperature version (compact)**



a0002518

*Dimensions in SI units*

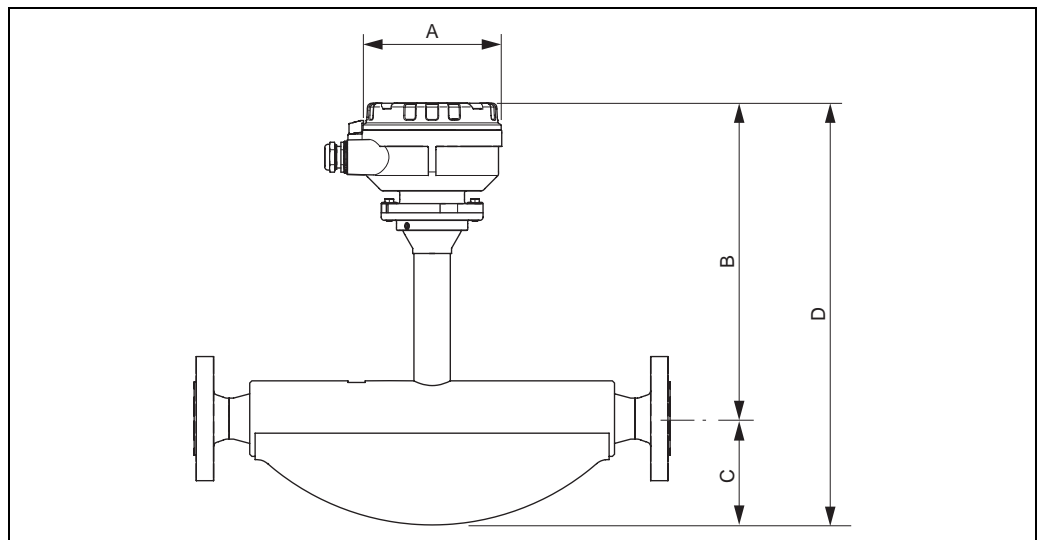
DN	A	B	C	D	E
25	187	168	100	350	450
50	187	168	141	365	506
80	187	168	200	385	585

All dimensions in [mm]

*Dimensions in US units*

DN	A	B	C	D	E
1"	7.36	6.61	3.94	13.78	17.72
2"	7.36	6.61	5.55	14.37	19.92
3"	7.36	6.61	7.87	15.16	23.03

All dimensions in [inch]

**High-temperature version (remote)**

40002519

*Dimensions in SI units*

DN	A	C	D	E
25	129	105	292	397
50	129	141	307	448
80	129	200	327	527

All dimensions in [mm]

*Dimensions in US units*

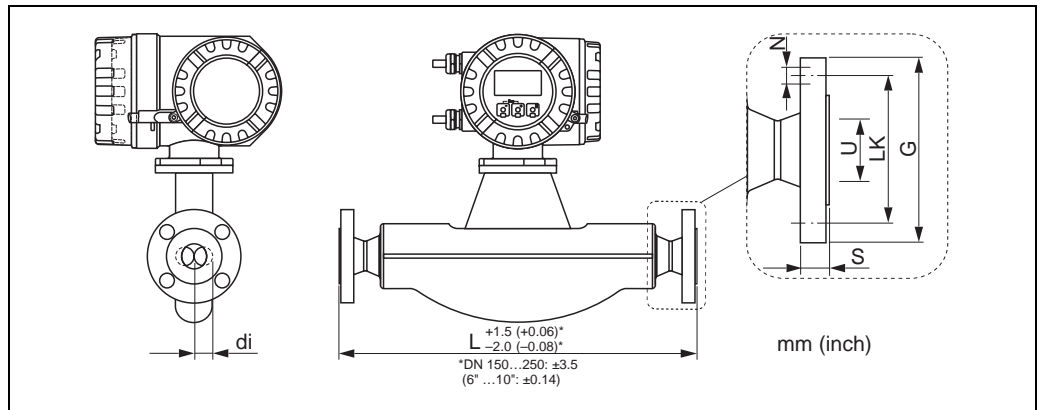
DN	A	C	D	E
1"	5.08	4.13	11.50	15.63
2"	5.08	5.55	12.09	17.64
3"	5.08	7.87	12.87	20.75

All dimensions in [inch]



**Process connections in SI units**

*Flange connections EN (DIN), ASME B16.5, JIS*



a0002501-ae

*Flange connections EN (DIN)*

<b>Flange according to EN 1092-1 (DIN 2501 / DIN 2512N <sup>1)</sup>) / PN 16: 1.4404/316L</b>							
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 $\mu$ m							
DN	G	L	N	S	LK	U	di
100	220	1128	8 × Ø18	20	180	107.1	51.20
150	285	1330	8 × Ø22	22	240	159.3	68.90
250 <sup>2)</sup>	405	1780	12 × Ø26	26	355	260.4	102.26

<sup>1)</sup> Flange with groove according to EN 1092-1 Form D (DIN 2512N) available

<sup>2)</sup> Not available in Alloy

All dimensions in [mm]

<b>Flange according to EN 1092-1 (DIN 2501 / DIN 2512N <sup>1)</sup>) / PN 40: 1.4404/316L, Alloy C-22</b>							
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 $\mu$ m							
DN	G	L	N	S	LK	U	di
8	95	370	4 × Ø14	16	65	17.3	5.35
15	95	404	4 × Ø14	16	65	17.3	8.30
25	115	440	4 × Ø14	18	85	28.5	12.00
40	150	550	4 × Ø18	18	110	43.1	17.60
50	165	715	4 × Ø18	20	125	54.5	26.00
80	200	840	8 × Ø18	24	160	82.5	40.50
100	235	1128	8 × Ø22	24	190	107.1	51.20
150	300	1370	8 × Ø26	28	250	159.3	68.90
250 <sup>2)</sup>	450	1850	12 × Ø33	38	385	258.8	102.26

<sup>1)</sup> Flange with groove according to EN 1092-1 Form D (DIN 2512N) available

<sup>2)</sup> Not available in Alloy

All dimensions in [mm]

<b>Flange according to EN 1092-1 (DIN 2501) / PN 40 (with DN 25-Flanges): 1.4404/316L</b>							
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm							
DN	G	L	N	S	LK	U	di
8	115	440	4 × Ø14	18	85	28.5	5.35
15	115	440	4 × Ø14	18	85	28.5	8.30

All dimensions in [mm]

<b>Flange according to EN 1092-1 (DIN 2501 / DIN 2512N ) extension-reduction / PN 16: 1.4404/316L</b>							
Only for nominal diameter DN 250 (on request)							
Surface roughness (flange): Ra 0.8 to 3.2 µm							
DN	G	L	N	S	LK	U	di
150	285	1980	8 × Ø22	22	240	159.3	102.26
200	340	1940	12 × Ø22	24	295	207.3	102.26
300	460	1940	12 × Ø26	28	410	309.7	102.26

All dimensions in [mm]

<b>Flange according to EN 1092-1 (DIN 2501 / DIN 2512N ) extension-reduction / PN 40: 1.4404/316L</b>							
Only for nominal diameter DN 250 (on request)							
Surface roughness (flange): Ra 0.8 to 3.2 µm							
DN	G	L	N	S	LK	U	di
150	300	1980	8 × Ø26	28	250	159.3	102.26
200	375	1940	12 × Ø30	34	320	206.5	102.26
300	515	1940	16 × Ø33	42	450	307.9	102.26

All dimensions in [mm]

<b>Flange according to EN 1092-1 (DIN 2501 / DIN 2512N <sup>1)</sup>) / PN 63: 1.4404/316L, Alloy C-22</b>							
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm							
DN	G	L	N	S	LK	U	di
50	180	724	4 × Ø22	26	135	54.5	26.00
80	215	875	8 × Ø22	28	170	81.7	40.50
100	250	1128	8 × Ø26	30	200	106.3	51.20
150	345	1410	8 × Ø33	36	280	157.1	68.90
250 <sup>2)</sup>	470	1890	12 × Ø36	46	400	255.4	102.26

<sup>1)</sup> Flange with groove according to EN 1092-1 Form D (DIN 2512N) available

<sup>2)</sup> Not available in Alloy

All dimensions in [mm]

<b>Flange EN 1092-1 (DIN 2501 / DIN 2512N <sup>1)</sup>) / PN 100: 1.4404/316L, Alloy C-22</b>							
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm							
DN	G	L	N	S	LK	U	di
8	105	400	4 × Ø14	20	75	17.3	5.35
15	105	420	4 × Ø14	20	75	17.3	8.30
25	140	470	4 × Ø18	24	100	28.5	12.00
40	170	590	4 × Ø22	26	125	42.5	17.60
50	195	740	4 × Ø26	28	145	53.9	26.00
80	230	885	8 × Ø26	32	180	80.9	40.50
100	265	1128	8 × Ø30	36	210	104.3	51.20
150	355	1450	12 × Ø33	44	290	154.0	68.90

<sup>1)</sup> Flange with groove according to EN 1092-1 Form D (DIN 2512N) available  
 All dimensions in [mm]

*Flange connections ASME B16.5*

<b>Flange according to ASME B16.5 / Cl 150: 1.4404/316L, Alloy C-22</b>							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
8	88.9	370.0	4 × Ø15.7	11.2	60.5	15.7	5.35
15	88.9	404.0	4 × Ø15.7	11.2	60.5	15.7	8.30
25	108.0	440.0	4 × Ø15.7	14.2	79.2	26.7	12.00
40	127.0	550.0	4 × Ø15.7	17.5	98.6	40.9	17.60
50	152.4	715.0	4 × Ø19.1	19.1	120.7	52.6	26.00
80	190.5	840.0	4 × Ø19.1	23.9	152.4	78.0	40.50
100	228.6	1128.0	8 × Ø19.1	23.9	190.5	102.4	51.20
150	279.4	1398.0	8 × Ø22.4	25.4	241.3	154.2	68.90
250 <sup>1)</sup>	406.4	1836.8	12 × Ø25.4	30.2	362.0	254.5	102.26

<sup>1)</sup> Not available in Alloy  
All dimensions in [mm]

<b>Flange according to ASME B16.5 / Cl 300: 1.4404/316L, Alloy C-22</b>							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
8	95.2	370.0	4 × Ø15.7	14.2	66.5	15.7	5.35
15	95.2	404.0	4 × Ø15.7	14.2	66.5	15.7	8.30
25	123.9	440.0	4 × Ø19.0	17.5	88.9	26.7	12.00
40	155.4	550.0	4 × Ø22.3	20.6	114.3	40.9	17.60
50	165.1	715.0	8 × Ø19.0	22.3	127.0	52.6	26.00
80	209.5	840.0	8 × Ø22.3	28.4	168.1	78.0	40.50
100	254.0	1128.0	8 × Ø22.3	31.7	200.1	102.4	51.20
150	317.5	1417.0	12 × Ø22.3	36.5	269.7	154.2	68.90
250 <sup>1)</sup>	444.5	1868.2	16 × Ø28.4	47.4	387.3	254.5	102.26

<sup>1)</sup> Not available in Alloy  
All dimensions in [mm]

**Flange according to ASME B16.5 / CI 600: 1.4404/316L, Alloy C-22**  
 Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8	95.3	400.0	4 × Ø15.7	20.6	66.5	13.9	5.35
15	95.3	420.0	4 × Ø15.7	20.6	66.5	13.9	8.30
25	124.0	490.0	4 × Ø19.1	23.9	88.9	24.3	12.00
40	155.4	600.0	4 × Ø22.4	28.7	114.3	38.1	17.60
50	165.1	742.0	8 × Ø19.1	31.8	127.0	49.2	26.00
80	209.6	900.0	8 × Ø22.4	38.2	168.1	73.7	40.50
100	273.1	1158.0	8 × Ø25.4	48.4	215.9	97.3	51.20
150	355.6	1467.0	12 × Ø28.4	47.8	292.1	154.2	68.90
250 <sup>1)</sup>	508.0	1951.2	16 × Ø35.1	69.9	431.8	254.5	102.26

<sup>1)</sup> Not available in Alloy  
 All dimensions in [mm]

**Flange according to ASME B16.5 extension-reduction / CI 150: 1.4404/316L**  
 Only for nominal diameter DN 250 /10" (auf Anfrage)  
 Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
150	279.4	1980	8 × Ø22.4	25.4	241.3	154.2	102.26
200	342.9	1940	8 × Ø22.4	28.4	298.5	202.7	102.26
300	482.6	1940	12 × Ø25.4	31.8	431.8	304.80	102.26

All dimensions in [mm]

**Flange according to ASME B16.5 extension-reduction / CI 300: 1.4404/316**  
 Only for nominal diameter DN 250 /10" (auf Anfrage)  
 Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
150	317.5	1980	12 × Ø22.4	36.5	269.7	154.2	102.26
200	381.0	1940	12 × Ø25.4	41.1	330.2	202.7	102.26
300	520.7	1940	16 × Ø31.7	50.8	450.8	304.80	102.26

All dimensions in [mm]

**Flange according to ASME B16.5 extension-reduction / CI 600: 1.4404/316L**  
 Only for nominal diameter DN 250 /10" (auf Anfrage)  
 Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
150	355.6	1980	12 × Ø28.4	54.2	292.1	154.2	102.26
200	419.1	1940	12 × Ø31.8	62.0	349.3	202.7	102.26

All dimensions in [mm]

## Flange connections JIS B2220

<b>Flange JIS B2220 / 10K:</b> 1.4404/316L, Alloy C-22							
Surface roughness (flange): Ra 3.2...6.3 µm							
DN	G	L	N	S	LK	U	di
50	155	715	4 × Ø19	16	120	50	26.00
80	185	832	8 × Ø19	18	150	80	40.50
100	210	1128	8 × Ø19	18	175	100	51.20
150	280	1354	8 × Ø23	22	240	150	68.90
250 <sup>1)</sup>	400	1780	12 × Ø25	24	355	250	102.26

<sup>1)</sup> Not available in Alloy  
All dimensions in [mm]

<b>Flange JIS B2220 / 20K:</b> 1.4404/316L, Alloy C-22							
Surface roughness (flange): Ra 1.6 to 3.2 µm							
DN	G	L	N	S	LK	U	di
8	95	370	4 × Ø15	14	70	15	5.35
15	95	404	4 × Ø15	14	70	15	8.30
25	125	440	4 × Ø19	16	90	25	12.00
40	140	550	4 × Ø19	18	105	40	17.60
50	155	715	8 × Ø19	18	120	50	26.00
80	200	832	8 × Ø23	22	160	80	40.50
100	225	1128	8 × Ø23	24	185	100	51.20
150	305	1386	12 × Ø25	28	260	150	68.90
250 <sup>1)</sup>	430	1850	12 × Ø27	34	380	250	102.26

<sup>1)</sup> Not available in Alloy  
All dimensions in [mm]

<b>Flange JIS B2220 / 40K:</b> 1.4404/316L, Alloy C-22							
Surface roughness (flange): Ra 1.6 to 3.2 µm							
DN	G	L	N	S	LK	U	di
8	115	400	4 × Ø19	20	80	15	5.35
15	115	425	4 × Ø19	20	80	15	8.30
25	130	485	4 × Ø19	22	95	25	12.00
40	160	600	4 × Ø23	24	120	38	17.60
50	165	760	8 × Ø19	26	130	50	26.00
80	210	890	8 × Ø23	32	170	75	40.50
100	250	1168	8 × Ø25	36	205	100	51.20
150	355	1498	12 × Ø33	44	295	150	68.90

All dimensions in [mm]

**Flange JIS B2220 / 63K:** 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
8	120	420	4 × Ø19	23	85	12	5.35
15	120	440	4 × Ø19	23	85	12	8.30
25	140	494	4 × Ø23	27	100	22	12.00
40	175	620	4 × Ø25	32	130	35	17.60
50	185	775	8 × Ø23	34	145	48	26.00
80	230	915	8 × Ø25	40	185	73	40.50
100	270	1168	8 × Ø27	44	220	98	51.20
150	365	1528	12 × Ø33	54	305	146	68.90

All dimensions in [mm]

**Flange JIS B2220 extension-reduction / 10K:** 1.4404/316L

Only for nominal diameter DN 250 (on request)

Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
150	280	1980	8 × Ø23	22	240	150	102.26
200	330	1940	12 × Ø23	22	290	200	102.26
300	445	1940	16 × Ø25	24	400	300	102.26

All dimensions in [mm]

**Flange JIS B2220 extension-reduction / 20K:** 1.4404/316L

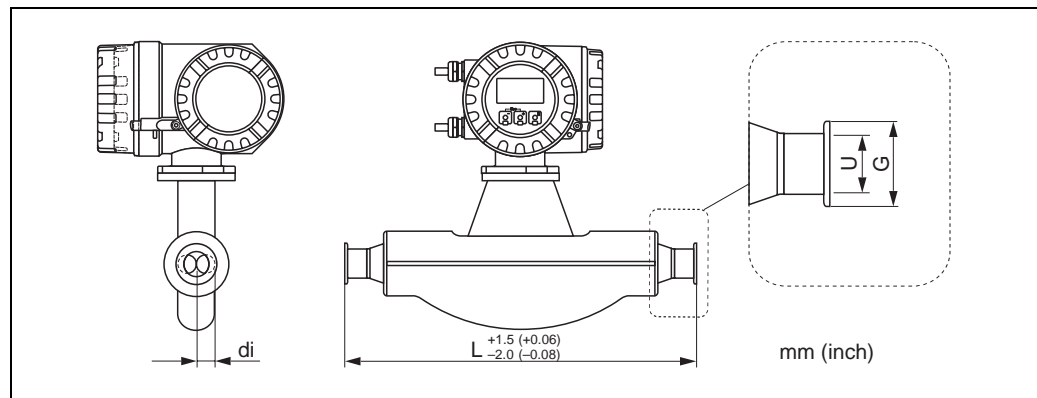
Only for nominal diameter DN 250 (on request)

Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
150	305	1980	12 × Ø25	28	260	150	102.26
200	350	1940	12 × Ø25	30	305	200	102.26
300	480	1940	16 × Ø27	36	430	300	102.26

All dimensions in [mm]

## Tri-Clamp



Tri-Clamp: 1.4404/316L					
DN	Clamp	G	L	U	$d_i$
8	1"	50.4	367	22.1	5.35
15	1"	50.4	398	22.1	8.30
25	1"	50.4	434	22.1	12.00
40	1½"	50.4	560	34.8	17.60
50	2"	63.9	720	47.5	26.00
80	3"	90.9	900	72.9	40.50
100	4"	118.9	1128	97.4	51.20

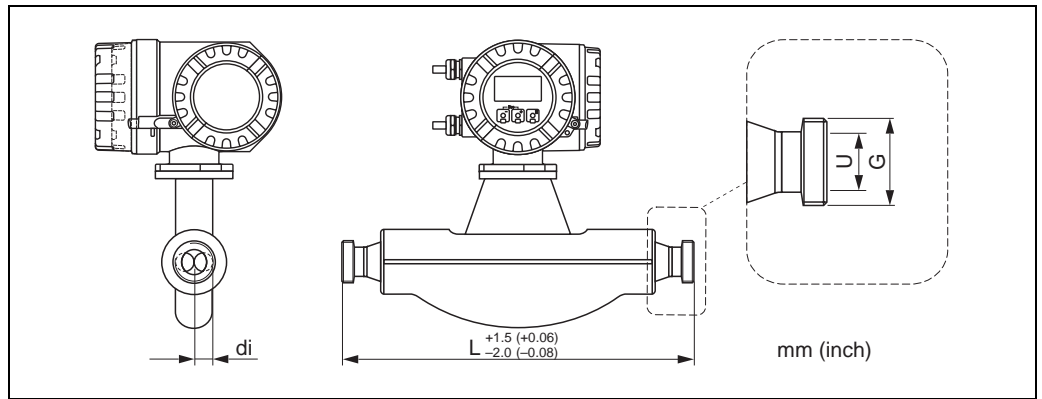
3A version also available ( $R_a \leq 0.8 \mu\text{m}/150$  grit, Option:  $R_a \leq 0.4 \mu\text{m}/240$  grit)  
All dimensions in [mm]

½"-Tri-Clamp: 1.4404/316L					
DN	Clamp	G	L	U	$d_i$
8	½"	25.0	367	9.5	5.35
15	½"	25.0	398	9.5	8.30

3A version also available ( $R_a \leq 0.8 \mu\text{m}/150$  grit, Option:  $R_a \leq 0.4 \mu\text{m}/240$  grit)  
All dimensions in [mm]



DIN 11851 (threaded hygienic connection)

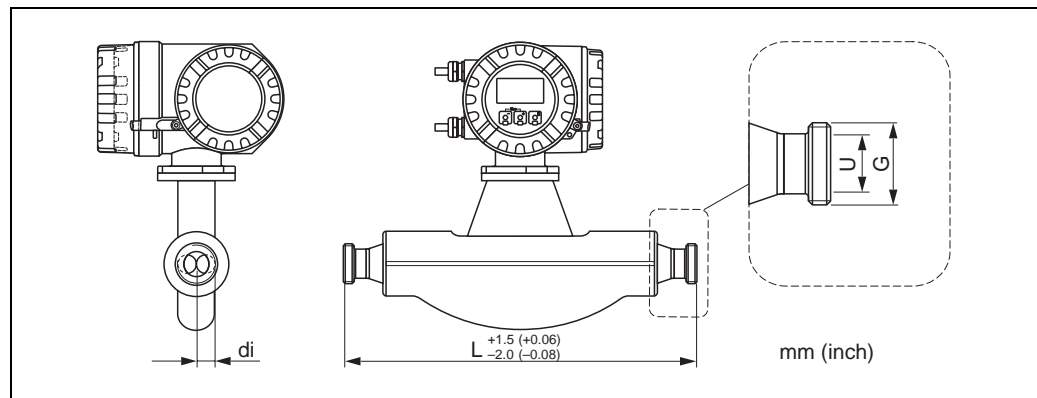


Threaded hygienic connection DIN 11851: 1.4404/316L

DN	G	L	U	di
8	Rd 34 × 1/8"	367	16	5.35
15	Rd 34 × 1/8"	398	16	8.30
25	Rd 52 × 1/6"	434	26	12.00
40	Rd 65 × 1/6"	560	38	17.60
50	Rd 78 × 1/6"	720	50	26.00
80	Rd 110 × 1/4"	900	81	40.50
100	Rd 130 × 1/4"	1128	100	51.20

3A version also available ( $Ra \leq 0.8 \mu\text{m}/150$  grit)  
 All dimensions in [mm]

## DIN 11864-1 Form A (threaded hygienic connection)

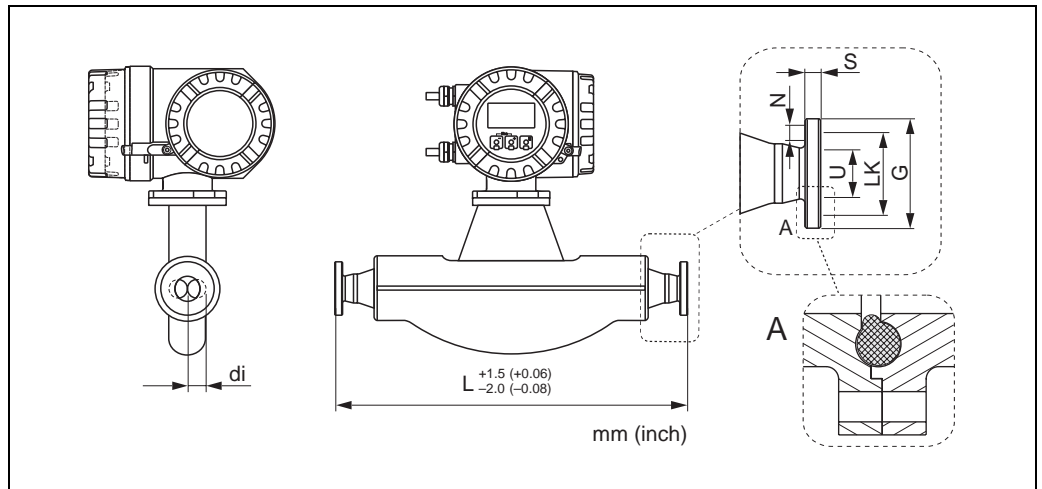


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Threaded hygienic connection DIN 11864-1 Form A: 1.4404/316L				
DN	G	L	U	di
8	Rd 28 × 1/8"	367	10	5.35
15	Rd 34 × 1/8"	398	16	8.30
25	Rd 52 × 1/6"	434	26	12.00
40	Rd 65 × 1/6"	560	38	17.60
50	Rd 78 × 1/6"	720	50	26.00
80	Rd 110 × 1/4"	900	81	40.50
100	Rd 130 × 1/4"	1128	100	51.20

3A version also available ( $R_a \leq 0.8 \mu\text{m}/150$  grit)  
 All dimensions in [mm]

DIN 11864-2 Form A (flat flange with groove)

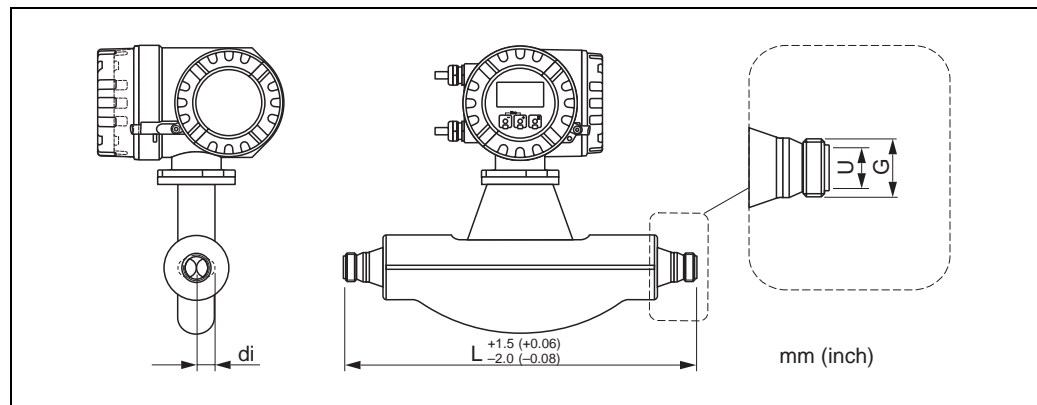


Detail A: The flange has the smaller groove for the O-ring on the sensor side. When mounting the sensor the corresponding flange must have accordingly a larger groove.

DIN 11864-2 Form A (flat flange with groove): 1.4404/316L							
DN	G	L	N	S	LK	U	di
8	54	387	4 × Ø9	10	37	10	5.35
15	59	418	4 × Ø9	10	42	16	8.30
25	70	454	4 × Ø9	10	53	26	12.00
40	82	560	4 × Ø9	10	65	38	17.60
50	94	720	4 × Ø9	10	77	50	26.00
80	133	900	8 × Ø11	12	112	81	40.50
100	159	1128	8 × Ø11	14	137	100	51.20

3A version also available (Ra ≤ 0.8 µm/150 grit, Option: Ra ≤ 0.4 µm/240 grit)  
All dimensions in [mm]

## ISO 2853 (threaded hygienic connection)



a0002523-ae

Threaded hygienic connection ISO 2853: 1.4404/316L

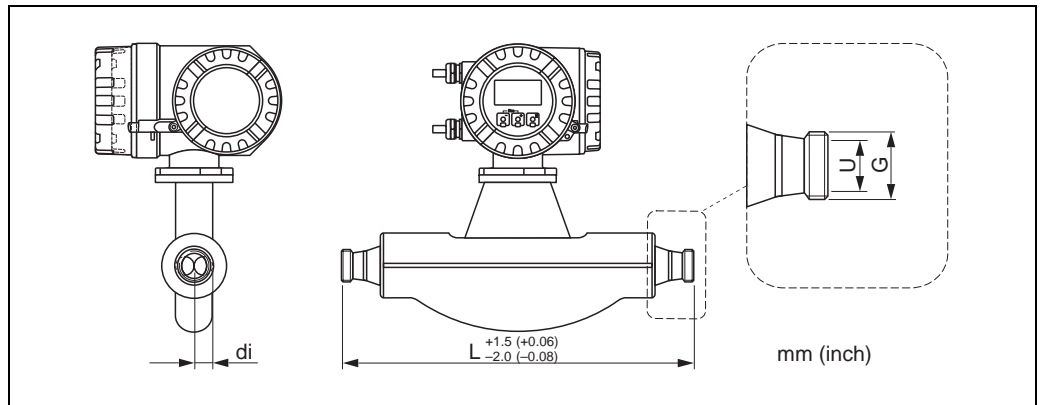
DN	G <sup>1)</sup>	L	N	di
8	37.13	367	22.6	5.35
15	37.13	398	22.6	8.30
25	37.13	434	22.6	12.00
40	52.68	560	35.6	17.60
50	64.16	720	48.6	26.00
80	91.19	900	72.9	40.50
100	118.21	1128	97.6	51.20

<sup>1)</sup> Max. thread diameter to ISO 2853 Annex A

3A version also available (Ra ≤ 0.8 μm/150 grit, Option: Ra ≤ 0.4 μm/240 grit)

All dimensions in [mm]

SMS 1145 (threaded hygienic connection)



a0002524-ae

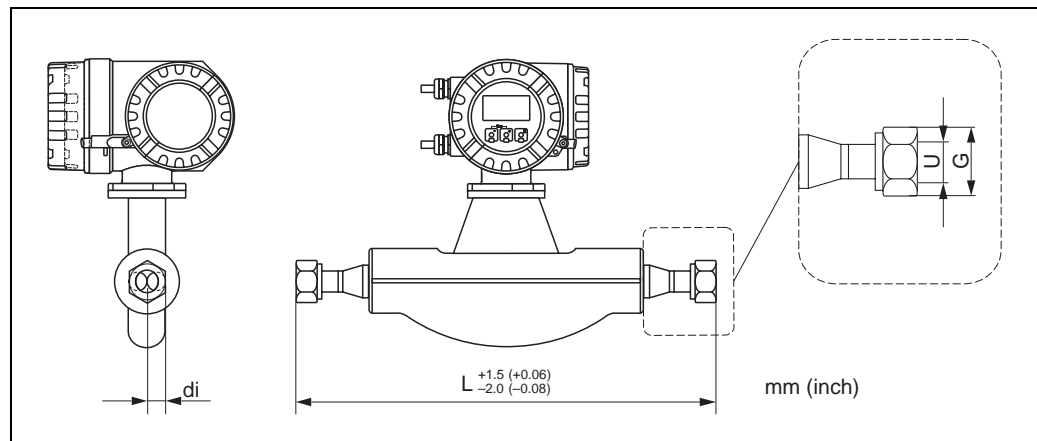
Threaded hygienic connections SMS 1145: 1.4404/316L

DN	G	L	U	di
8	Rd 40 x 1/6"	367	22.6	5.35
15	Rd 40 x 1/6"	398	22.6	8.30
25	Rd 40 x 1/6"	434	22.6	12.00
40	Rd 60 x 1/6"	560	35.6	17.60
50	Rd 70 x 1/6"	720	48.6	26.00
80	Rd 98 x 1/6"	900	72.9	40.50
100	Rd 132 x 1/6"	1128	97.6	51.20

3A version also available (Ra ≤ 0.8 µm/150 grit, Option: Ra ≤ 0.4 µm/240 grit)

All dimensions in [mm]

## VCO connections



a0004552-ae

**8-VCO-4 (1/2"): 1.4404/316L**

DN	G	L	U	di
8	AF 1"	390	10.2	5.35

All dimensions in [mm]

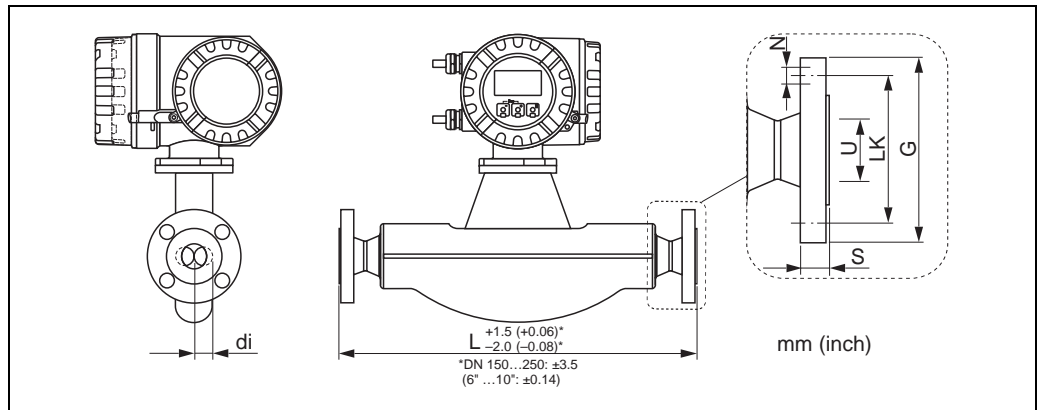
**12-VCO-4 (3/4"): 1.4404/316L**

DN	G	L <sup>1)</sup>	U	di
15	AF 1 1/2"	430	15.7	8.30

All dimensions in [mm]

**Process connections in US units**

*Flange connections ASME B16.5*



a0002501-ae

**Flange according to ASME B16.5 / CI 150: 1.4404/316L, Alloy C-22**

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
3/8"	3.50	14.6	4 × Ø 0.62	0.44	2.38	0.62	0.21
1/2"	3.50	15.9	4 × Ø 0.62	0.44	2.38	0.62	0.33
1"	4.25	17.3	4 × Ø 0.62	0.56	3.12	1.05	0.47
1 1/2"	5.00	21.7	4 × Ø 0.62	0.69	3.88	1.61	0.69
2"	6.00	28.1	4 × Ø 0.75	0.75	4.75	2.07	1.02
3"	7.50	33.1	4 × Ø 0.75	0.94	6.00	3.07	1.59
4"	9.00	44.4	8 × Ø 0.75	0.94	7.50	4.03	2.01
6"	11.0	55.0	8 × Ø 0.88	0.99	9.50	6.07	2.71
10" <sup>1)</sup>	16.0	72.3	12 × Ø 1.0	1.19	14.25	10.0	4.03

<sup>1)</sup> Not available in Alloy  
All dimensions in [inch]

**Flange according to ASME B16.5 / CI 300: 1.4404/316L, Alloy C-22**

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
3/8"	3.75	14.57	4 × Ø0.62	0.56	2.62	0.62	0.21
1/2"	3.75	15.91	4 × Ø0.62	0.56	2.62	0.62	0.33
1"	4.88	17.32	4 × Ø0.75	0.69	3.50	1.05	0.47
1 1/2"	6.12	21.65	4 × Ø0.88	0.81	4.50	1.61	0.69
2"	6.50	28.15	8 × Ø0.75	0.88	5.00	2.07	1.02
3"	8.25	33.07	8 × Ø0.88	1.12	6.62	3.07	1.59
4"	10.00	44.41	8 × Ø0.88	1.25	7.88	4.03	2.02
6"	12.50	55.79	12 × Ø0.88	1.44	10.62	6.07	2.71
10" <sup>1)</sup>	17.50	73.55	16 × Ø1.12	1.87	15.25	10.02	4.03

<sup>1)</sup> Not available in Alloy  
All dimensions in [inch]

<b>Flange according to ASME B16.5 / CI 600: 1.4404/316L, Alloy C-22</b>							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
3/8"	3.75	15.75	4 × Ø0.62	0.81	2.62	0.55	0.21
1/2"	3.75	16.54	4 × Ø0.62	0.81	2.62	0.55	0.33
1"	4.88	19.29	4 × Ø0.75	0.94	3.50	0.96	0.47
1½"	6.12	23.62	4 × Ø0.88	1.13	4.50	1.50	0.69
2"	6.50	29.21	8 × Ø0.75	1.25	5.00	1.94	1.02
3"	8.25	35.43	8 × Ø0.88	1.50	6.62	2.90	1.59
4"	10.75	45.59	8 × Ø1.00	1.91	8.50	3.83	2.02
6"	14.00	57.76	12 × Ø1.12	1.88	11.50	6.07	2.71
10" <sup>1)</sup>	20.00	76.82	16 × Ø1.38	2.75	17.00	10.02	4.03

<sup>1)</sup> Not available in Alloy  
All dimensions in [inch]

<b>Flange according to ASME B16.5 extension-reduction / CI 150: 1.4404/316L</b>							
Only for nominal diameter DN 250 /10" (on request)							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
6"	11.00	77.95	8 × Ø22.4	1.00	9.50	6.07	4.03
8"	13.50	76.38	8 × Ø22.4	1.12	11.75	7.98	4.03
12"	19.00	76.38	12 × Ø25.4	1.25	17.00	12.00	4.03

All dimensions in [inch]

<b>Flange according to ASME B16.5 extension-reduction / CI 300: 1.4404/316</b>							
Only for nominal diameter DN 250 /10" (on request)							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
6"	12.5	78.0	12 × Ø 0.88	1.44	10.6	6.07	4.03
8"	15.0	76.4	12 × Ø 1.00	1.62	13.0	7.98	4.03
12"	20.5	76.4	16 × Ø 1.25	2.00	17.7	12.0	4.03

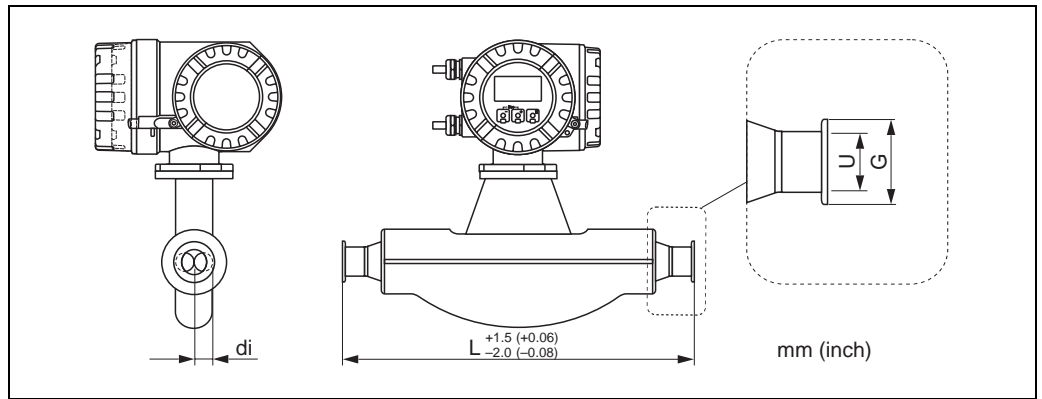
All dimensions in [inch]

<b>Flange according to ASME B16.5 extension-reduction / CI 600: 1.4404/316L</b>							
Only for nominal diameter DN 250 /10" (on request)							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
6"	14.0	78.0	12 × Ø 1.12	2.13	11.5	6.07	4.03
8"	16.5	76.4	12 × Ø 1.25	2.44	13.7	7.98	4.03

All dimensions in [inch]



Tri-Clamp



a0002515-ae

**Tri-Clamp: 1.4404/316L**

DN	Clamp	G	L	U	di
3/8"	1"	1.98	14.4	0.87	0.21
1/2"	1"	1.98	15.7	0.87	0.33
1"	1"	1.98	17.1	0.87	0.47
1 1/2"	1 1/2"	1.98	22.0	1.37	0.69
2"	2"	2.52	28.3	1.87	1.02
3"	3"	3.58	35.4	2.87	1.59
4"	4"	4.68	44.4	3.83	2.01

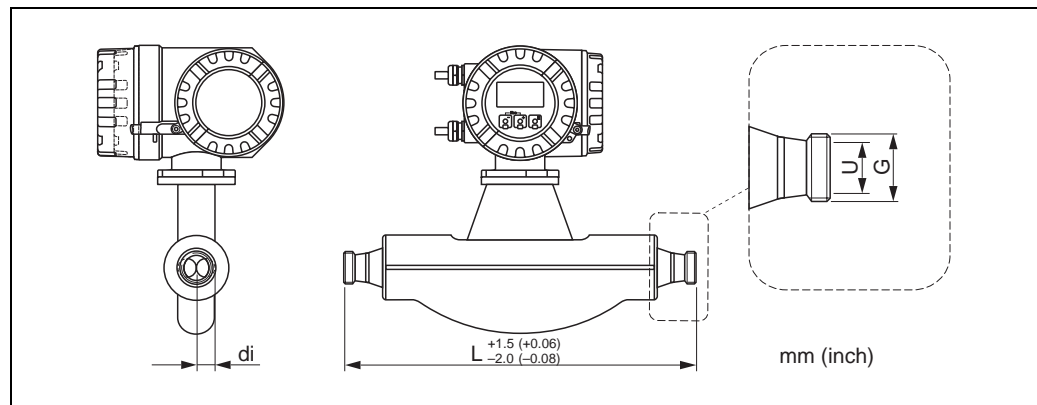
3A version also available ( $Ra \leq 0.8 \mu\text{m}/150$  grit, Option:  $Ra \leq 0.4 \mu\text{m}/240$  grit)  
All dimensions in [inch]

**1/2"-Tri-Clamp: 1.4404/316L**

DN	Clamp	G	L	U	di
3/8"	1/2"	0.98	14.4	0.37	0.21
1/2"	1/2"	0.98	15.7	0.37	0.33

3A version also available ( $Ra \leq 0.8 \mu\text{m}/150$  grit, Option:  $Ra \leq 0.4 \mu\text{m}/240$  grit)  
All dimensions in [inch]

## SMS 1145 (Threaded hygienic connection)



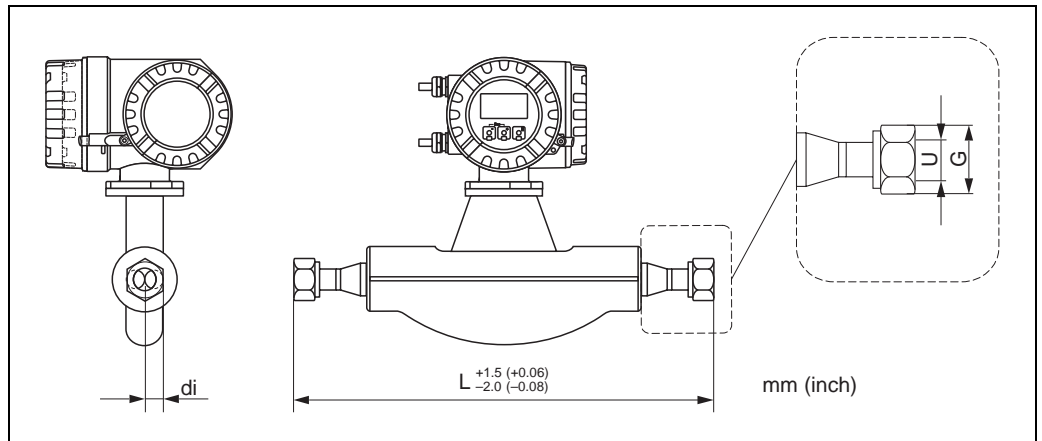
a0002524-ae

Threaded hygienic connection SMS 1145: 1.4404/316L				
DN	G	L	U	di
3/8"	Rd 40 × 1/6"	14.68	0.904	0.214
1/2"	Rd 40 × 1/6"	15.92	0.904	0.332
1"	Rd 40 × 1/6"	17.36	0.904	0.480
1 1/2"	Rd 60 × 1/6"	22.40	1.424	0.704
2"	Rd 70 × 1/6"	28.80	1.944	0.104
3"	Rd 98 × 1/6"	36.00	2.916	1.620
4"	Rd 132 × 1/6"	45.12	3.904	2.048

3A version also available ( $R_a \leq 0.8 \mu\text{m}/150$  grit, Option:  $R_a \leq 0.4 \mu\text{m}/240$  grit)

All dimensions in [inch]

VCO connections



a0004552-00

<b>8-VCO-4 (1/2"): 1.4404/316L</b>				
DN	G	L	U	$d_i$
3/8"	AF 1"	15.35	0.40	0.21

All dimensions in [inch]

<b>12-VCO-4 (3/4"): 1.4404/316L</b>				
DN	G	$L^1$	U	$d_i$
1/2"	AF 1 1/2"	16.93	0.62	0.33

All dimensions in [inch]

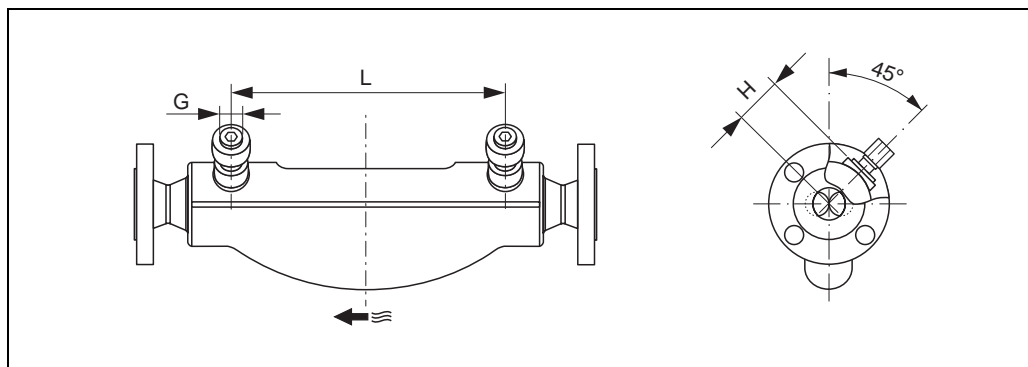
**Purge connections / secondary containment monitoring**



**Caution!**

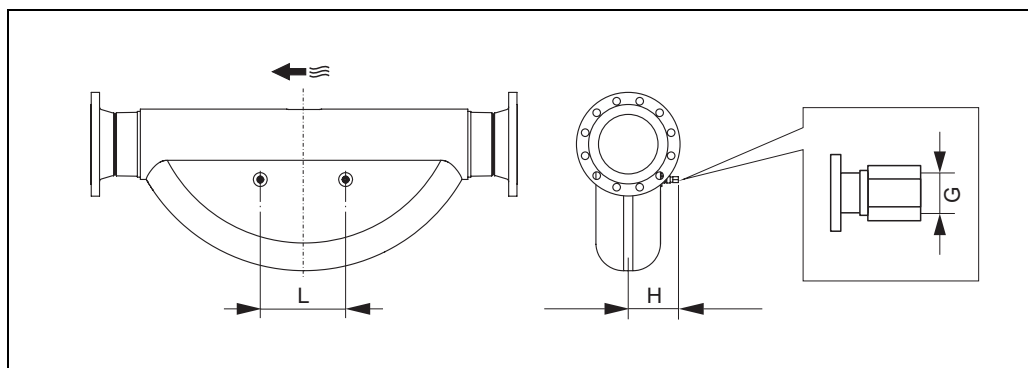
- The secondary containment is filled with dry nitrogen (N<sub>2</sub>). Do not open the purge connections unless the containment can be filled immediately with a dry inert gas. Use only low gauge pressure to purge. Maximum pressure: 5 bar (72.5 psi).
- Purge connections or secondary containment monitoring can not be combined with separately available heating jacket.

*Dimensions (not available for the Promass F high-temperature version)*



DN 8 bis DN 150 (3/8" to 6")

DN		G	H		L	
[mm]	[inch]		[mm]	[inch]	[mm]	[inch]
8	3/8"	1/2"-NPT	62	2.44	216	8.50
15	1/2"	1/2"-NPT	62	2.44	220	8.66
25	1"	1/2"-NPT	62	2.44	260	10.24
40	1 1/2"	1/2"-NPT	67	2.64	310	12.20
50	2"	1/2"-NPT	79	3.11	452	17.78
80	3"	1/2"-NPT	101	3.98	560	22.0
100	4"	1/2"-NPT	120	4.72	684	27.0
150	6"	1/2"-NPT	141	5.55	880	34.6



DN 250 (10")

DN		G	H		L	
[mm]	[inch]		[mm]	[inch]	[mm]	[inch]
250	10"	1/2"-NPT	182	7.17	380	14.96

### Rupture disk

Sensor housings with integrated rupture disks are optionally available.



#### Warning!

- Make sure that the function and operation of the rupture disk is not impeded through the installation. Triggering overpressure in the housing as stated on the indication label. Take adequate precautions to ensure that no damage occurs, and risk to human life is ruled out, if the rupture disk is triggered. Rupture disk: Burst pressure 10 to 15 bar (145 to 217 psi).
- Please note that the housing can no longer assume a secondary containment function if a rupture disk is used.
- It is not permitted to open the connections or remove the rupture disk.



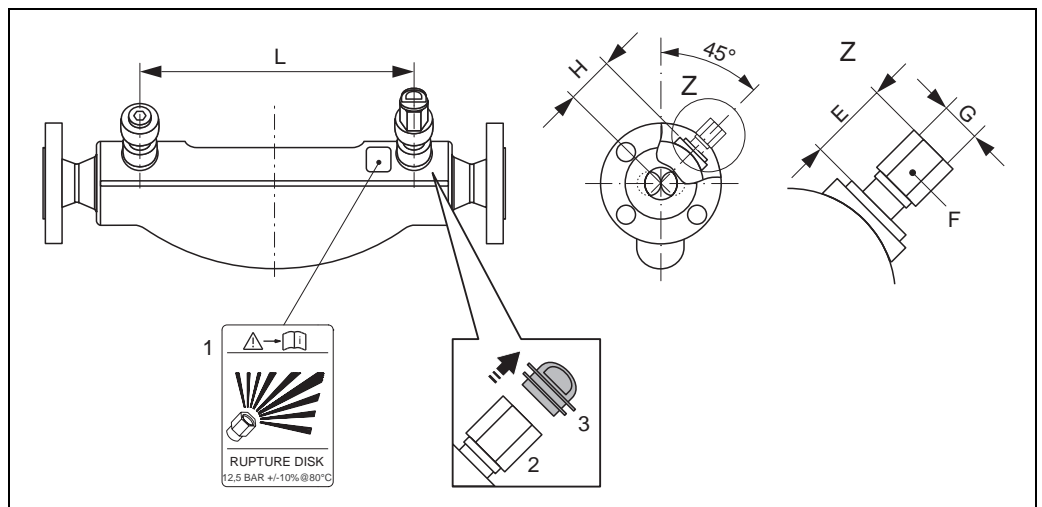
#### Caution!

- Rupture disks can not be combined with separately available heating jacket.
- The existing connection nozzles are not designed for a rinse or pressure monitoring function.



#### Note!

- Before commissioning, please remove the transport protection of the rupture disk.
- Please note the indication labels.

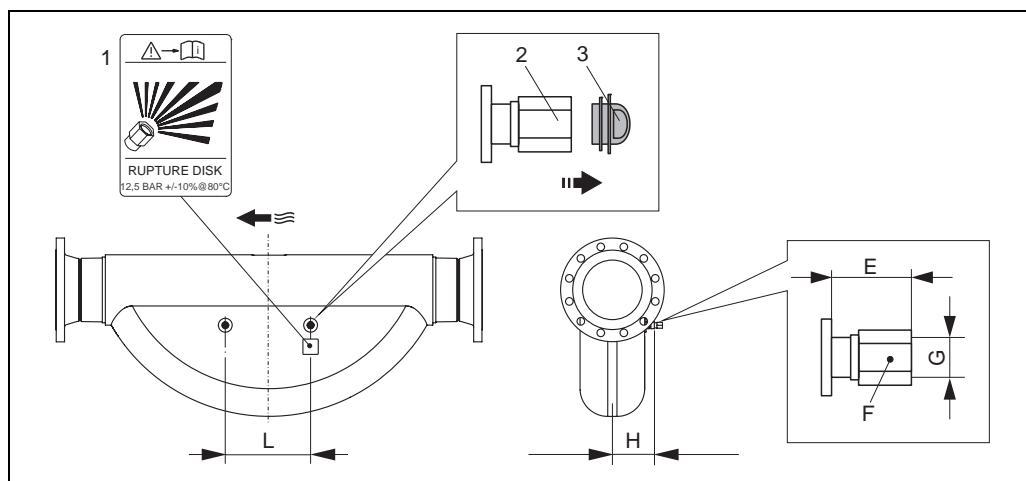


A0008361

DN 8 to DN 150 (3/8" to 6")

- 1 Indication label for the rupture disk
- 2 1/2" NPT internal screw thread with 1" width across flat
- 3 Transport protection

DN		E		F	G	H		L	
[mm]	[inch]	[mm]	[inch]			[mm]	[inch]	[mm]	[inch]
8	3/8"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	62	2.44	216	8.50
15	1/2"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	62	2.44	220	8.66
25	1"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	62	2.44	260	10.24
40	1 1/2"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	67	2.64	310	12.20
50	2"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	79	3.11	452	17.78
80	3"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	101	3.98	560	22.0
100	4"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	120	4.72	684	27.0
150	6"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	141	5.55	880	34.6



DN 250 (10")

- 1 Indication label for the rupture disk
- 2 1/2" NPT internal screw thread with 1" width across flat
- 3 Transport protection

DN		E		F	G	H		L	
[mm]	[inch]	[mm]	[inch]			[mm]	[inch]	[mm]	[inch]
250	10"	ca. 42	ca. 1.65	AF 1"	1/2"-NPT	182	7.17	380	14.96

## Weight

- Compact version: see tables below
- Remote version
  - Transmitter: see the tables below
  - Wall-mount housing: 5 kg (11 lbs)

### Weight information in SI units

DN [mm]	8	15	25	40	50	80	100	150	250 <sup>1)</sup>
Compact version	11	12	14	19	30	55	96	154	400
High temperature compact version	–	–	14.7	–	30.7	55.7	–	–	–
Compact version Ex d	20	21	23	28	39	64	105	163	409
Remote version	9	10	12	17	28	53	94	152	398
High temperature remote version	–	–	13.5	–	29.5	54.5	–	–	–

<sup>1)</sup>With 10" according to ASME B16.5 Cl 300 flanges  
 All values (weight) refer to devices with EN/DIN PN 40 flanges.  
 Weight information in [kg].

### Weight information in US

DN [inch]	3/8"	1/2"	1"	1 1/2"	2"	3"	4"	6"	10" <sup>1)</sup>
Compact version	24	26	31	42	66	121	212	339	882
High temperature compact version	–	–	32	–	68	123	–	–	–
Compact version Ex d	44	46	51	62	86	141	232	359	902
Remote version	20	22	26	37	62	117	207	335	877
High temperature Remote version	–	–	29	–	65	120	–	–	–

<sup>1)</sup> With 10" according to ASME B16.5 Cl 300 flanges  
 All values (weight) refer to devices with EN/DIN PN 40 flanges.  
 Weight information in [lbs].

**Material****Transmitter housing**

Compact version

- Powder coated die-cast aluminium
- Stainless steel housing: stainless steel 1.4301/ASTM 304
- Window material: Glass or polycarbonate

Remote version

- Remote field housing: powder coated die-cast aluminium
- Wall-mount housing: powder coated die-cast aluminium
- Window material: Glass

**Sensor housing / containment**

- Acid and alkali-resistant outer surface
- Stainless Steel 1.4301/1.4307/304L

**Connection housing, sensor (remote version)**

- Stainless Steel 1.4301/304 (standard)
- Powder coated die-cast aluminum  
(high-temperature version and version for heating)

**Process connections**

- Stainless Steel 1.4404/316L
  - Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220
  - DIN 11864-2 Form A (flat flange with groove)
  - Threaded hygienic connection:
    - DIN 11851
    - SMS 1145
    - ISO 2853
    - DIN 11864-1 Form A
  - Tri-Clamp (OD-Tubes)
  - VCO connections
- Alloy C-22 2.4602/N 06022  
Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220

*high-temperature version*

- Stainless Steel 1.4404/316L  
Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220
- Alloy C-22 2.4602/N 06022  
Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220

**Measuring tubes**

- DN 8 to 100 (3/8" to 4"): Stainless Steel 1.4539/904L; manifold: 1.4404/316L
- DN 150 (6"): Stainless Steel 1.4404/316L
- DN 250 (10"): Stainless Steel 1.4404/316L; manifold: CF3M
- DN 8 to 150 (3/8" to 6"): Alloy C-22 2.4602/N 06022

*high-temperature version*

DN 25, 50, 80: Alloy C-22 2.4602/N 06022

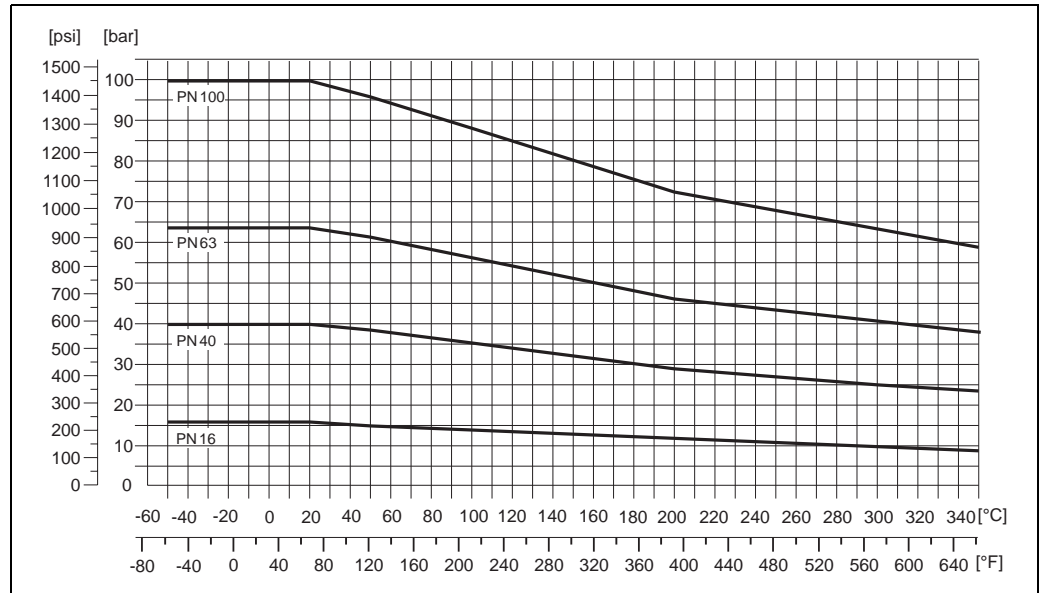
**Material load diagram**



**Warning!**  
The following material load curves refer to the entire sensor and not just the process connection.

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

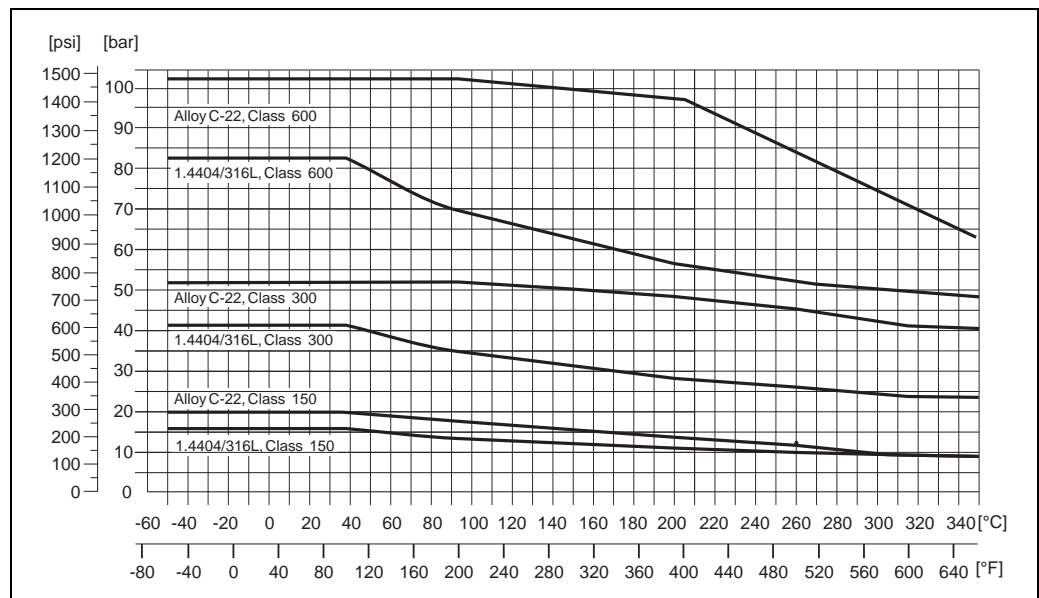
Flange material: 1.4404/316L, Alloy C-22



The values for the temperature range from +200 °C to +350 °C (+392 °F to +662 °F) are exclusively valid for the high-temperature version.

**Flange connection according to ASME B16.5**

Flange material: 1.4404/316L, Alloy C-22

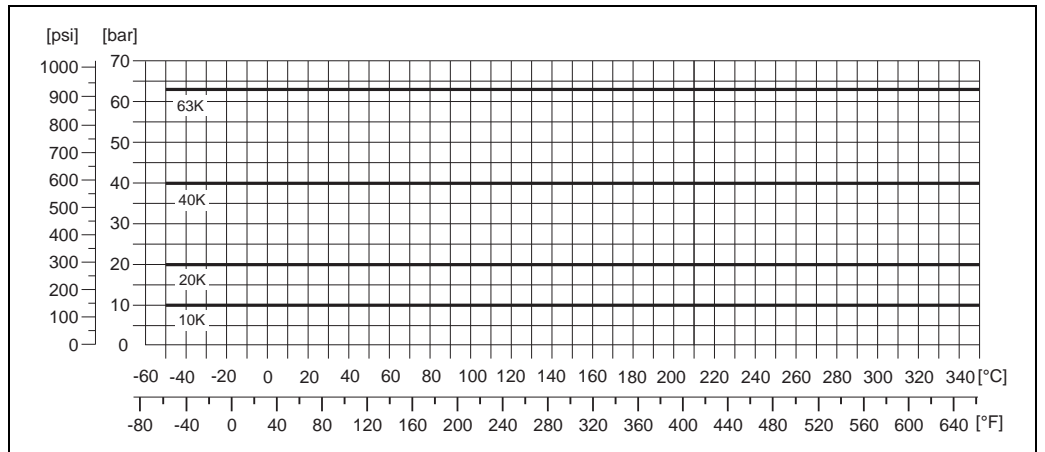


The values for the temperature range from +200 °C to +350 °C (+392 °F to +662 °F) are exclusively valid for high-temperature version.



**Flange connection to JIS B2220**

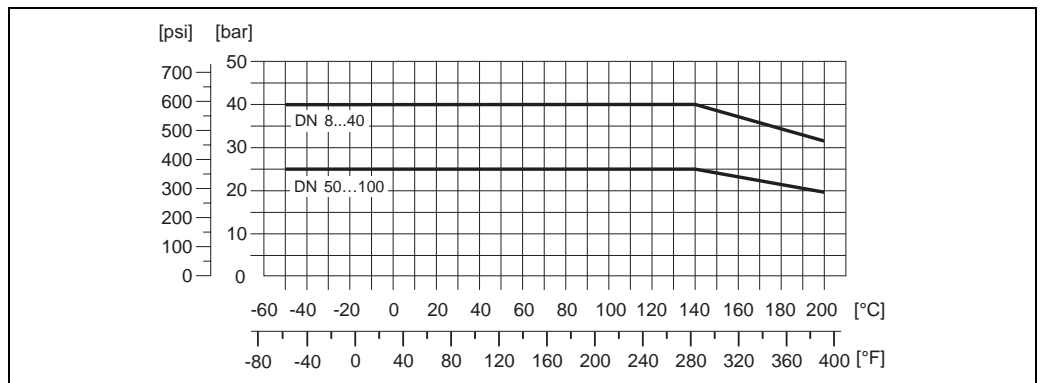
Flange material: 1.4404/316L, Alloy C-22



The values for the temperature range from +200 °C to +350 °C (+392 °F to +662 °F) are exclusively valid for high-temperature version.

**Threaded hygienic connection to DIN 11851 / SMS 1145**

Connection material: 1.4404/316L

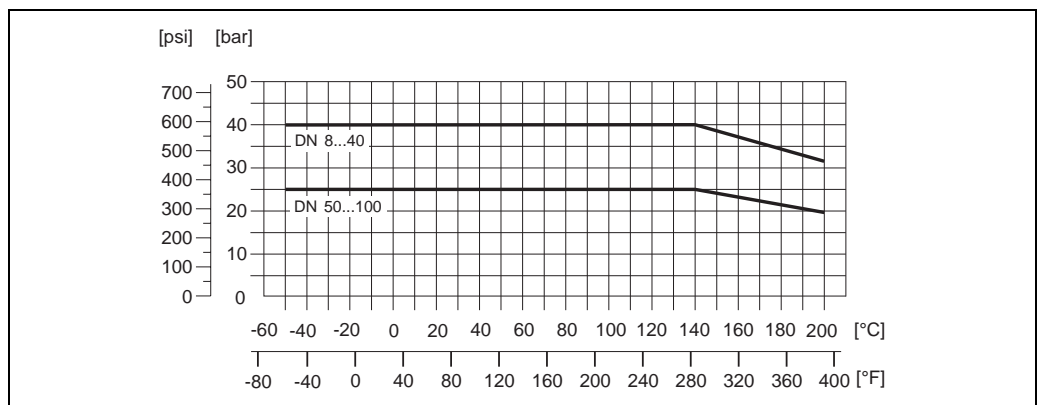


**Tri-Clamp process connection**

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

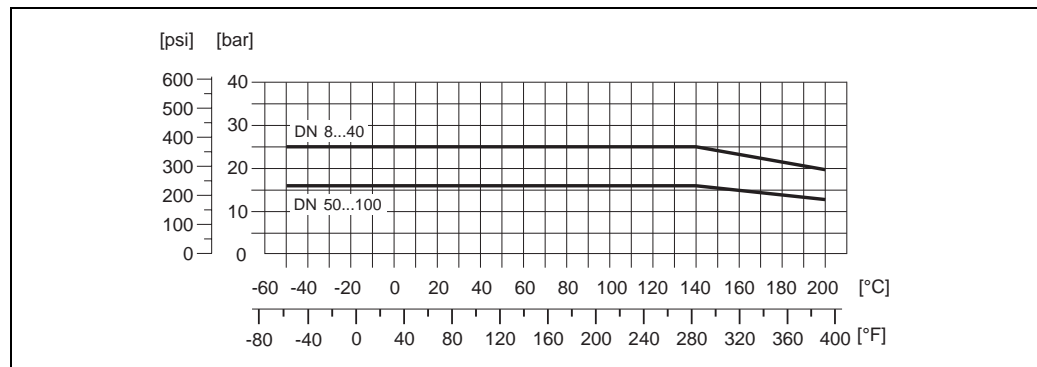
**Threaded hygienic connection to DIN 11864-1**

Connection material: 1.4404/316L



**Flange connection to DIN 11864-2 Form A (flat flange with groove)**

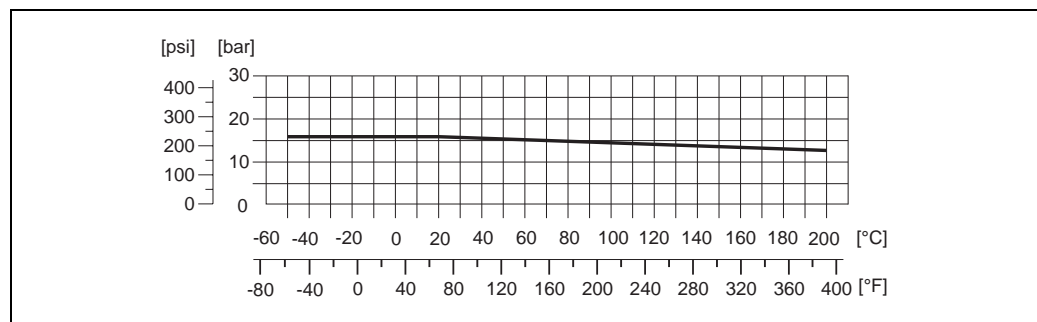
Flange material: 1.4404/316L



a0004659-ae

**Threaded hygienic connection to ISO 2853**

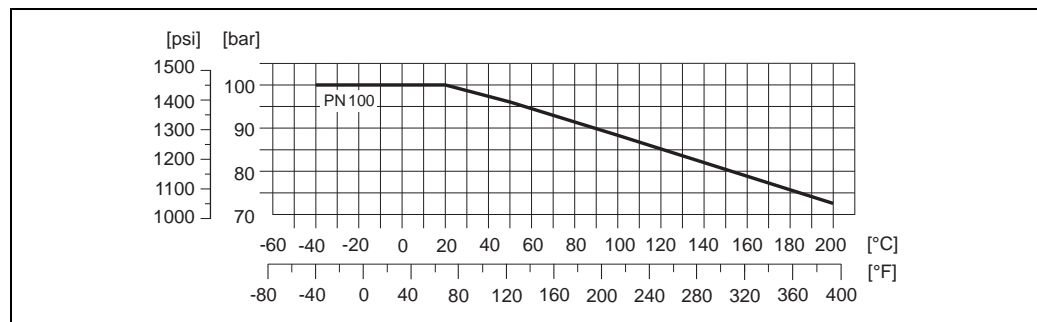
Connection material: 1.4404/316L



a0004660-ae

**VCO process connection**

Connection material: 1.4404/316L



a0004553-ae

**Process connections****Welded process connections**

- Flanges according to EN 1092-1 (DIN 2501), according to ASME B16.5, JIS B2220, VCO connections
- Sanitary connections: Tri-Clamp, threaded hygienic connections (DIN 11851, SMS 1145, ISO 2853, DIN 11864-1), flange to DIN 11864-2 Form A (flat flange with groove)

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## Human interface

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<b>Display elements</b>	<ul style="list-style-type: none"> <li>■ Liquid-crystal display: backlit, two lines (Promass 80) or four lines (Promass 83) with 16 characters per line</li> <li>■ Selectable display of different measured values and status variables</li> <li>■ At ambient temperatures below <math>-20\text{ °C}</math> (<math>-4\text{ °F}</math>) the readability of the display may be impaired.</li> </ul>
<b>Operating elements</b>	<p><b>Promass 80</b></p> <ul style="list-style-type: none"> <li>■ Local operation with three keys (□, +, E)</li> <li>■ Quick Setup menus for straightforward commissioning</li> </ul> <p><b>Promass 83</b></p> <ul style="list-style-type: none"> <li>■ Local operation with three optical keys (□/+/E)</li> <li>■ Application-specific Quick Setup menus for straightforward commissioning</li> </ul>
<b>Language group</b>	<p>Language groups available for operation in different countries:</p> <ul style="list-style-type: none"> <li>■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese</li> <li>■ Eastern Europe/Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech</li> <li>■ South and Eastern Asia (SEA): English, Japanese, Indonesian</li> </ul> <p><b>Only Promass 83</b></p> <ul style="list-style-type: none"> <li>■ China (CN): English, Chinese</li> </ul> <p>The language group is changed using the "FieldCare" operating program.</p>
<b>Remote operation</b>	<p><b>Promass 80</b></p> <p>Remote operation via HART, PROFIBUS PA</p> <p><b>Promass 83</b></p> <p>Remote operation via HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, MODBUS RS485</p>

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## Certificates and approvals

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<b>CE mark</b>	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
<b>C-Tick symbol</b>	The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)"
<b>Ex approval</b>	Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are contained in separate explosion protection documentation which you can order if required.
<b>Sanitary compatibility</b>	<ul style="list-style-type: none"> <li>■ 3A approval</li> <li>■ EHEDG-tested</li> </ul>

<b>FOUNDATION Fieldbus certification</b>	<p>The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus Foundation. The flowmeter thus meets all the requirements of the specifications listed below:</p> <ul style="list-style-type: none"> <li>■ Certified to FOUNDATION Fieldbus specification</li> <li>■ The flowmeter meets all the specifications of the FOUNDATION Fieldbus-H1.</li> <li>■ Interoperability Test Kit (ITK), revision status 5.01 (Certification on request)</li> <li>■ The device can also be operated in conjunction with other-make certified devices.</li> <li>■ Physical Layer Conformance Test of the Fieldbus Foundation</li> </ul>
<b>PROFIBUS DP/PA certification</b>	<p>The flow device has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> <li>■ Certified to PROFIBUS Profile Version 3.0 (device certification number: on request)</li> <li>■ The device can also be operated with certified devices of other manufacturers (interoperability)</li> </ul>
<b>MODBUS certification</b>	<p>The measuring device meets all the requirements of the MODBUS/TCP conformity and integration test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the "MODBUS/TCP Conformance Test Laboratory" of the University of Michigan.</p>
<b>Other standards and guidelines</b>	<ul style="list-style-type: none"> <li>■ EN 60529 Degrees of protection by housing (IP code)</li> <li>■ EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.</li> <li>■ IEC/EN 61326 "Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements).</li> <li>■ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.</li> <li>■ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.</li> <li>■ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics</li> </ul>
<b>Pressure measuring device approval</b>	<p>Flowmeters with a nominal diameter smaller or equal DN 25 are covered by Art. 3(3) of the European directive 97/23/EC (Pressure Equipment Directive) and are designed according to sound engineering practice. For larger nominal diameters, optional approvals according to Cat. II/III are available if required (depends on fluid and process pressure).</p> <p>Optionally flowmeters in accordance to the guidelines AD 2000 are available on request.</p>

**Functional safety**

SIL -2: accordance IEC 61508/IEC 61511-1 (FDIS)  
 "4–20 mA" - output according to the following order code:

**Promass 80**

Promass80\*\*\*\_\*\*\*\*\*A  
 Promass80\*\*\*\_\*\*\*\*\*D  
 Promass80\*\*\*\_\*\*\*\*\*S  
 Promass80\*\*\*\_\*\*\*\*\*T  
 Promass80\*\*\*\_\*\*\*\*\*8

**Promass 83**

Promass83***_*****A	Promass83***_*****M	Promass83***_*****Ø
Promass83***_*****B	Promass83***_*****R	Promass83***_*****2
Promass83***_*****C	Promass83***_*****S	Promass83***_*****3
Promass83***_*****D	Promass83***_*****T	Promass83***_*****4
Promass83***_*****E	Promass83***_*****U	Promass83***_*****5
Promass83***_*****L	Promass83***_*****W	Promass83***_*****6

## Ordering Information

The Endress +Hauser service organization can provide detailed ordering information and information on the order codes upon request.

## Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor.

## Documentation

- Flow measuring technology (FA005D)
- Technical Information
  - Promass 80A, 83A (T054D)
  - Promass 80E, 83E (TI061D)
  - Promass 80H, 83H (TI074D)
  - Promass 80I, 83I (TI075D)
  - Promass 80M, 83M (TI102D)
  - Promass 80P, 83P (TI078D)
  - Promass 80S, 83S (TI076D)
- Operating Instructions/Description of Device Functions
  - Promass 80 HART (BA057D/BA058D)
  - Promass 80 PROFIBUS PA (BA072D/BA073D)
  - Promass 83 HART (BA059D/BA060D)
  - Promass 83 FOUNDATION Fieldbus (BA065D/BA066D)
  - Promass 83 PROFIBUS DP/PA(BA063D/BA064D)
  - Promass 83 MODBUS (BA107D/BA108D)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IECEx NEPSI
- Functional safety manual Promass 80, 83 (SD077D)

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## Registered trademarks

KALREZ® and VITON®

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®

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

SWAGELOK®

Registered trademark of Swagelok & Co., Solon, USA

HART®

Registered trademark of HART Communication Foundation, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™ Fieldbus

Registered trademark of the Fieldbus FOUNDATION, Austin, USA

MODBUS®

Registered trademark of the MODBUS Organization

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, Fieldcheck®, FieldCare®, Applicator®

Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH



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