

Technical Information

Proline Promass 80P, 83P

Coriolis flowmeter



The specialist for life sciences with extended transmitter functionality

Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Dedicated for applications under sterile conditions in the life sciences industry

Device properties

- ASME BPE, 3A and EHEDG conform & low delta ferrite
- Electropolished measuring tube in 1.4435 (316L)
- Fast recovery from CIP/SIP
- Device in compact or remote version

Promass 83

- 4-line backlit display with touch control
- HART, PROFIBUS PA/DP, Modbus RS485, FF, EtherNet/IP

Your benefits

- Highest process quality – fully compliant to industry enquirements
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no in/outlet run needs

Promass 83

- Quality – software for filling & dosing, density & concentration, advanced diagnostics (Promass 83)
- Flexible data transfer options – numerous communication types
- Automatic recovery of data for servicing

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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

Δm = moving mass

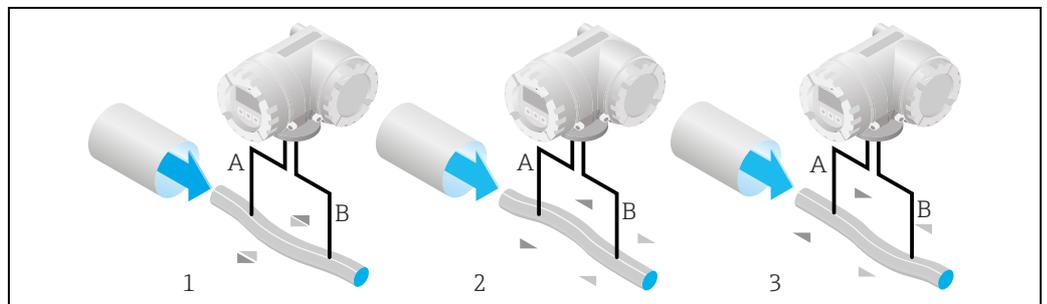
ω = rotational velocity

v = velocity of the moving mass in a rotating or oscillating system

The amplitude of the Coriolis force depends on the moving mass Δm , its velocity v in the system, and thus on the mass flow. Instead of a constant angular velocity ω , the Promass sensor uses oscillation.

This causes the tube through which the fluid is flowing to oscillate. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):

- If there is zero flow, i.e. when the fluid stands still, the oscillation measured at points A and B has the same phase, and thus there is no phase difference (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



a0003383

The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. The system balance required for proper measurement is created by exciting an eccentrically arranged swinging mass to antiphase oscillation. This patented TMB™ system (Torsion Mode Balanced System) guarantees perfect measurements, even in changing process and environmental conditions. Therefore, the device is just as easy to install as the familiar two-tube systems. Consequently, no special measures for attachment are required in front of or behind the sensor. The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

Density measurement

The measuring tube is continuously excited at its resonance frequency. A change in the mass and thus the density of the oscillating system (comprising the measuring tube 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

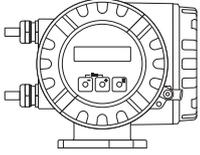
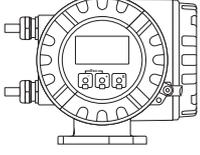
The temperature of the measuring tube is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output.

Measuring system

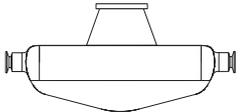
The measuring system consists of a transmitter and a sensor. Two versions are available:

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

Transmitter

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

Sensor

<p>P</p>  <p>a0006828</p>	<ul style="list-style-type: none"> ■ For use in sterile applications in heavily regulated industries. ■ Nominal diameters: DN 8 to 50 ($\frac{3}{8}$" to 2") ■ Materials: <ul style="list-style-type: none"> - Sensor: stainless steel, 1.4301 (304) - Measuring tube: stainless steel, 1.4435 (316L) - Process connections: stainless steel, 1.4435 (316L); stainless steel, 1.4404 (316/316L) - Surface quality: Ra_{max} 0.76 μm (30 μin) (mechanically polished); Ra_{max} 0.38 μm (15 μin) (electropolished) - Delta ferrite <1%
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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]	[in]	[kg/h]	[lb/min]
8	$\frac{3}{8}$ "	0 to 2000	0 to 73.50
15	$\frac{1}{2}$ "	0 to 6500	0 to 238.9
25	1"	0 to 18000	0 to 661.5
40	1 $\frac{1}{2}$ "	0 to 45000	0 to 1654
50	2"	0 to 70000	0 to 2573

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:

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

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

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

$$\rho_{(G)} = \text{Gas density in [kg/m}^3\text{] at operating conditions}$$

DN		x
[mm]	[in]	
8	3/8"	60
15	1/2"	80
25	1"	90
40	1 1/2"	90
50	2"	90

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

Calculation example for gas:

- Sensor type: Promass P, DN 50
- Gas: air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range (liquid): 70000 kg/h
- x = 90 (for Promass P, DN 50)

Max. possible full scale value:

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

Recommended full scale values

See information in the "Limiting flow" section → 24 ff.

Operable flow range

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.

Input signal

Status input (auxiliary input)

U = 3 to 30 V DC, R_i = 5 kΩ, 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 kΩ, galvanically isolated.

Switch level: ±3 to ±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 kΩ, galvanically isolated.

Switch level: ±3 to ±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 μA

- Active: 4 to 20 mA, R_L < 700 Ω, U_{out} = 24 V DC, short-circuit proof
- Passive: 0/4 to 20 mA, R_i = 150 Ω, 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.r./°C, resolution: 0.5 μ 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.r./°C, resolution: 0.5 μ 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)

HART protocol

Order code "Power supply; Display", option A, B, C, D, E, F, G, H, X, 7, 8 (HART 5)

- Valid until software: 3.01.XX

Order code "Power supply; Display", option P, Q, R, S, T, U, 4, 5 (HART 7)

- Valid as of software: 3.07.XX

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 →  8

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 →  8

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 →  8

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

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

Power supply

Terminal assignment

Promass 80

Order characteristic for "inputs/outputs"	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
<i>Fixed communication boards (permanent assignment)</i>				
A	Status input	Status output	Frequency output	Current output, HART
B	-	-	-	PROFIBUS PA
F	-	-	Frequency output Ex i, passive	Current output Ex i active, HART
G	-	-	Frequency output Ex i, passive	Current output Ex i passive, HART
H	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 characteristic for "inputs/outputs", option	Terminal No. (inputs/ outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
<i>Fixed communication boards (permanent assignment)</i>				
A	-	-	Frequency output	Current output, HART
B	Relay output	Relay output	Frequency output	Current output, HART
F	-	-	-	PROFIBUS PA, Ex i
G	-	-	-	FOUNDATION Fieldbus Ex i
H	-	-	-	PROFIBUS PA
J	-	-	+5V (ext. termination)	PROFIBUS DP
K	-	-	-	FOUNDATION Fieldbus
Q	-	-	Status input	Modbus RS485
R	-	-	Current output 2 Ex i, active	Current output 1 Ex i active, HART
S	-	-	Frequency output Ex i, passive	Current output Ex i active, HART
T	-	-	Frequency output Ex i, passive	Current output Ex i passive, HART
U	-	-	Current output 2 Ex i, passive	Current output 1 Ex i passive, HART
<i>Flexible communication boards</i>				
C	Relay output 2	Relay output 1	Frequency output	Current output, HART
D	Status input	Relay output	Frequency output	Current output, HART
E	Status input	Relay output	Current output 2	Current output 1, HART
L	Status input	Relay output 2	Relay output 1	Current output, HART
M	Status input	Frequency output 2	Frequency output 1	Current output, HART
N	Current output	Frequency output	Status input	Modbus RS485
P	Current output	Frequency output	Status input	PROFIBUS DP
V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
W	Relay output	Current output 3	Current output 2	Current output 1, HART
0	Status input	Current output 3	Current output 2	Current output 1, HART
2	Relay output	Current output 2	Frequency output	Current output 1, HART
3	Current input	Relay output	Current output 2	Current output 1, HART
4	Current input	Relay output	Frequency output	Current output, HART
5	Status input	Current input	Frequency output	Current output, HART
6	Status input	Current input	Current output 2	Current output 1, HART
7	Relay output 2	Relay output 1	Status input	Modbus RS485

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

Power consumption AC: <15 VA (including sensor)
 DC: <15 W (including sensor)

Switch-on current

- Max. 13.5 A (<50 ms) at 24 V DC
- Max. 3 A (<5 ms) at 260 V AC

Power supply failure **Promass 80**

Lasting min. 1 power cycle:

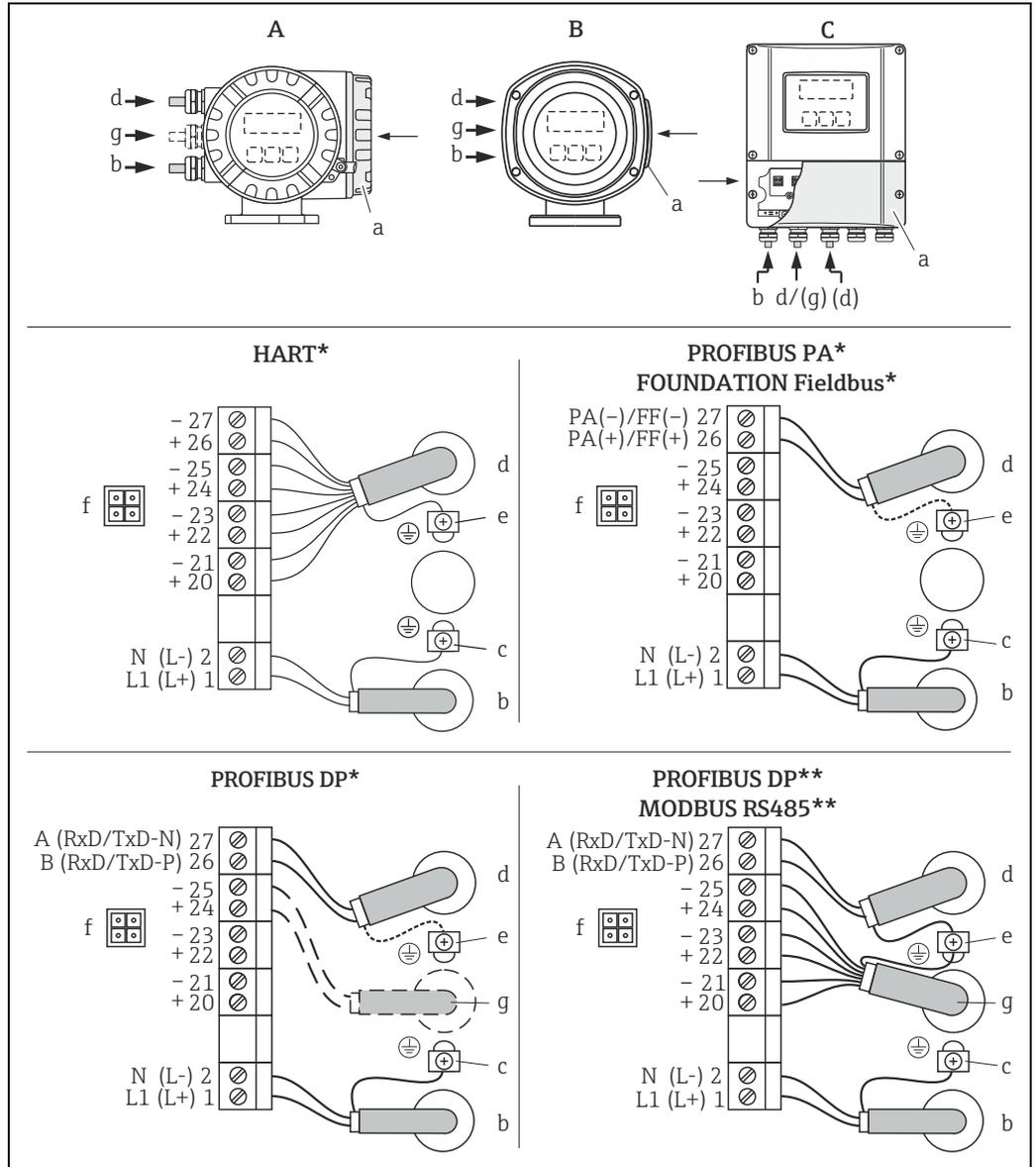
- EEPROM saves measuring system data if the power supply fails
- HistoROM/S-DAT: exchangeable data storage chip with sensor specific data (nominal diameter, serial number, calibration factor, zero point etc.)

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.)

Electrical connection



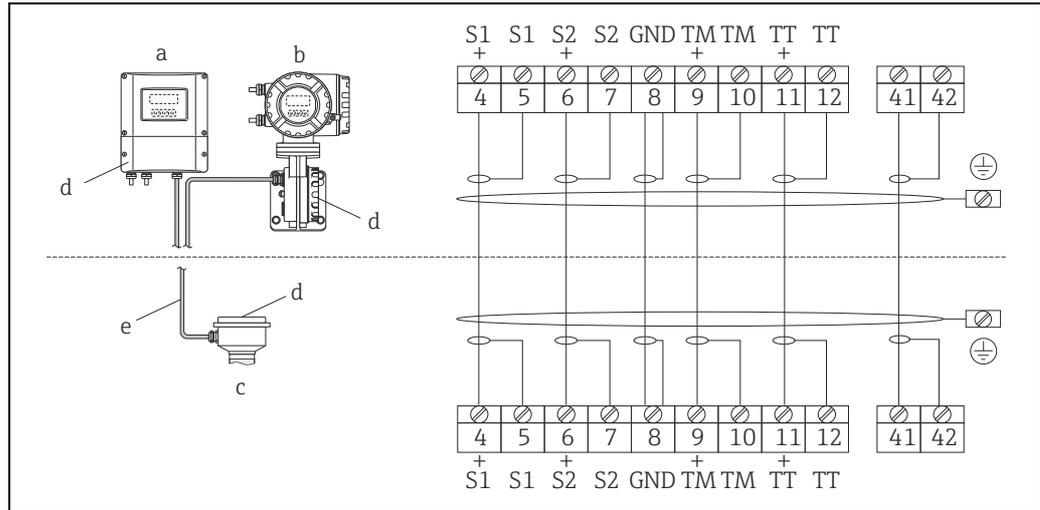
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Connecting the transmitter, cable cross-section: max. 2.5 mm²

- 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 → 8
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 → 8
Cable for external termination (only for PROFIBUS DP with permanent assignment communication board):
Terminal No. 24: +5 V
Terminal No. 25: DGND

Electrical connection, remote version



Connecting the remote version

- a Wall-mount housing transmitter: non-hazardous area and ATEX II3G, zone 2 → see separate "Ex documentation"
 b Wall-mount housing transmitter: ATEX II2G, Zone 1, FM/CSA → see separate "Ex documentation"
 c Connection housing sensor
 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

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.

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, ½" NPT, G ½"

Connecting cable for remote version

- Cable entry M20 × 1.5 (8 to 12 mm) (0.31" to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Cable specification

- 6 × 0.38 mm² (PVC cable with common shield and individually shielded cores)
- Conductor resistance: ≤50 Ω/km (≤0.015 Ω/ft)
- Capacitance: core/shield: ≤420 pF/m (≤128 pF/ft)
- Cable length: max. 20 m (65 ft)
- Permanent operating temperature: max. +105 °C (+221 °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 IEC/EN 61326, and NAMUR recommendation NE 21/43.

Performance characteristics

Reference operating conditions

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

To obtain measured errors, use the Applicator sizing tool *Applicator*: → 70.

Maximum measured error

Design fundamentals → 15

o.r. = of reading; $1 \text{ g/cm}^3 = 1 \text{ kg/l}$; T = fluid temperature

Base accuracy

Mass flow and volume flow (liquids)

Promass 83P:

- $\pm 0.10\%$ o.r.

Promass 80P:

- $\pm 0.15\%$ o.r.

Mass flow (gases)

$\pm 0.50\%$ o.r.

Density (liquids)

- Reference conditions: $\pm 0.0005 \text{ g/cm}^3$
- Field density calibration: $\pm 0.0005 \text{ g/cm}^3$ (valid after field density calibration under process conditions)
- Standard density calibrations: $\pm 0.01 \text{ g/cm}^3$ (valid over the entire measuring range of the sensor → 20)
- Special density calibration: $\pm 0.002 \text{ g/cm}^3$ (optional, valid range: $+5$ to $+80 \text{ }^\circ\text{C}$ ($+41$ to $+176 \text{ }^\circ\text{F}$) and 0 to 2.0 g/cm^3)

Temperature

$\pm 0.5 \text{ }^\circ\text{C} \pm 0.005 \cdot T \text{ }^\circ\text{C}$ ($\pm 1 \text{ }^\circ\text{F} \pm 0.003 \cdot (T - 32) \text{ }^\circ\text{F}$)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
8	$\frac{3}{8}$ "	0.20	0.007
15	$\frac{1}{2}$ "	0.65	0.024
25	1"	1.80	0.066
40	$1\frac{1}{2}$ "	4.50	0.165
50	2"	7.00	0.257

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
8	2000	200.0	100.0	40.00	20.00	4.000
15	6500	650.0	625.0	130.0	65.00	13.00
25	18000	1800	900.0	360.0	180.0	36.00
40	45000	4500	2250	900.0	450.0	90.00
50	70000	7000	3500	1400	700.0	140.0

US units

DN [in]	1:1 [lb/min]	1:10 [lb/min]	1:20 [lb/min]	1:50 [lb/min]	1:100 [lb/min]	1:500 [lb/min]
3/8	73.50	7.350	3.675	1.470	0.735	0.147
1/2	238.9	23.89	11.95	4.778	2.389	0.478
1	661.5	66.15	33.08	13.23	6.615	1.323
1 1/2	1654	165.4	82.70	33.08	16.54	3.308
2	2573	257.3	128.7	51.46	25.73	5.146

Accuracy of outputs

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

The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

Current output

Accuracy: Max. $\pm 0.05\%$ o.f.s. or $\pm 5\ \mu\text{A}$

Pulse/frequency output

Accuracy: Max. $\pm 50\%$ ppm o.r.

Repeatability

Design fundamentals → 15

o.r. = of reading; $1\ \text{g}/\text{cm}^3 = 1\ \text{kg}/\text{l}$; T = fluid temperature

Base repeatability

Mass flow and volume flow (liquids)

$\pm 0.05\%$ o.r.

Mass flow (gases)

$\pm 0.25\%$ o.r.

Density (liquids)

$\pm 0.00025\ \text{g}/\text{cm}^3$

Temperature

$\pm 0.25\ ^\circ\text{C} \pm 0.0025 \cdot T\ ^\circ\text{C}$ ($\pm 0.45\ ^\circ\text{F} \pm 0.0015 \cdot (T-32)\ ^\circ\text{F}$)

Response time

- The response time depends on the configuration (damping).
- Response time in the event of erratic changes in the measured variable (only mass flow): after 100 ms 95 % of the full scale value.

Influence of fluid 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 $\pm 0.0002\%$ of the full scale value / $^\circ\text{C}$ ($\pm 0.0001\%$ of the full scale value / $^\circ\text{F}$).

Influence of fluid pressure

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

DN		Promass P
[mm]	[in]	[% o.r./bar]
8	3/8"	-0.002
15	1/2"	-0.006
25	1"	-0.005
40	1 1/2"	-0.005
50	2"	-0.005

o.r. = of reading

Design fundamentals

o.r. = of reading

BaseAccu = base accuracy in % o.r.

BaseRepeat = base repeatability in % o.r.

MeasValue = measured value (in flow units consistent with the zero point stability value → 13)

ZeroPoint = zero point stability

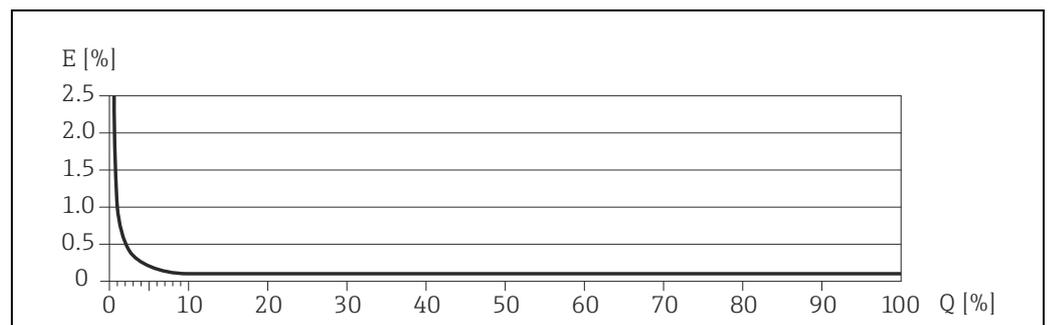
Calculation of the maximum measured error depending on flowrate

Flowrate (in flow units consistent with the zero point stability value → 13)	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021332</small>	$\pm \text{BaseAccu}$ <small>A0021339</small>
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021333</small>	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021334</small>

Calculation of the repeatability depending on flowrate

Flowrate (in flow units consistent with the zero point stability value → 13)	Repeatability in % o.r.
$\geq \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021335</small>	$\pm \text{BaseRepeat}$ <small>A0021340</small>
$< \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021336</small>	$\pm 1/2 \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021337</small>

Example for maximum measured error



E = Error: Maximum measured error as % o.r. (example Promass 83P)

Q = Flow rate as %

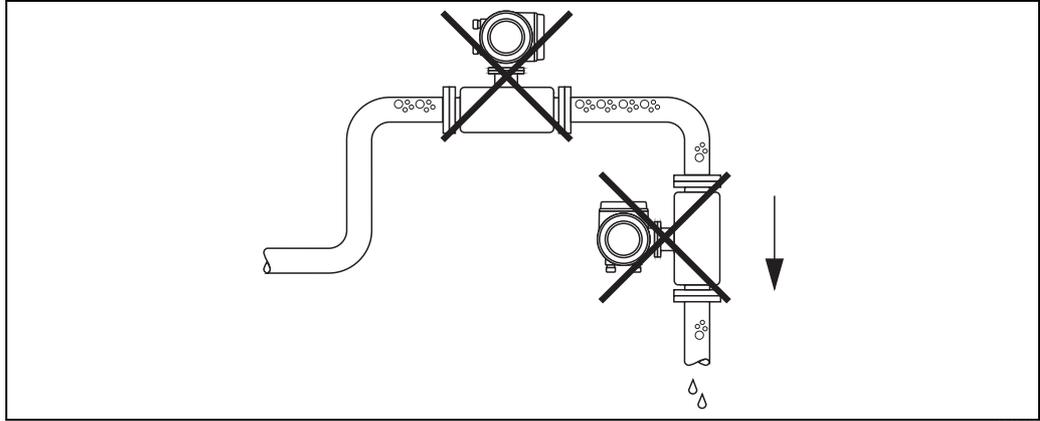
Installation

Mounting location

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

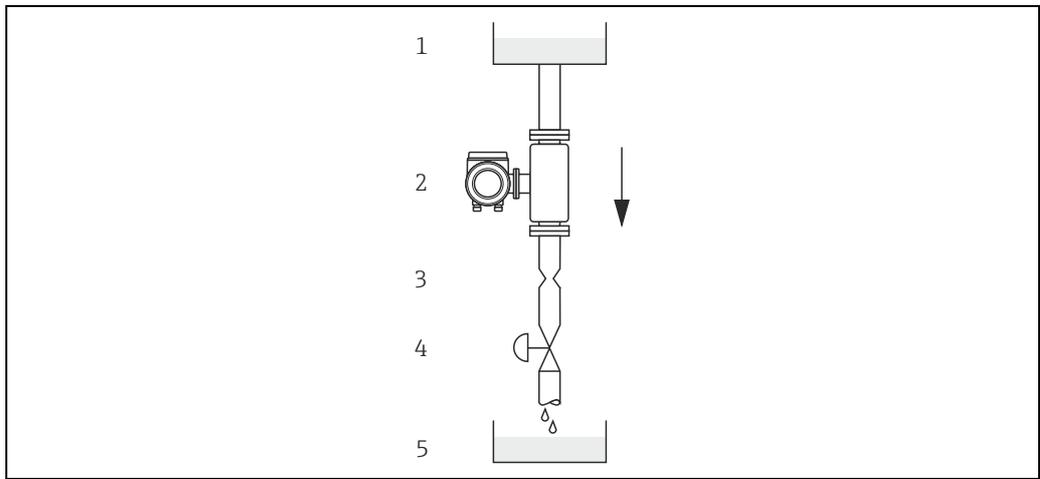
Therefore, avoid the following mounting locations in the pipe installation:

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



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.



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

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

DN		Ø Orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
8	3/8"	6	0.24
15	1/2"	10	0.39
25	1"	14	0.55
40	1 1/2"	22	0.87
50	2"	28	1.10

Orientation

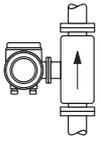
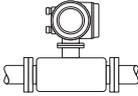
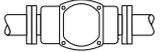
Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction of fluid flow through the pipe).

Vertical (Fig. V)

Recommended orientation with upward direction of flow. When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. Thus the measuring tubes can be completely drained and protected against solids buildup.

Horizontal (Fig. H1 to H3)

The transmitter can be installed in any orientation in a horizontal pipe run.

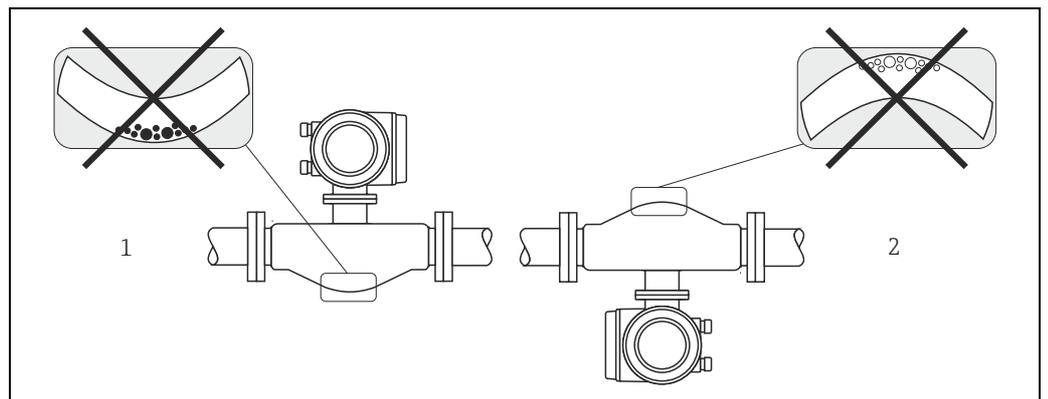
Orientation:	Vertical	Horizontal, Transmitter head up	Horizontal, Transmitter head down	Horizontal, Transmitter head to the side
	 <small>a0004572</small> <i>Fig. V</i>	 <small>a0004576</small> <i>Fig. H1</i>	 <small>a0004580</small> <i>Fig. H2</i>	 <small>a0007558</small> <i>Fig. H3</i>
Standard, Compact version	✓✓	✓✓	✓✓	✓✓
Standard, Remote version	✓✓	✓✓	✓✓	✓✓

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

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

- For fluids with very high temperatures, we recommend the horizontal orientation with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V).
- For fluids with very low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

When using a bent measuring tube and horizontal installation, the position of the sensor has to be matched to the fluid properties!



Horizontal installation for sensors with a bent measuring tube

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

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.

Inlet and outlet runs

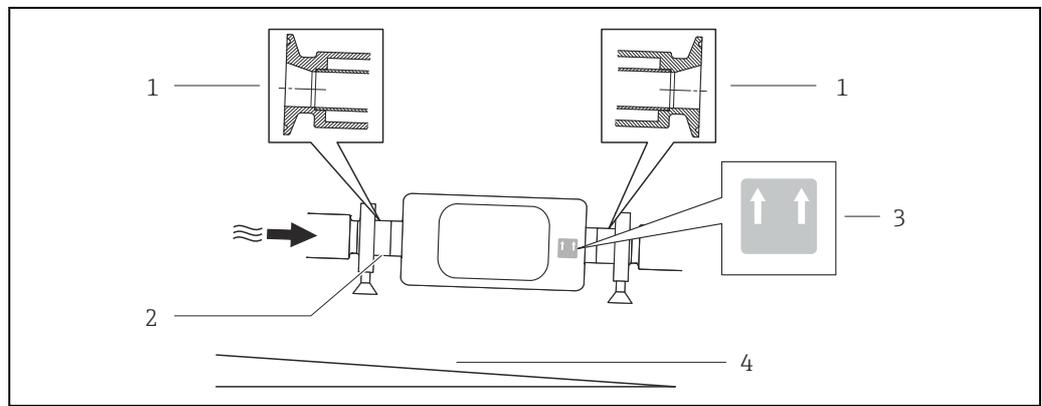
There are no installation requirements regarding inlet and outlet runs.

Length of connecting cable

Max. 20 meters (66 ft), remote version

Special installation instructions**Eccentric clamps**

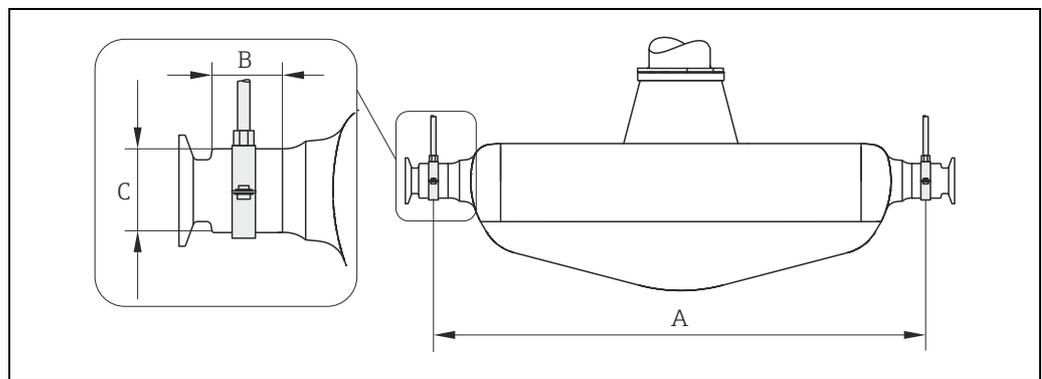
Eccentric Clamps can be used to ensure complete drainability when the sensor is installed in a horizontal line. When lines are pitched in a specific direction and at a specific slope, gravity can be used to achieve complete drainability. The sensor must be installed in the correct position with the tube bend facing to the side, to ensure full drainability in the horizontal position. Markings on the sensor show the correct mounting position to optimize drainability.



- 1 Eccentric clamp connection
- 2 Line on the underside indicates the lowest point of the eccentric process connection.
- 3 "This side up" label indicates which side is up
- 4 Slope the device in accordance with the hygiene guidelines. Slope: approx. 2 % or 21mm/m (0.24 in/feet)

Hygienic connections (mounting clamp with lining between clamp and instrument)

It is not necessary to support the sensor under any circumstances for operational performance. If the requirement exists to support the sensor the following recommendation should be followed.



Mounting with mounting clamp

DN		A		B		C	
[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]
8	3/8"	298	11.73	33.0	1.30	28	1.10
15	1/2"	402	15.83	33.0	1.30	28	1.10
25	1"	542	21.34	33.0	1.30	38	1.50
40	1 1/2"	750	29.53	36.5	1.44	50	1.97
50	2"	1019	40.12	44.1	1.74	68	2.68

Zero point adjustment

All measuring devices are calibrated to state-of-the-art technology. Calibration takes place under reference operating conditions → 12. Consequently, the zero point adjustment is generally **not** necessary.

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

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

Environment

Ambient temperature range	Sensor, transmitter: <ul style="list-style-type: none"> ■ Standard: -20 to +60 °C (-4 to +140 °F) ■ Optional: -40 to +60 °C (-40 to +140 °F) ■ Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions. ■ At ambient temperatures below -20 °C (-4 °F) the readability of the display may be impaired.
Storage temperature	-40 to +80 °C (-40 to +176 °F), preferably +20 °C (+68 °F)
Degree of protection	Standard: IP 67 (NEMA 4X) for transmitter and sensor
Shock resistance	According to IEC/EN 60068-2-31
Vibration resistance	Acceleration up to 1 g, 10 to 150 Hz, following IEC/EN 60068-2-6
Electromagnetic compatibility (EMC)	As per IEC/EN 61326 and NAMUR recommendation NE 21

Process

Fluid temperature range **Sensor**
 -50 to +200 °C (-58 to +392 °F)

Medium density 0 to 5000 kg/m³ (0 to 312 lb/ft³)

**Fluid pressure range
(nominal pressure)** **Flanges**

- According to DIN PN 40 to 63
- According to ASME B16.5 Cl 150, Cl 300
- JIS 20K, 40K

Secondary containment pressure rating

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

The following secondary containment pressure rating is only valid for a fully welded sensor housing and/or a device equipped with closed purge connections (never opened, as delivered).

DN		Secondary containment rating (designed with a safety factor ≥ 4)		Burst pressure of secondary containment	
[mm]	[in]	[bar]	[psi]	[bar]	[psi]
8	$\frac{3}{8}$	25	362	190	2755
15	$\frac{1}{2}$	25	362	175	2535
25	1	25	362	165	2930
40	$1\frac{1}{2}$	16	232	64	925
50	2	10	145	54	780

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 →  26).

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).

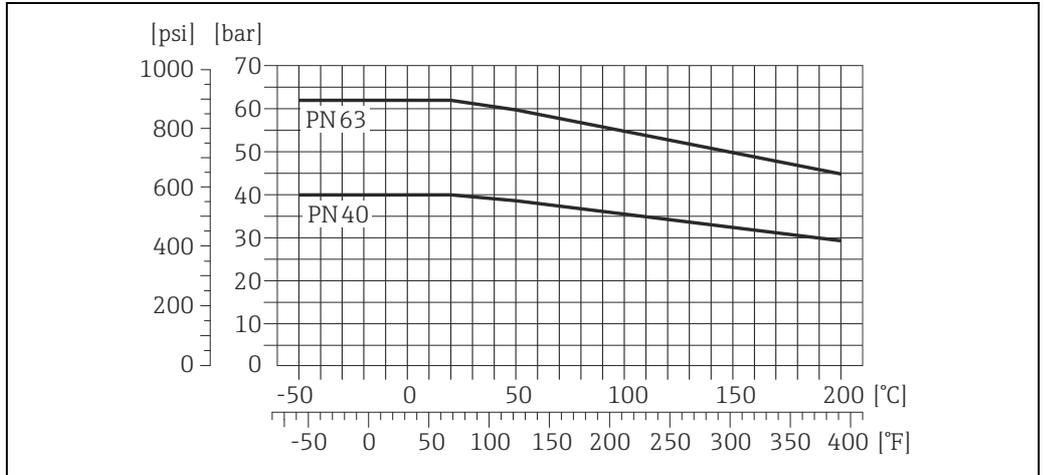
If a device equipped with purge connections is connected to the purge system, the maximum pressure rating is defined by the purge system itself or the device, whichever is lower.

Pressure-Temperature ratings

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

Flange according to EN 1092-1 (DIN 2501)

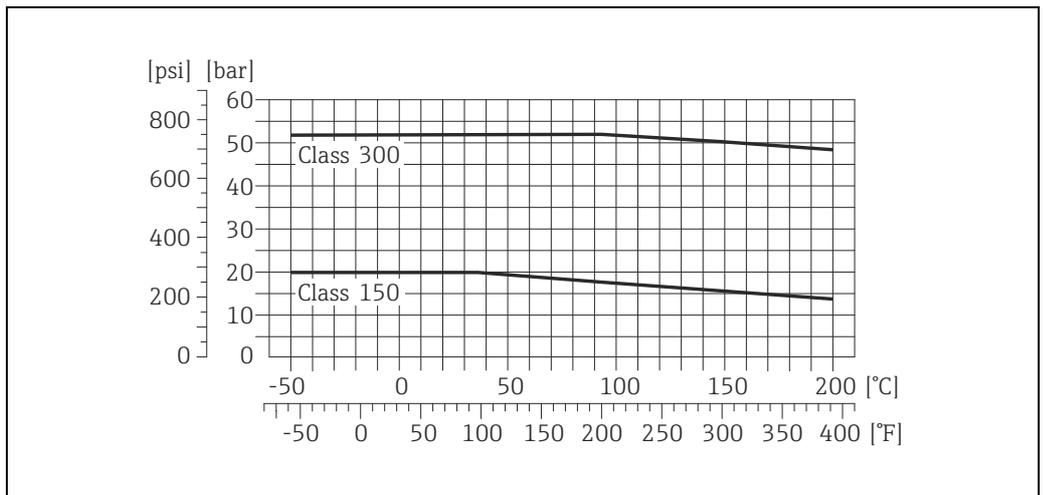
Flange material: 1.4404 (F316/F316L)



A0020994-EN

Flange according to ASME B16.5

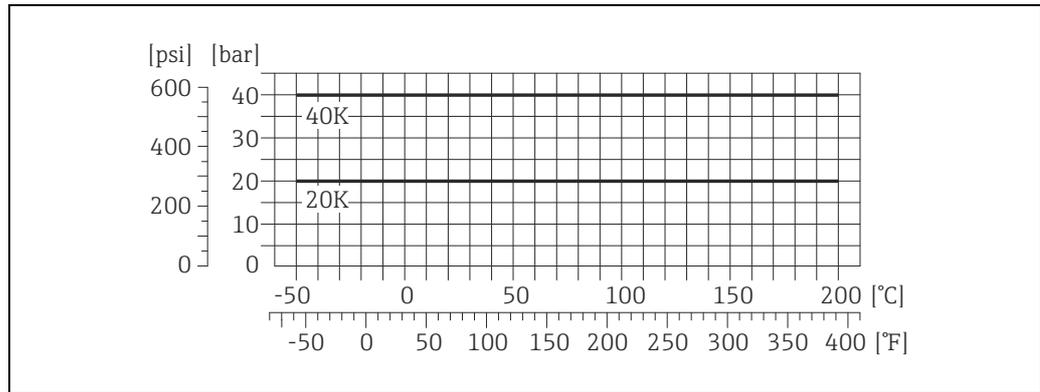
Flange material: 1.4404 (F316/F316L)



A0020997-EN

JIS B2220 flange

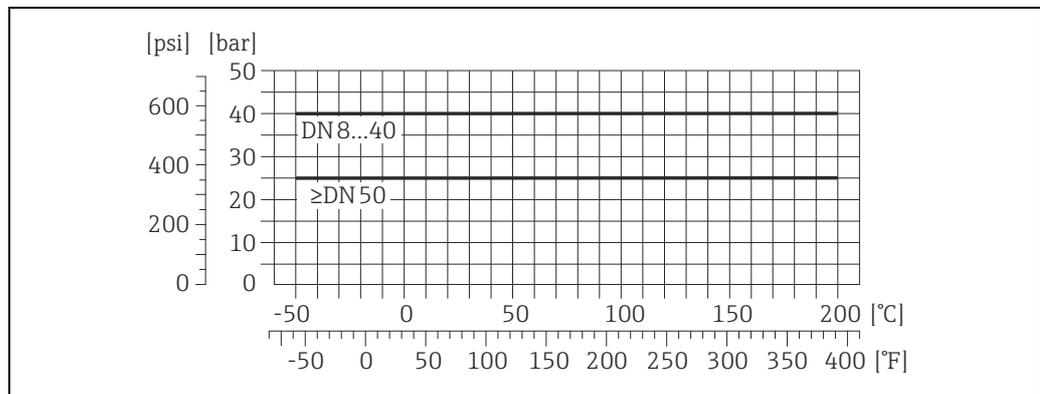
Flange material: 1.4404 (F316/F316L)



A0020998-EN

DIN 11851 thread

Connection material: 1.4435 (316L)

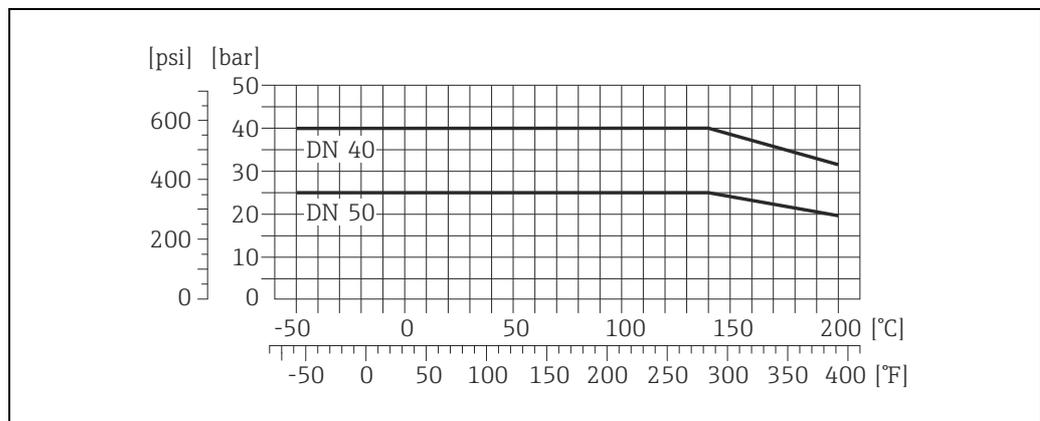


A0007012

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

DIN11864-1A thread; DIN 11864-3A, clamp

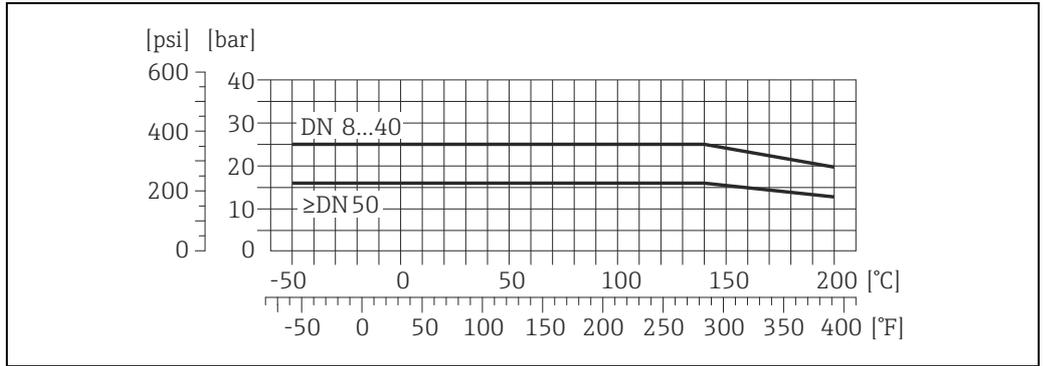
Connection material: 1.4435 (316L)



A0012817

DIN 11864-2A flange

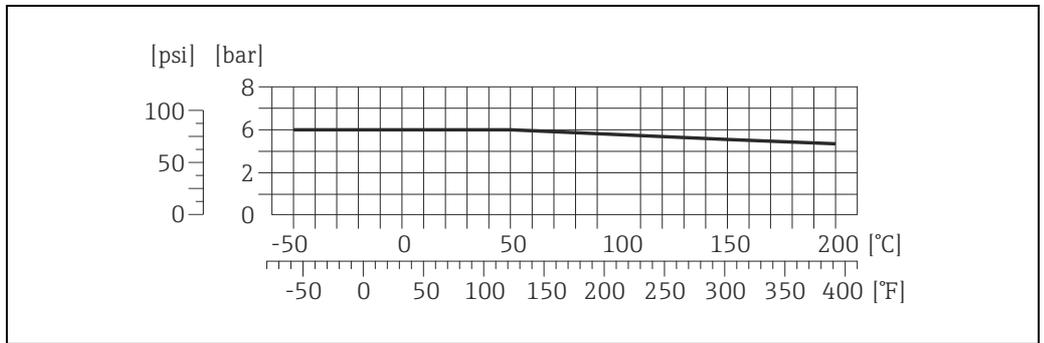
Flange material: 1.4435 (316L)



A0020999-EN

SMS 1145 thread

Connection material: 1.4435 (316L)

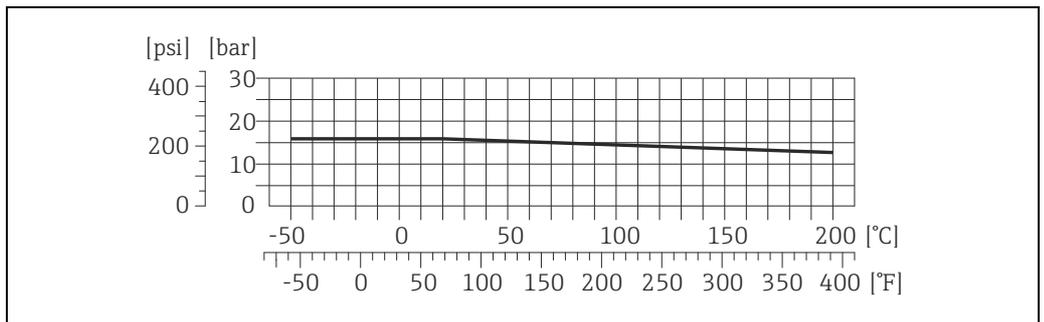


A0013056

SMS 1145 allows for applications up to 6 bar (87 psi) if suitable sealing materials are used. Please take this into account when selecting seals and counterparts as these components can limit the pressure and temperature range.

ISO 2853 thread

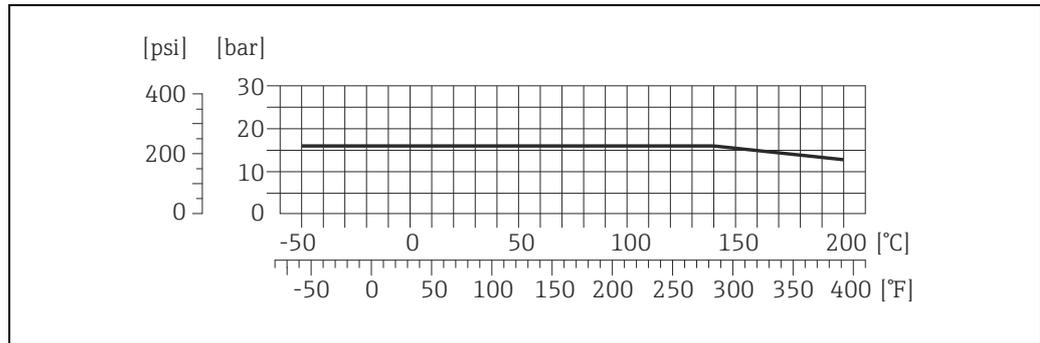
Connection material: 1.4435 (316L)



a0004660

Neumo BioConnect flange; BBS, flange small; BBS, thread

Flange material: 1.4435 (316L)



A002100-EN

Tri-Clamp; ISO 2852, clamp; DIN 32676, clamp; BBS Quick-connect; Neumo BioConnect, clamp

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.

Limiting flow

See information in the "Measuring range" section → [4](#)

Select nominal diameter by optimizing between required flow range and permissible pressure loss. See the "Measuring range" section for a list of maximum possible full scale values.

- 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 → [5](#)

Pressure loss

To calculate the pressure loss, use the *Applicator* sizing tool (→ [70](#)).

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.

Therefore, the following locations should be preferred for installation:

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

Heating

Some fluids require suitable measures to avoid heat transfer 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.

- 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 the 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 →  20.
- If using an electric trace heating system whose heating is regulated via phase angle control or pulse packages, influence on the measured values cannot be ruled out due to magnetic fields (i.e. for values that are greater than the values approved by the EN standard (sine 30 A/m)). In such cases, the sensor must be magnetically shielded.
The secondary containment can be shielded with tin plates or electric sheets without preferential direction (e.g. V330-35A) with the following properties:
 - Relative magnetic permeability $\mu_r \geq 300$
 - Plate thickness $d \geq 0.35 \text{ mm}$ ($\geq 0.014''$)
- Information on permitted temperature ranges →  20

Special heating jackets, which can be ordered separately from Endress+Hauser as an accessory, are available for the sensors.

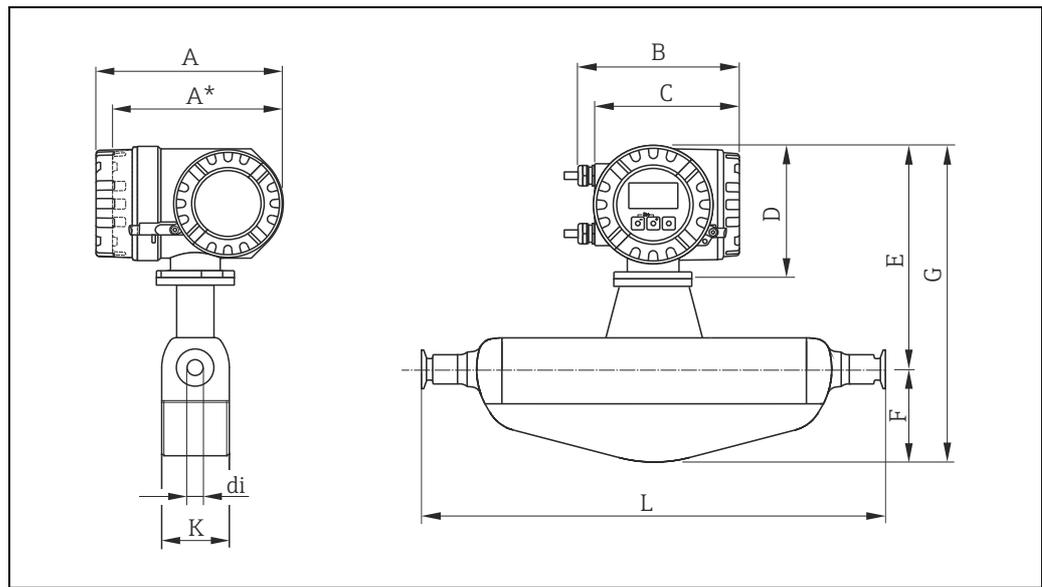
Mechanical construction

Design, dimensions

Dimensions:	
Field housing compact version, powder-coated die-cast aluminum	→  28
Transmitter compact version, stainless steel	→  29
Transmitter connection housing remote version (II2G, Zone 1)	→  30
Transmitter remote version, wall-mount housing (non hazardous area and II3G, zone 2)	→  31
Transmitter remote version, connection housing	→  32
Process connections in SI units	
Flange according to EN 1092-1 (DIN 2501), PN 40 Flange according to EN 1092-1 (DIN 2501), PN 63	→  33
Flange according to ASME B16.5, Cl 150 Flange according to ASME B16.5, Cl 300	→  34
JIS B2220 flange, 20K JIS B2220 flange, 40K	→  35
Tri-Clamp, DIN 11866 line C, ASME BPE Tri-Clamp 1", DIN 11866 line C, ASME BPE Tri-Clamp ¾", DIN 11866 line C, ASME BPE Tri-Clamp ½", DIN 11866 line C, ASME BPE	→  36
Tri-Clamp eccentric, DIN 11866 line C, ASME BPE	→  37
DIN 11851 thread, DIN 11866 line A DIN 11851 thread Rd 28 × ⅛", DIN 11866 line A	→  38
DIN 11864-1A thread, DIN 11866 line A	→  39
DIN 11864-2A flange, DIN 11866 line A, flange with notch	→  40
DIN 11864-3A clamp, DIN 11866 line A, with notch	→  41
DIN 11864-3A clamp eccentric, DIN 11866 line A, with notch	→  42
DIN 32676 clamp, DIN 11866 line A	→  43
DIN 32676 clamp eccentric, DIN 11866 line A	→  44
ISO 2852 clamp, ISO 2037	→  45
ISO 2852 clamp, DIN 11866 line B	→  46
ISO 2852 clamp, eccentric, DIN 11866 line B	→  47
ISO 2852 clamp eccentric (DN 15/50.5), DIN 11866 line B	→  47
ISO 2853 thread, ISO 2037	→  48
Neumo BioConnect clamp, DIN 11866 line A, clamp form R	→  49
Neumo BioConnect clamp eccentric, DIN 11866 line A, clamp form R	→  50
Neumo BioConnect flange, DIN 11866 line A, flange form R	→  51
BBS quick-connect (sterile orbital), DIN 11866 line A, female BBS quick-connect (sterile orbital), DIN 11866 line B, female	→  52
BBS quick-connect (sterile orbital) eccentric, DIN 11866 line A, female BBS quick-connect (sterile orbital) eccentric, DIN 11866 line B, female	→  53
BBS flange small (sterile orbital), DIN 11866 line A, female BBS flange small (sterile orbital), DIN 11866 line B, female	→  54
BBS thread (sterile orbital), DIN 11866 line A BBS thread (sterile orbital), DIN 11866 line B	→  55
SMS 1145 thread	→  56
Process connections in US units	
Flange according to ASME B16.5, Cl 150 Flange according to ASME B16.5, Cl 300	→  57

Dimensions:	
Tri-Clamp, DIN 11866 line C, ASME BPE Tri-Clamp 1", DIN 11866 line C, ASME BPE Tri-Clamp ¾", DIN 11866 line C, ASME BPE Tri-Clamp ½", DIN 11866 line C, ASME BPE	→ 36
Tri-Clamp eccentric, DIN 11866 line C, ASME BPE	→ 59
Neumo BioConnect clamp, DIN 11866 line A, clamp form R	→ 60
Neumo BioConnect clamp eccentric, DIN 11866 line A, clamp form R	→ 61
Neumo BioConnect flange, DIN 11866 line A, flange form R	→ 62
SMS 1145 thread	→ 63
Purge connections, secondary containment monitoring	→ 63

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



a0006881

Dimensions in SI units

DN	A	A*	B	C	D	E	F	G	K	L	di
8	227	207	187	168	160	280	108	388	92	¹⁾	¹⁾
15	227	207	187	168	160	280	108	388	92	¹⁾	¹⁾
25	227	207	187	168	160	280	121	401	92	¹⁾	¹⁾
40	227	207	187	168	160	304	173	477	132	¹⁾	¹⁾
50	227	207	187	168	160	315	241	556	167	¹⁾	¹⁾

* Blind version (without local display)

¹⁾ dependent on respective process connection
All dimensions in [mm]

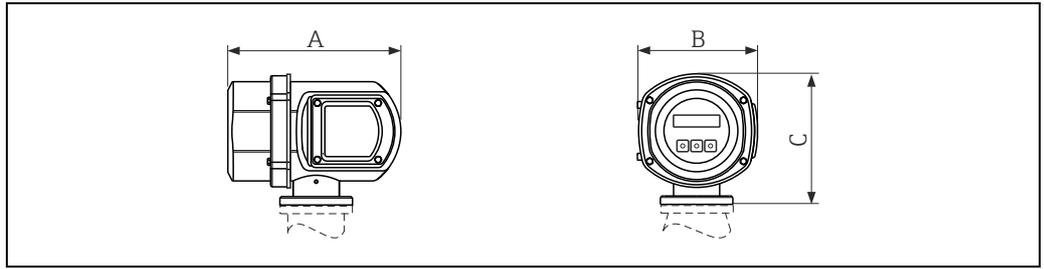
Dimensions in US units

DN	A	A*	B	C	D	E	F	G	K	L	di
$\frac{3}{8}$ "	8.93	8.15	7.36	6.61	6.30	11.02	4.25	15.28	3.62	¹⁾	¹⁾
$\frac{1}{2}$ "	8.93	8.15	7.36	6.61	6.30	11.02	4.25	15.28	3.92	¹⁾	¹⁾
1"	8.93	8.15	7.36	6.61	6.30	11.02	4.76	15.79	3.62	¹⁾	¹⁾
1½"	8.93	8.15	7.36	6.61	6.30	11.97	6.81	18.78	5.20	¹⁾	¹⁾
2"	8.93	8.15	7.36	6.61	6.30	12.40	9.49	21.89	6.57	¹⁾	¹⁾

* Blind version (without local display)

¹⁾ dependent on respective process connection
All dimensions in [in]

Transmitter compact version, stainless steel

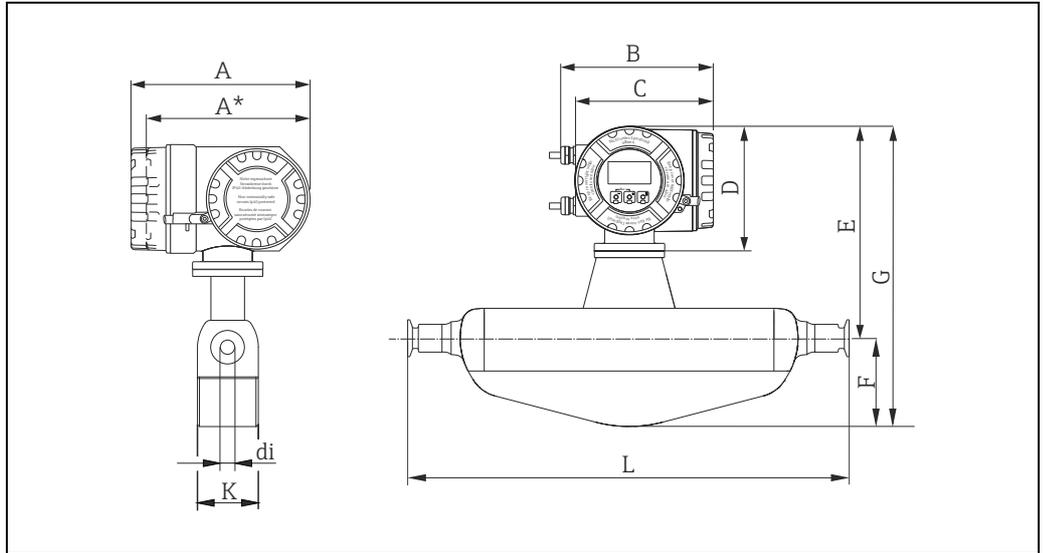


a0002245

Dimensions in SI and US units

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

Field housing compact version (II2G, Zone 1)



a0014392

Dimensions in SI units

DN	A	A*	B	C	D	E	F	G	K	L	di
8	240	217	206	186	178	298	108	406	92	1) ¹⁾	1) ¹⁾
15	240	217	206	186	178	298	108	406	92	1) ¹⁾	1) ¹⁾
25	240	217	206	186	178	298	121	419	92	1) ¹⁾	1) ¹⁾
40	240	217	206	186	178	322	173	495	132	1) ¹⁾	1) ¹⁾
50	240	217	206	186	178	333	241	574	167	1) ¹⁾	1) ¹⁾

* Blind version (without local display)

¹⁾ dependent on respective process connection

All dimensions in [mm]

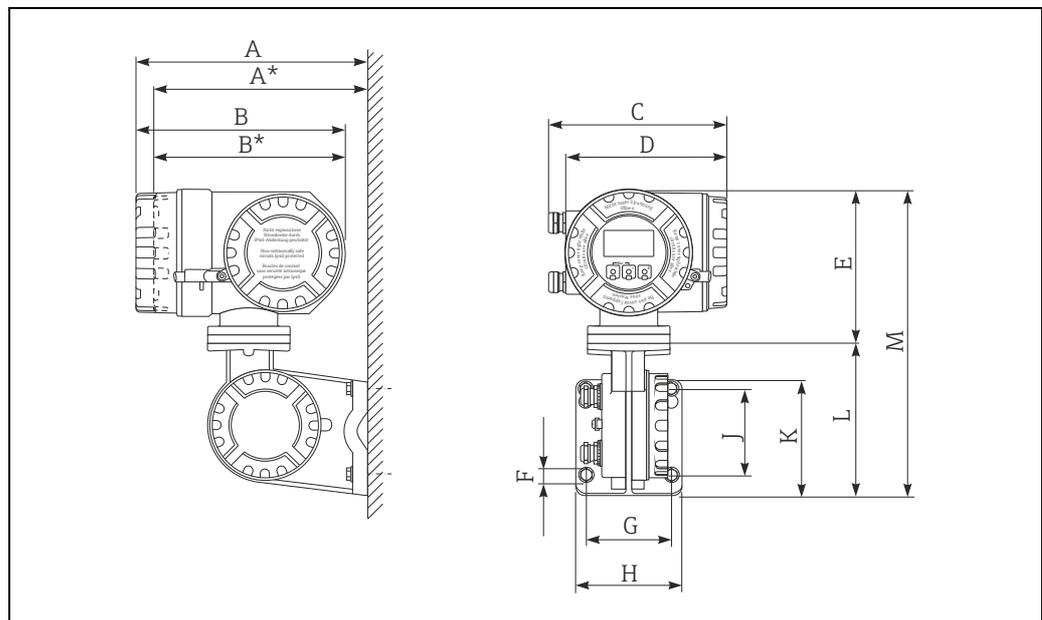
Dimensions in US units

DN	A	A*	B	C	D	E	F	G	K	L	di
3/8"	9.45	8.54	8.11	7.32	7.00	11.73	4.25	16.0	3.62	1) ¹⁾	1) ¹⁾
1/2"	9.45	8.54	8.11	7.32	7.00	11.73	4.25	16.0	3.92	1) ¹⁾	1) ¹⁾
1"	9.45	8.54	8.11	7.32	7.00	11.73	4.76	16.5	3.62	1) ¹⁾	1) ¹⁾
1 1/2"	9.45	8.54	8.11	7.32	7.00	12.68	6.81	19.5	5.20	1) ¹⁾	1) ¹⁾
2"	9.45	8.54	8.11	7.32	7.00	13.11	9.49	22.6	6.57	1) ¹⁾	1) ¹⁾

* Blind version (without local display)

¹⁾ dependent on respective process connection

All dimensions in [in]

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

All dimensions in [mm]

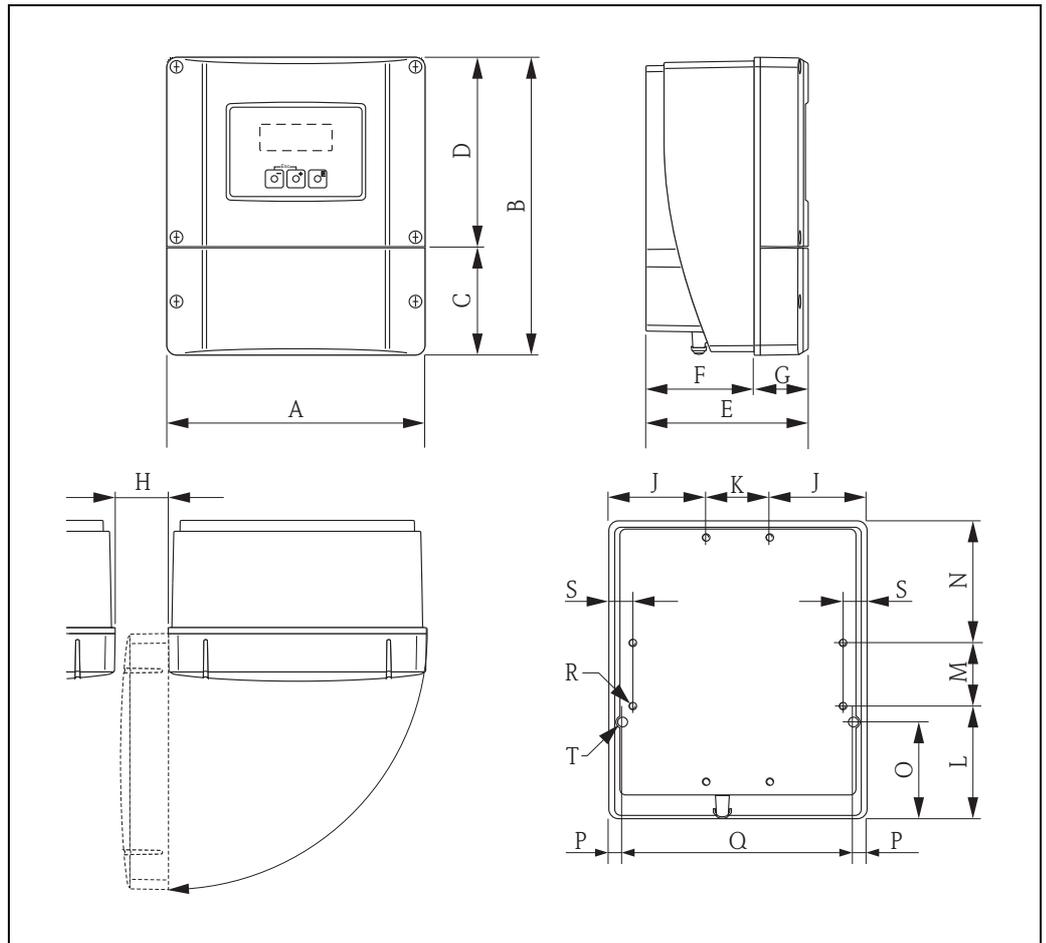
Dimensions in US units

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 local display)

All dimensions in [in]

Transmitter remote version, wall-mount housing (non hazardous area and II3G, zone 2)



a0001150

Dimensions (SI units)

A	B	C	D	E	F	G	H	J	K
215	250	90.5	159.5	135	90	45	> 50	81	53
L	M	N	O	P	Q	R	S	T ¹⁾	
95	53	102	81.5	11.5	192	8 × M5	20	2 × ∅ 6.5	

¹⁾ Securing screw for wall mounting: M6 (screw head max. 10.5 mm)

All dimensions in [mm]

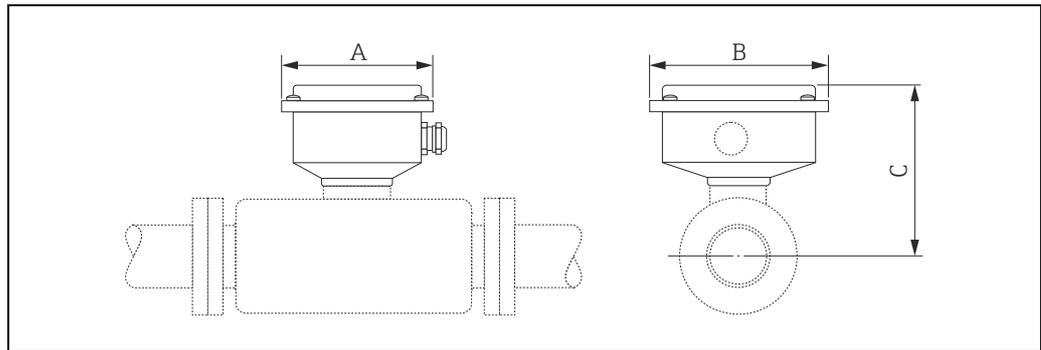
Dimensions (US units)

A	B	C	D	E	F	G	H	J	K
8.46	9.84	3.56	6.27	5.31	3.54	1.77	> 1.97	3.18	2.08
L	M	N	O	P	Q	R	S	T ¹⁾	
3.74	2.08	4.01	3.20	0.45	7.55	8 × M5	0.79	2 × ∅ 0.26	

¹⁾ Securing screw for wall mounting: M6 (screw head max. 0.41")

All dimensions in [in]

Transmitter remote version, connection housing



a0002516

Dimensions in SI units

DN	A	B	C
8	118.5	137.5	127
15	118.5	137.5	127
25	118.5	137.5	127
40	118.5	137.5	151
50	118.5	137.5	162

All dimensions in [mm]

Dimensions in US units

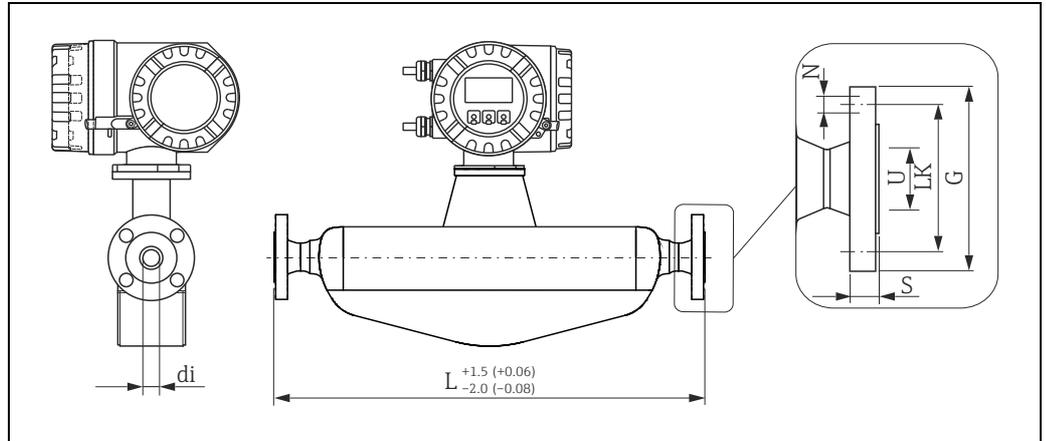
DN	A	B	C
3/8"	4.67	5.41	5.00
1/2"	4.67	5.41	5.00
1"	4.67	5.41	5.00
1 1/2"	4.67	5.41	5.94
2"	4.67	5.41	6.38

All dimensions in [in]

Process connections in SI units

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

Flange according to EN 1092-1 (DIN 2501), PN 63



Engineering unit mm (in)

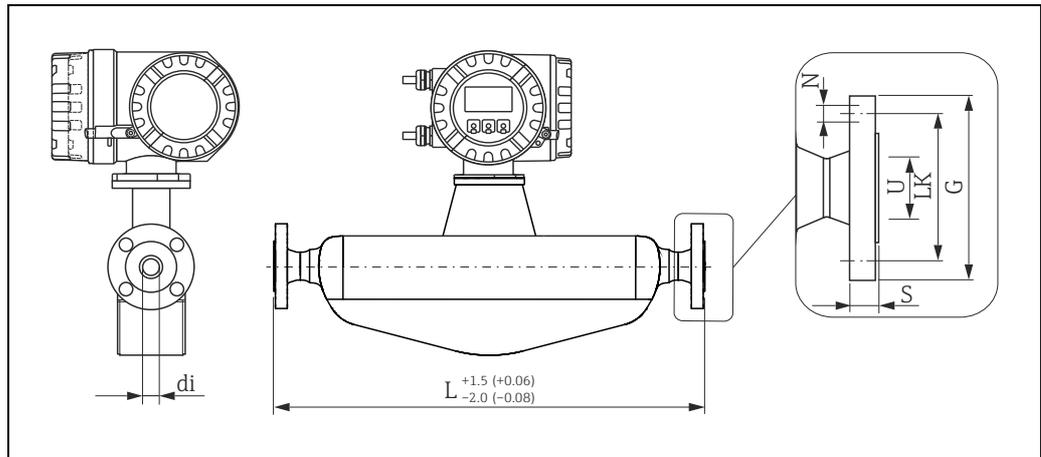
Flange according to EN 1092-1 (DIN 2501), PN 40: 1.4404 (F316/F316L)							
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm							
Order code for "Process connection", option D2Z							
DN	G	L	N	S	LK	U	di
8 ¹⁾	95.0	336	4 × Ø14	17.0	65.0	17.30	8.31
15	95.0	440	4 × Ø14	20.0	65.0	17.30	12.00
25	115.0	580	4 × Ø14	19.0	85.0	28.50	17.60
40	150.0	794	4 × Ø18	21.0	110.0	43.10	26.00
50	165.0	1071	4 × Ø18	25.0	125.0	54.50	40.50

¹⁾ DN 8 with DN 15 flange as standard
All dimensions in [mm]

Flange according to EN 1092-1 (DIN 2501), PN 63: 1.4404 (F316/F316L)							
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 0.8 to 3.2 µm							
Order code for "Process connection", option D3Z							
DN	G	L	N	S	LK	U	di
50	180.0	1083	4 × Ø22	29.0	135.0	54.50	40.50

All dimensions in [mm]

Flange according to ASME B16.5, Cl 150
 Flange according to ASME B16.5, Cl 300



Engineering unit mm (in)

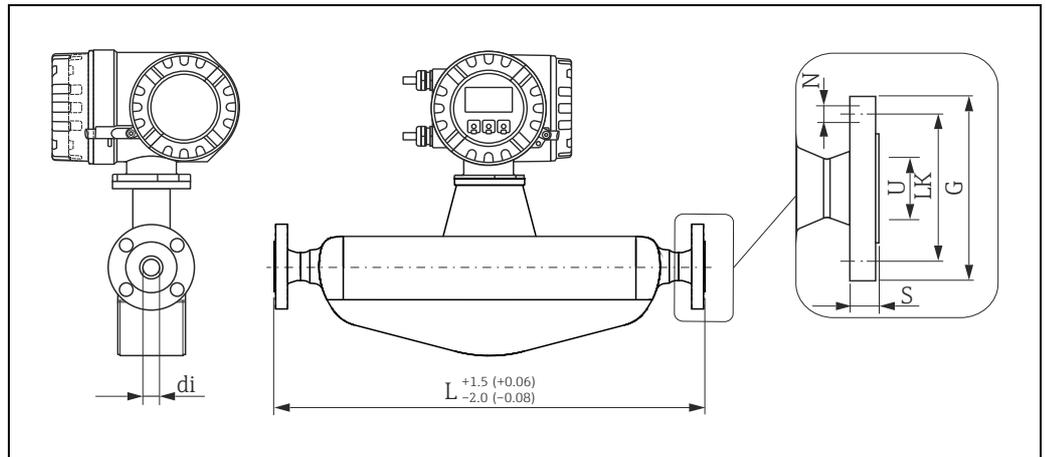
Flange according to ASME B16.5, Cl 150: 1.4404 (F316/F316L)							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
Order code for "Process connection", option AAZ							
DN	G	L	N	S	LK	U	di
8 ¹⁾	88.9	336	4 × Ø15.7	17.1	60.5	15.70	8.31
15	88.9	440	4 × Ø15.7	17.1	60.5	15.70	12.00
25	108.0	580	4 × Ø15.7	17.6	79.2	26.70	17.60
40	127.0	794	4 × Ø15.7	18.6	98.6	40.90	26.00
50	152.4	1071	4 × Ø19.1	25.1	120.7	52.60	40.50

¹⁾ DN 8 with DN 15 flange as standard
 All dimensions in [mm]

Flange according to ASME B16.5, Cl 300: 1.4404 (F316/F316L)							
Surface roughness (flange): Ra 3.2 to 6.3 µm							
Order code for "Process connection", option ABZ							
DN	G	L	N	S	LK	U	di
8 ¹⁾	95.2	336	4 × Ø15.7	16.6	66.5	15.70	8.31
15	95.2	440	4 × Ø15.7	16.6	66.5	15.70	12.00
25	123.9	580	4 × Ø19.1	18.1	88.9	26.70	17.60
40	155.4	794	4 × Ø22.3	24.6	114.3	40.90	26.00
50	165.1	1071	8 × Ø19.1	27.6	127.0	52.60	40.50

¹⁾ DN 8 with DN 15 flange as standard
 All dimensions in [mm]

JIS B2220 flange, 20K
 JIS B2220 flange, 40K



Engineering unit mm (in)

JIS B2220 flange 20K: 1.4404 (F316/F316L) Surface roughness (flange): Ra 3.2 to 6.3 µm Order code for "Process connection", option NDZ							
DN	G	L	N	S	LK	U	di
8 ¹⁾	95	336	4 × Ø15	16.0	70.0	15.00	8.31
15	95	440	4 × Ø15	16.0	70.0	15.00	12.00
25	125	580	4 × Ø19	17.5	90.0	25.00	17.60
40	140	794	4 × Ø19	20.0	105.0	40.00	26.00
50	155	1071	8 × Ø19	27.5	120.0	50.00	40.50

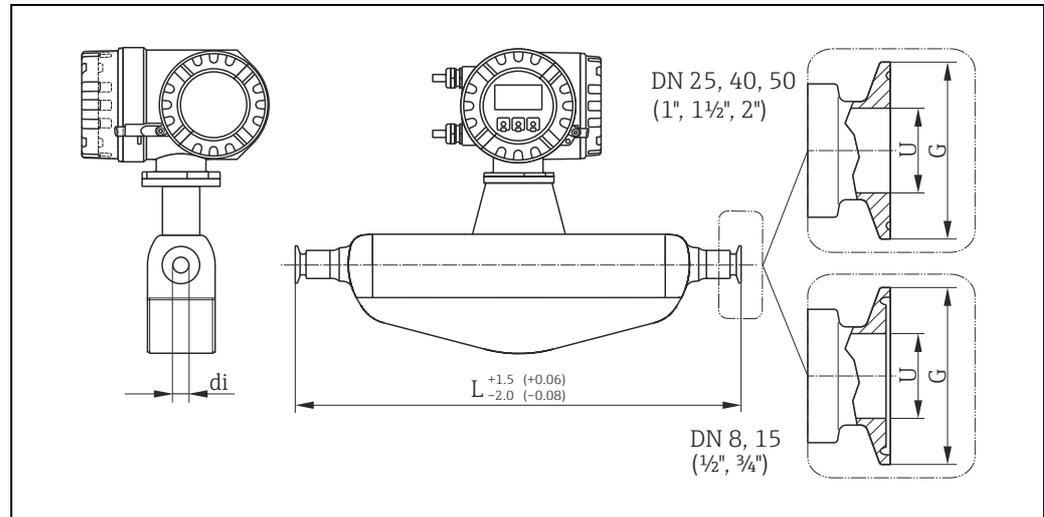
¹⁾ DN 8 with DN 15 flange as standard
 All dimensions in [mm]

JIS B2220 flange 40K: 1.4404 (F316/F316L) Surface roughness (flange): Ra 3.2 to 6.3 µm Order code for "Process connection", option NGZ							
DN	G	L	N	S	LK	U	di
8 ¹⁾	115	336	4 × Ø19	21.0	80.0	15.00	8.31
15	115	440	4 × Ø19	21.0	80.0	15.00	12.00
25	130	589	4 × Ø19	22.0	95.0	25.00	17.60
40	160	804	4 × Ø23	26.0	120.0	38.00	26.00
50	165	1071	8 × Ø19	26.0	130.0	50.00	40.50

¹⁾ DN 8 with DN 15 flange as standard
 All dimensions in [mm]

Tri-Clamp, DIN 11866 line C, ASME BPE
 Tri-Clamp 1", DIN 11866 line C, ASME BPE
 Tri-Clamp ¾", DIN 11866 line C, ASME BPE
 Tri-Clamp ½", DIN 11866 line C, ASME BPE

All Tri-Clamp connections correspond to the relevant ASME BPE hygienic clamp dimensions.



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Engineering unit mm (in)

Tri-Clamp, DIN 11866 line C, ASME BPE: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.76 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option FTM

DN	Clamp	G	L	U	di
8	½"	25.0	362	9.40	8.31
15	¾"	25.0	466	15.75	12.00
25	1"	50.4	606	22.10	17.60
40	1½"	50.4	818	34.80	26.00
50	2"	63.9	1096	47.50	40.50

All dimensions in [mm]

Tri-Clamp 1", DIN 11866 line C, ASME BPE: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option FAB

DN	Clamp	G	L	U	di
8	1"	50.4	362	22.10	8.31
15	1"	50.4	466	22.10	12.00

All dimensions in [mm]

Tri-Clamp ¾", DIN 11866 line C, ASME BPE: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option FPE

DN	Clamp	G	L	U	di
8	¾"	25.0	362	15.75	8.31

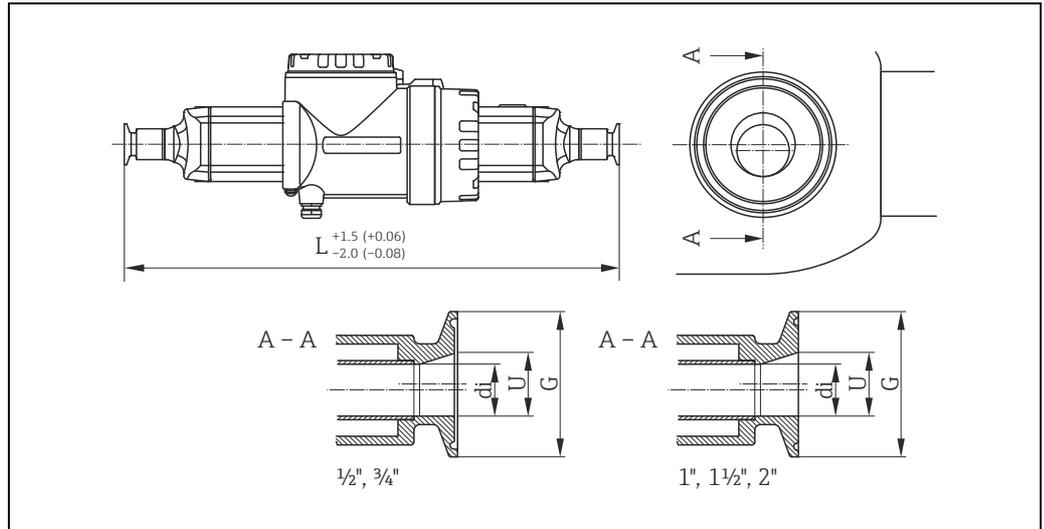
All dimensions in [mm]

Tri-Clamp ½", DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 µm or Ra_{max} 0.38 µm electropolished Order code for "Process connection", option FUG						
DN	Clamp	G	L	U	di	
15	½"	25.0	466	9.40	12.00	

All dimensions in [mm]

Tri-Clamp eccentric, DIN 11866 line C, ASME BPE

All Tri-Clamp connections correspond to the relevant ASME BPE hygienic clamp dimensions.



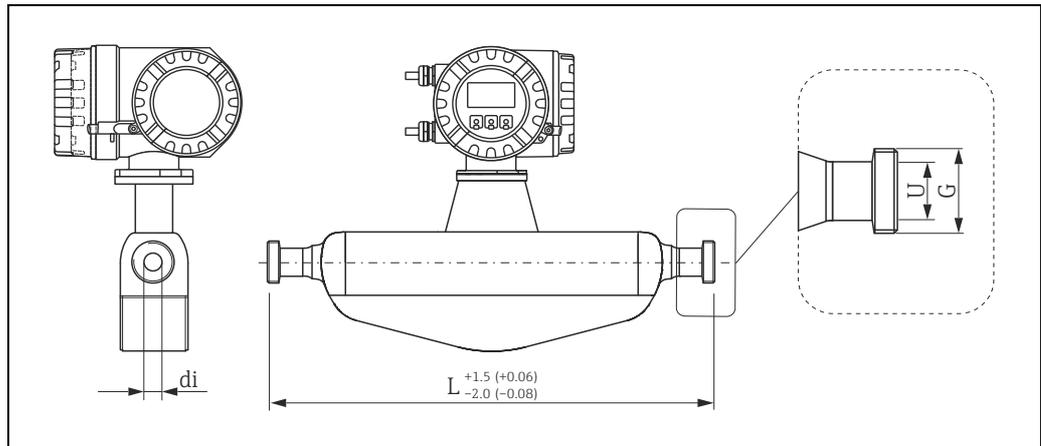
Engineering unit mm (in)

Tri-Clamp eccentric, DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 µm or Ra_{max} 0.38 µm electropolished						
DN	Order code for "Process connection", option	Clamp	G	L	U	di
8	ETA	½"	25.0	362	9.40	8.31
15	ETB	¾"	25.0	466	15.75	12.00
25	ETC	1"	50.4	606	22.10	17.60
40	ETD	1½"	50.4	825	34.80	26.00
50	ETE	2"	63.9	1103	47.50	40.50

All dimensions in [mm]

Further information refer to "Eccentric clamps" → 18.

DIN 11851 thread, DIN 11866 line A
 DIN 11851 thread Rd $28 \times \frac{1}{8}$ ", DIN 11866 line A



A0022149

Engineering unit mm (in)

DIN 11851 thread, DIN 11866 line A: 1.4435 (316L)
 Surface roughness: $Ra_{max} 0.75 \mu\text{m}$ or $Ra_{max} 0.38 \mu\text{m}$ electropolished
 Order code for "Process connection", option FMD

DN	G	L	U	di
8	Rd $34 \times \frac{1}{8}$ "	362	16.00	8.31
15	Rd $34 \times \frac{1}{8}$ "	466	16.00	12.00
25	Rd $52 \times \frac{1}{6}$ "	606	26.00	17.60
40	Rd $65 \times \frac{1}{6}$ "	825	38.00	26.00
50	Rd $78 \times \frac{1}{6}$ "	1107	50.00	40.50

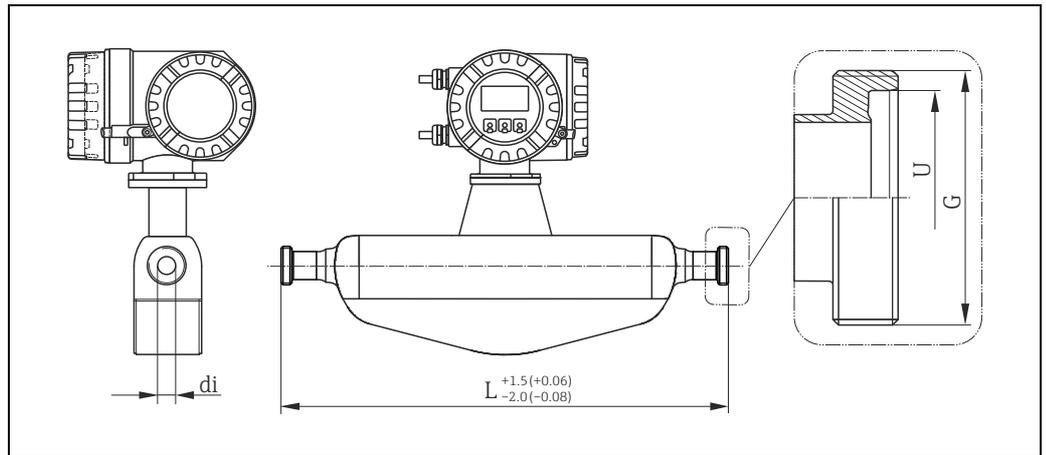
All dimensions in [mm]

DIN 11851 thread Rd $28 \times \frac{1}{8}$ ", DIN 11866 line A: 1.4435 (316L)
 Surface roughness: $Ra_{max} 0.75 \mu\text{m}$ or $Ra_{max} 0.38 \mu\text{m}$ electropolished
 Order code for "Process connection", option FGD

DN	G	L	U	di
8	Rd $28 \times \frac{1}{8}$ "	362	10.00	8.31
15	Rd $28 \times \frac{1}{8}$ "	466	10.00	12.00

All dimensions in [mm]

DIN 11864-1A thread, DIN 11866 line A



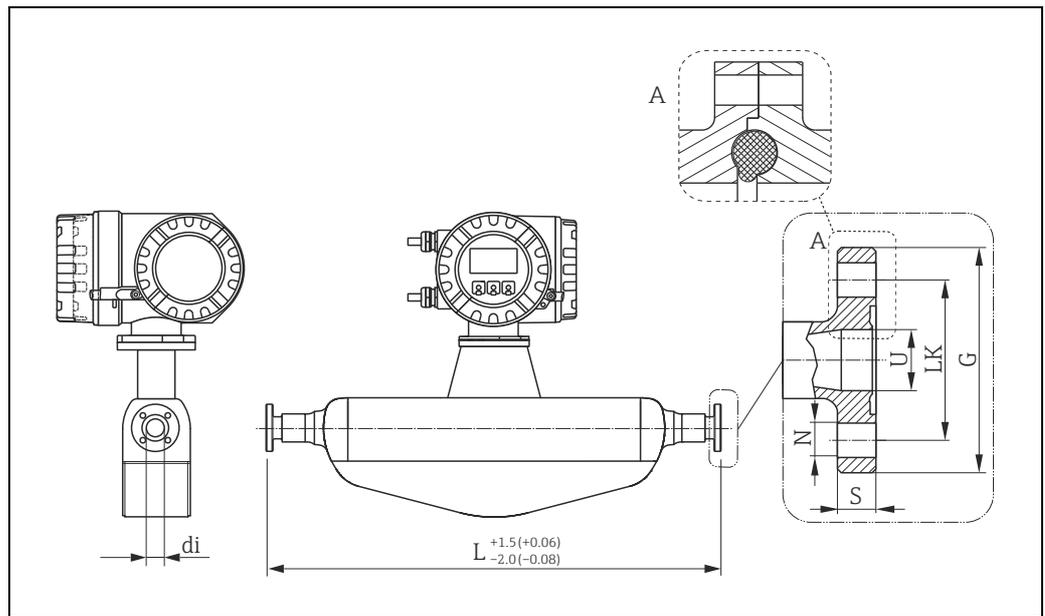
A0022150

Engineering unit mm (in)

DN 11864-1A thread, DIN 11866 line A: 1.4435 (316L)				
Surface roughness: Ra_{max} 0.75 μ m or Ra_{max} 0.38 μ m electropolished				
Order code for "Process connection", option FLH				
DN	G	L	U	di
8	Rd 34 \times 1/8"	362	16.00	8.31
15	Rd 34 \times 1/8"	466	16.00	12.00
25	Rd 52 \times 1/6"	620	26.00	17.60
40	Rd 65 \times 1/6"	825	38.00	26.00
50	Rd 78 \times 1/6"	1107	50.00	40.50

All dimensions in [mm]

DIN 11864-2A flange, DIN 11866 line A, flange with notch



A0022151

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. Engineering unit mm (in).

DIN 11864-2A flange, DIN 11866 line A, flange with notch: 1.4435 (316L)

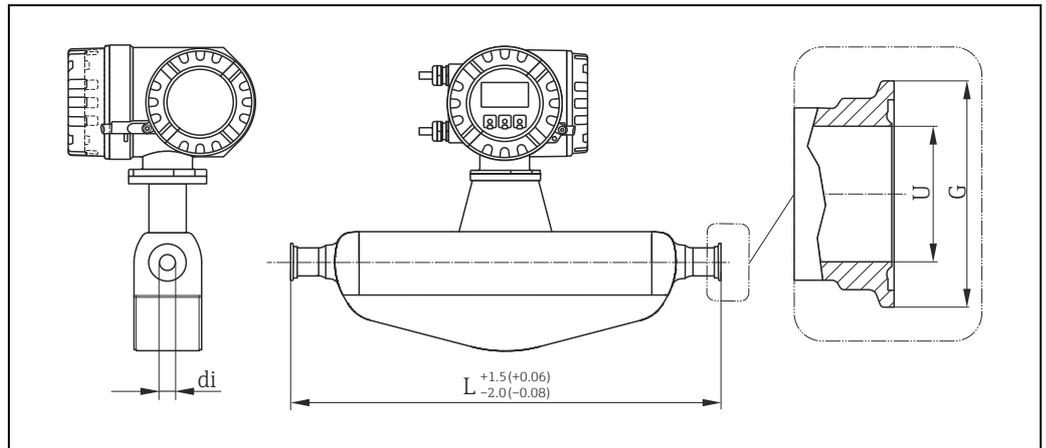
Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished

Order code for "Process connection", option FKG

DN	G	L	N	S	LK	U	di
8	59.0	384	4 × Ø9	10	42	16.00	8.31
15	59.0	488	4 × Ø9	10	42	16.00	12.00
25	70.0	626	4 × Ø9	10	53	26.00	17.60
40	82.0	840	4 × Ø9	10	65	38.00	26.00
50	94.0	1120	4 × Ø9	10	77	50.00	40.50

All dimensions in [mm]

DIN 11864-3A clamp, DIN 11866 line A, with notch



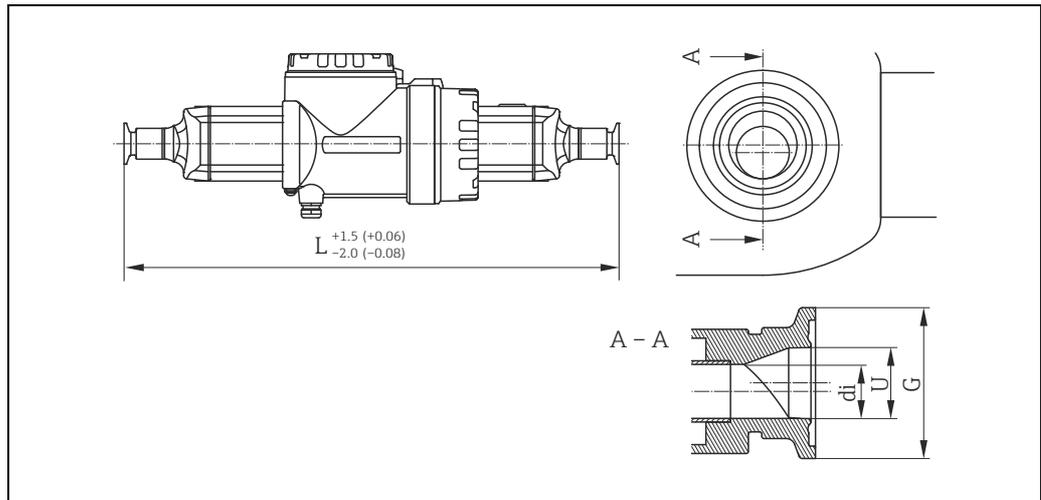
A0022152

Engineering unit mm (in)

DIN 11864-3A clamp, DIN 11866 line A, with notch: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option FWA				
DN	G	L	U	di
8	34.0	370	16.00	8.31
15	34.0	474	16.00	12.00
25	50.5	614	26.00	17.60
40	64.0	825	38.00	26.00
50	77.5	1096	50.00	40.50

All dimensions in [mm]

DIN 11864-3A clamp eccentric, DIN 11866 line A, with notch



A0022179

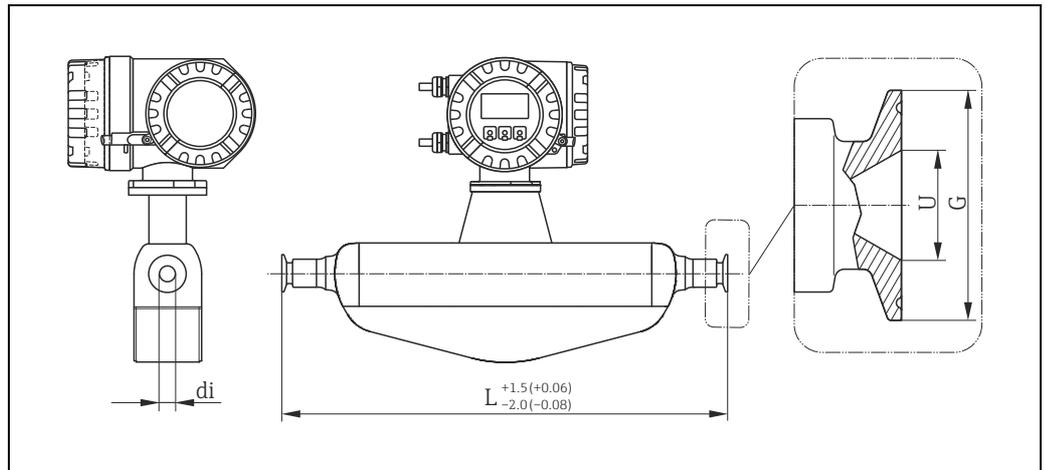
Engineering unit mm (in)

DIN 11864-3A clamp, eccentric, DIN 11866 line A, with notch: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option FWB

DN	G	L	U	di
8	34.0	370	10.00	8.31
15	34.0	474	16.00	12.00
25	50.5	624	26.00	17.60
50	77.5	1112	50.00	40.50

All dimensions in [mm]

DIN 32676 clamp, DIN 11866 line A

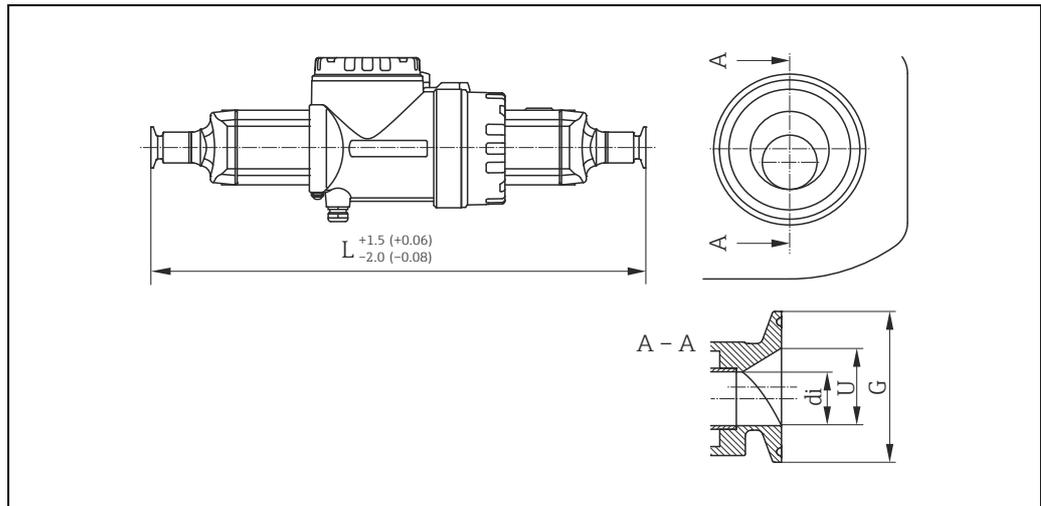


Engineering unit mm (in)

DIN 32676 clamp, DIN 11866 line A: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option FDW				
DN	G	L	U	di
8	34.0	362	16.00	8.31
15	34.0	466	16.00	12.00
25	50.5	606	26.00	17.60
40	50.5	819	38.00	26.00
50	64.0	1097	50.00	40.50

All dimensions in [mm]

DIN 32676 clamp eccentric, DIN 11866 line A



A0022185

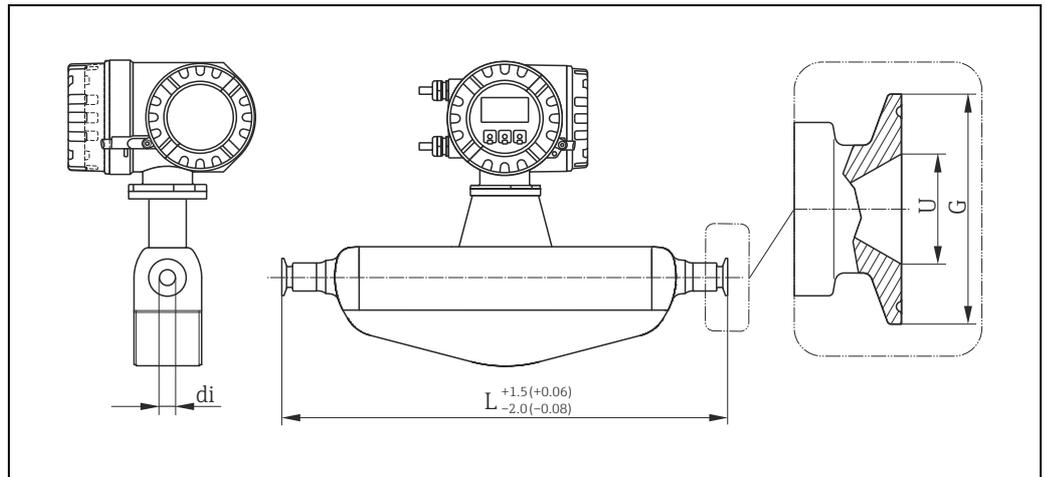
Engineering unit mm (in)

DIN 32676 clamp eccentric, DIN 11866 line A: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option FDZ

DN	G	L	U	di
8	34.0	362	10.00	8.31
15	34.0	466	16.00	12.00
25	50.5	606	26.00	17.60
50	64.0	1103	50.00	40.50

All dimensions in [mm]

ISO 2852 clamp, ISO 2037

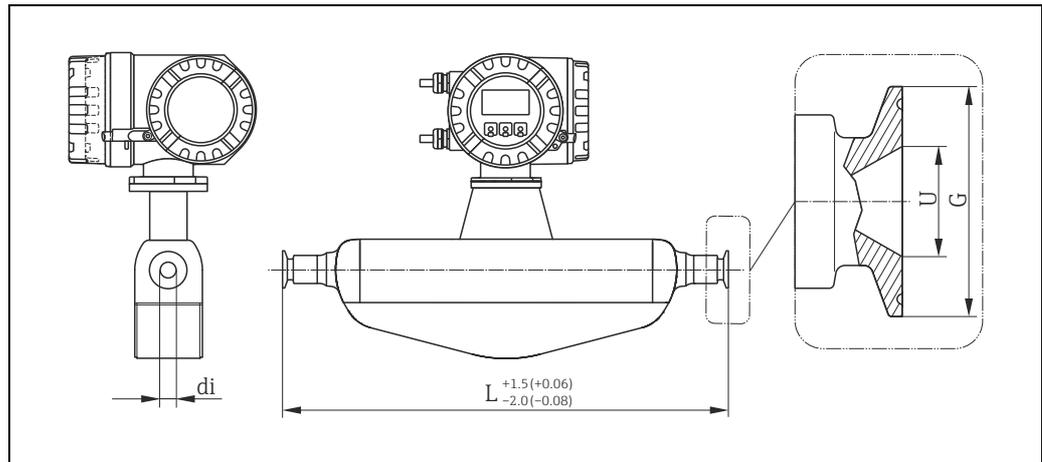


Engineering unit mm (in)

ISO 2852 clamp, ISO 2037: 1.4435 (316L)				
Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished				
Order code for "Process connection", option FEA				
DN	G	L	U	di
8	50.5	362	22.60	8.31
15	50.5	466	22.60	12.00
25	50.5	606	22.60	17.60
40	50.5	818	35.60	26.00
50	64.0	1096	48.60	40.50

All dimensions in [mm]

ISO 2852 clamp, DIN 11866 line B



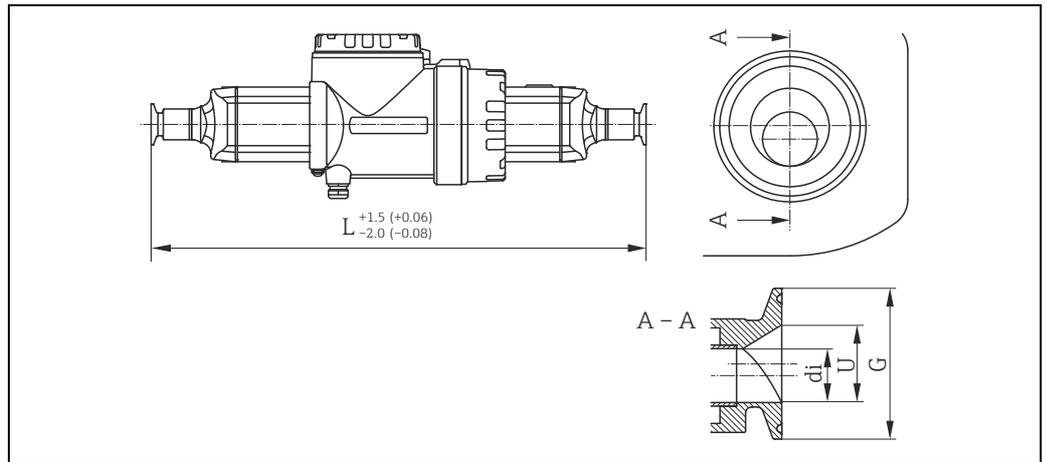
Engineering unit mm (in)

ISO 2852 clamp, DIN 11866 line B: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option FEB

DN	G	L	U	di
8	34.0	362	14.00	8.31
15	34.0	466	18.10	12.00
25	50.5	606	29.70	17.60
40	64.0	818	44.30	26.00
50	77.5	1096	56.30	40.50

All dimensions in [mm]

ISO 2852 clamp, eccentric, DIN 11866 line B

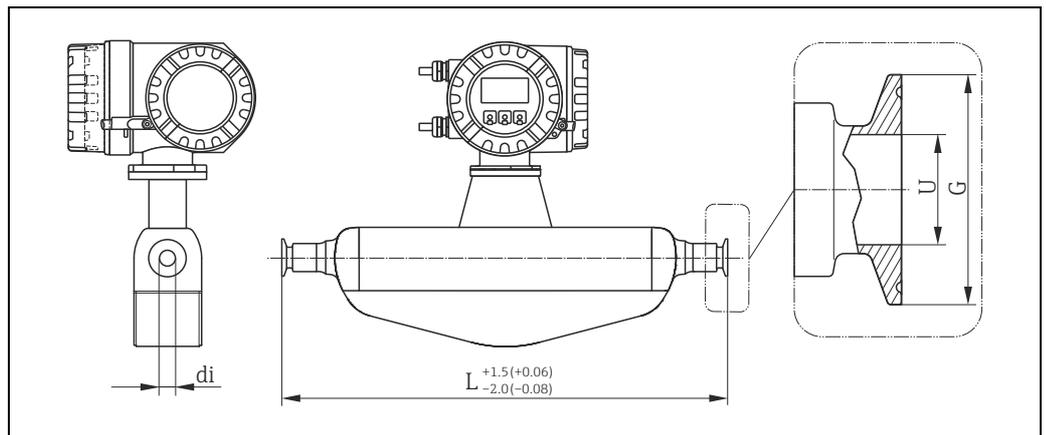


Engineering unit mm (in)

ISO 2852 clamp, eccentric, DIN11866 line B: 1.4435 (316L) Surface roughness: Ra _{max} 0.75 µm or Ra _{max} 0.38 µm electropolished Order code for "Process connection", option FEC				
DN	G	L	U	di
8	34.0	362	10.30	8.31
15	34.0	466	14.00	12.00
25	34.0	606	18.10	17.60
40	50.5	825	29.70	26.00
50	64.0	1096	44.30	40.50

All dimensions in [mm]

ISO 2852 clamp eccentric (DN 15/50.5), DIN 11866 line B

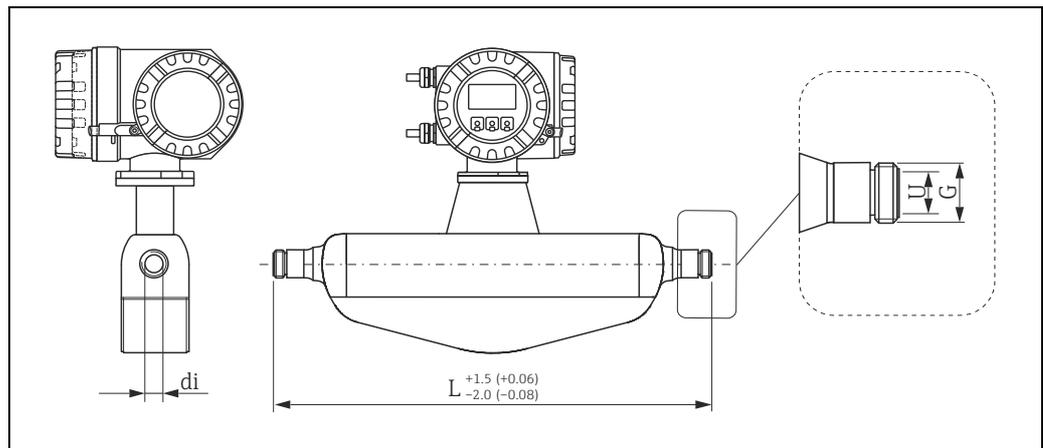


Engineering unit mm (in)

ISO 2852 clamp eccentric (DN 15/50.5), DIN 11866 line B: 1.4435 (316L) Surface roughness: Ra _{max} 0.75 µm or Ra _{max} 0.38 µm electropolished Order code for "Process connection", option FED				
DN	G	L	U	di
25	50.5	606	18.10	17.60

All dimensions in [mm]

ISO 2853 thread, ISO 2037



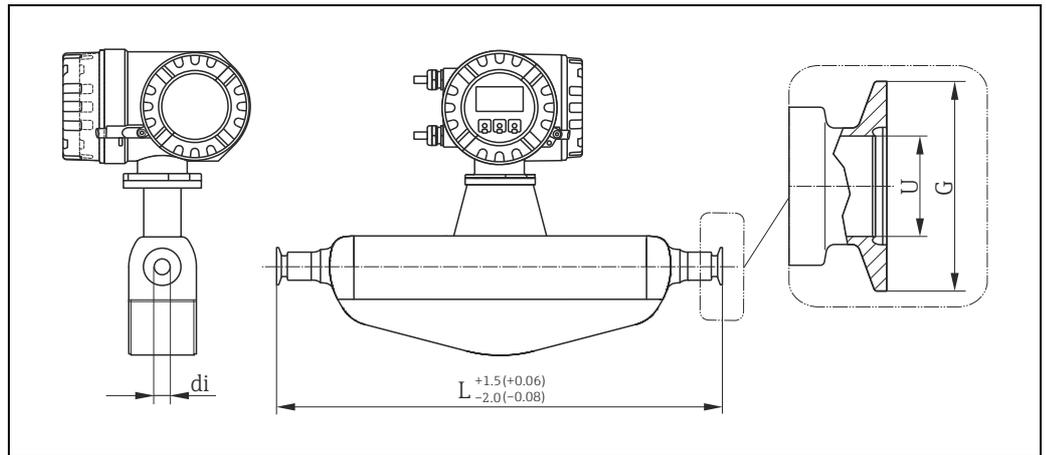
A0022153

Engineering unit mm (in)

ISO 2853 thread, ISO 2037: 1.4435 (316L)				
Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished				
Order code for "Process connection", option FJG				
DN	G	L	U	di
8	37.13	370	22.60	8.31
15	37.13	474	22.60	12.00
25	37.13	614	22.60	17.60
40	50.65	829	35.60	26.00
50	64.10	1107	48.60	40.50

All dimensions in [mm]

Neumo BioConnect clamp, DIN 11866 line A, clamp form R



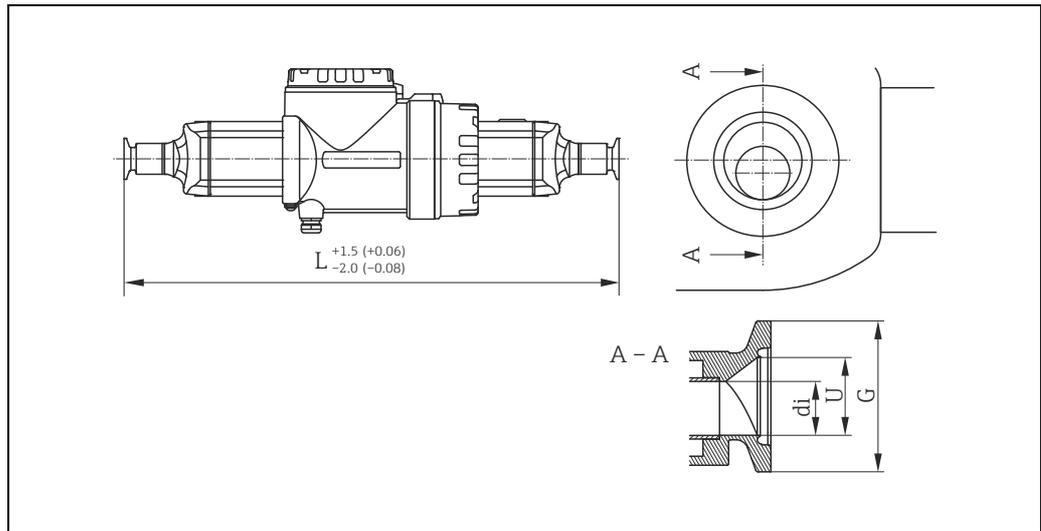
A0022194

Engineering unit mm (in)

Neumo BioConnect clamp, DIN 11866 line A, clamp form R: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option BCD				
DN	G	L	U	di
8	25.0	362	10.00	8.31
15	25.0	466	16.00	12.00
25	50.4	606	26.00	17.60
40	64.0	819	38.00	26.00
50	77.4	1097	50.00	40.50

All dimensions in [mm]

Neumo BioConnect clamp eccentric, DIN 11866 line A, clamp form R



A0022185

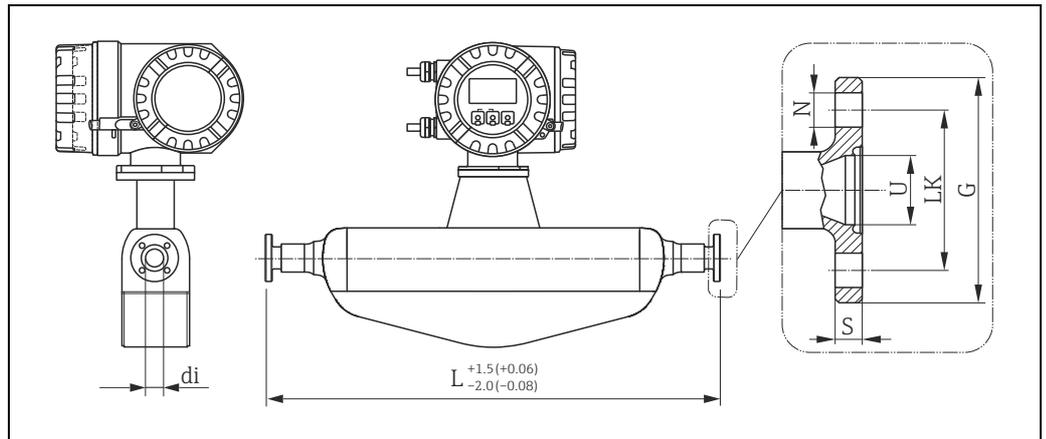
Engineering unit mm (in)

Neumo BioConnect clamp eccentric, DIN 11866 line A, clamp form R: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option BED

DN	G	L	U	di
8	25	362	10.00	8.31
15	25	466	16.00	12.00
25	25	610	26.00	17.60
50	25	1102	50.00	40.50

All dimensions in [mm]

Neumo BioConnect flange, DIN 11866 line A, flange form R



A0011067

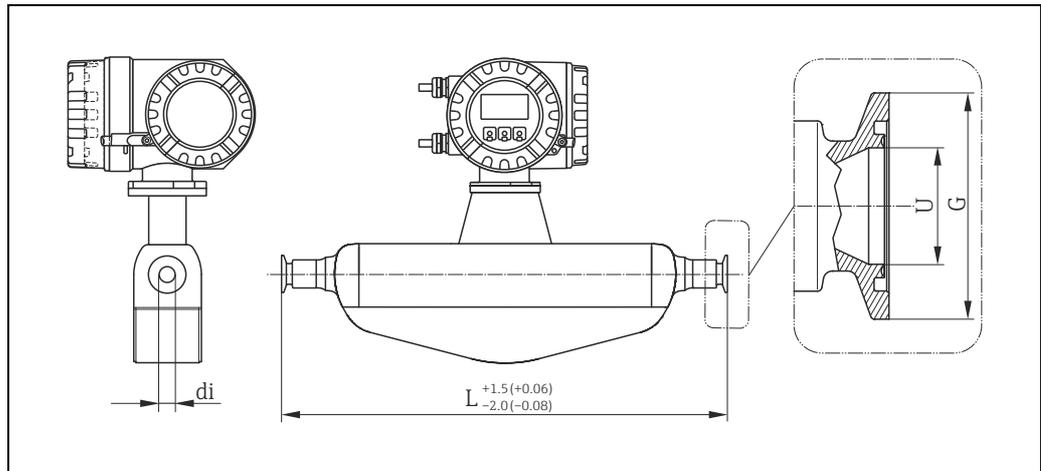
Engineering unit mm (in)

Neumo BioConnect flange, DIN 11866 line A, flange form R: 1.4435 (316L)
Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
Order code for "Process connection", option BFD

DN	G	L	N	S	LK	U	di
8	65	384	4 × Ø9	10	45	10.00	8.31
15	75	488	4 × Ø9	10	55	16.00	12.00
25	85	626	4 × Ø9	12	65	26.00	17.60
40	100	840	4 × Ø9	12	80	38.00	26.00
50	110	1120	4 × Ø9	14	90	50.00	40.50

All dimensions in [mm]

BBS quick-connect (sterile orbital), DIN 11866 line A, female
 BBS quick-connect (sterile orbital), DIN 11866 line B, female



Engineering unit mm (in)

BBS quick-connect (sterile orbital), DIN 11866 line A, female: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option BBD

DN	G	L	U	di
8	25.0	362	10.00	8.31
15	50.5	466	16.00	12.00
25	50.5	606	26.00	17.60
40	64.0	819	38.00	26.00
50	77.5	1097	50.00	40.50

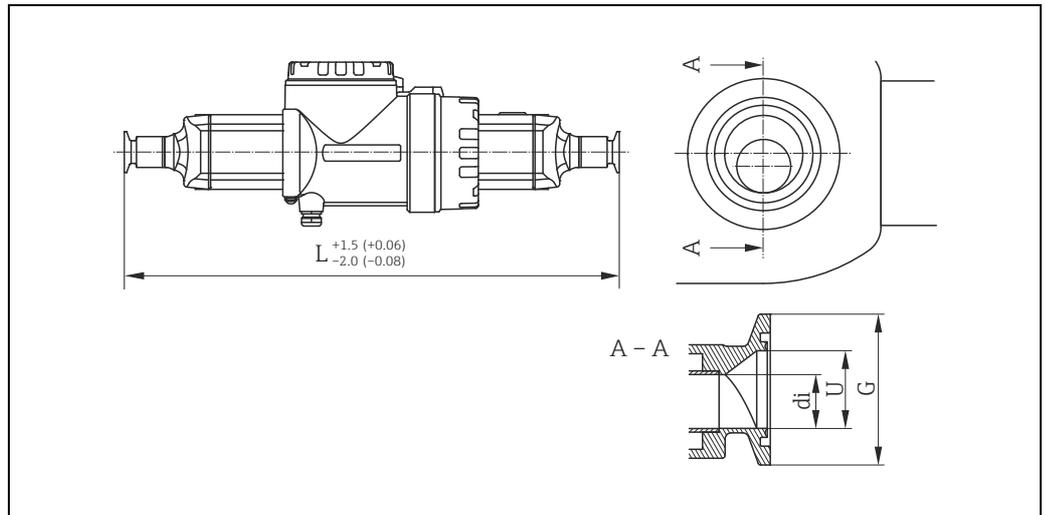
All dimensions in [mm]

BBS quick-connect (sterile orbital), DIN 11866 line B, female: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished
 Order code for "Process connection", option BBF

DN	G	L	U	di
8	51.0	362	14.00	8.31
15	50.5	466	18.10	12.00
25	50.5	606	29.70	17.60
40	64.0	825	44.30	26.00
50	77.5	1103	56.30	40.50

All dimensions in [mm]

BBS quick-connect (sterile orbital) eccentric, DIN 11866 line A, female
 BBS quick-connect (sterile orbital) eccentric, DIN 11866 line B, female



Engineering unit mm (in)

BBS quick-connect (sterile orbital) eccentric, DIN 11866 line A, female: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μ m or Ra_{max} 0.38 μ m electropolished
 Order code for "Process connection", option BBE

DN	G	L	U	di
8	25.0	362	10.00	8.31
15	50.5	466	16.00	12.00
25	50.5	606	26.00	17.60
50	77.5	1103	50.00	40.50

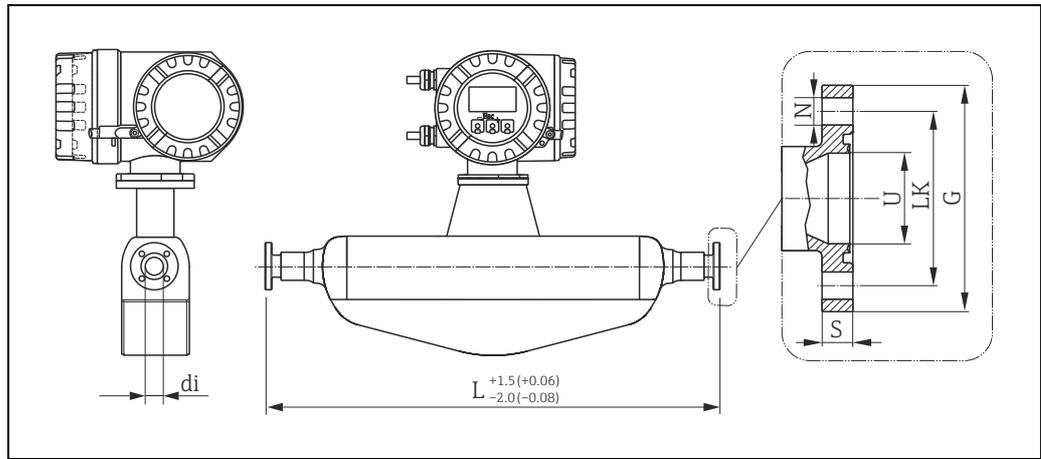
All dimensions in [mm]

BBS quick-connect (sterile orbital) eccentric, DIN 11866 line B, female: 1.4435 (316L)
 Surface roughness: Ra_{max} 0.75 μ m or Ra_{max} 0.38 μ m electropolished
 Order code for "Process connection", option BBG

DN	G	L	U	di
8	25.0	362	10.30	8.31
15	50.5	466	14.00	12.00
25	50.5	606	18.10	17.60
40	50.5	825	29.70	26.00
50	64.0	1103	44.30	40.50

All dimensions in [mm]

BBS flange small (sterile orbital), DIN 11866 line A, female
 BBS flange small (sterile orbital), DIN 11866 line B, female



Engineering unit mm (in)

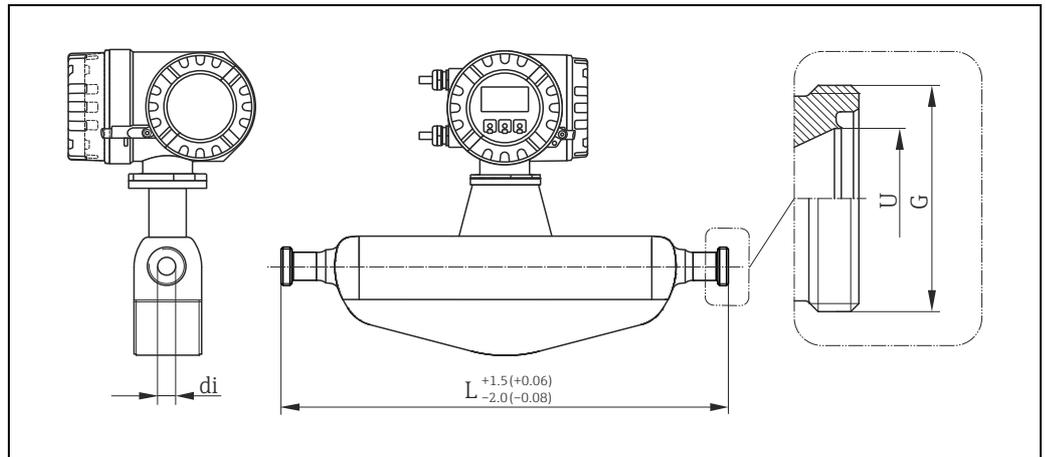
BBS flange small (sterile orbital), DIN 11866 line A, female: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option BBH							
DN	G	L	N	S	LK	U	di
8	59	384	4 × Ø 9	10	42	10.00	8.31
15	59	488	4 × Ø 9	10	42	16.00	12.00
25	70	626	4 × Ø 9	10	53	26.00	17.60
40	82	840	4 × Ø 9	10	65	38.00	26.00
50	94	1120	4 × Ø 9	10	77	50.00	40.50

All dimensions in [mm]

BBS flange small (sterile orbital), DIN 11866 line B, female: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option BBK							
DN	G	L	N	S	LK	U	di
8	59	384	4 × Ø 9	10	42	14.00	8.31
15	62	488	4 × Ø 9	10	45	18.10	12.00
25	74	626	4 × Ø 9	10	57	29.70	17.60
40	88	840	4 × Ø 9	10	71	44.30	26.00
50	103	1120	4 × Ø 9	10	85	56.30	40.50

All dimensions in [mm]

BBS thread (sterile orbital), DIN 11866 line A
 BBS thread (sterile orbital), DIN 11866 line B



Engineering unit mm (in)

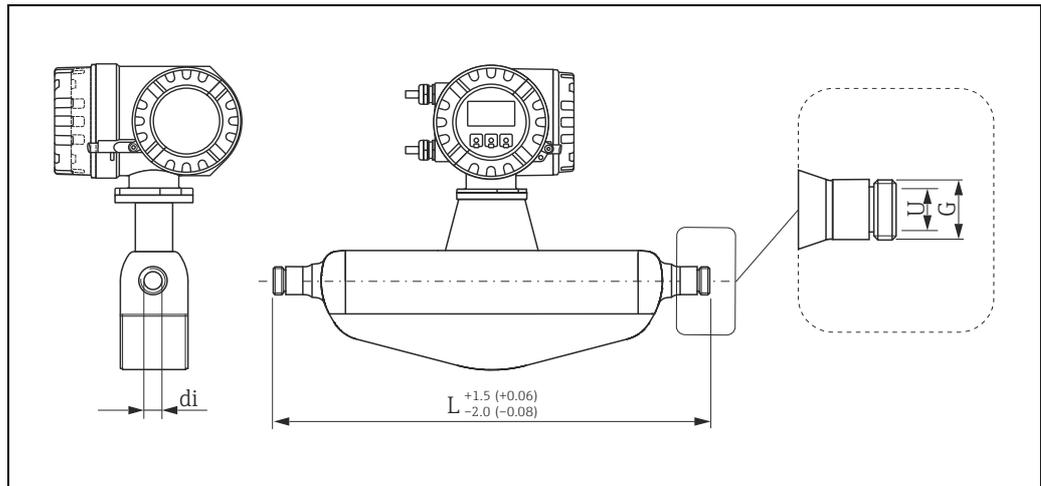
BBS thread (sterile orbital), DIN 11866 line A: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option BBA				
DN	G	L	U	di
8	M22×1.5	362	10.00	8.31
15	M30×2	466	16.00	12.00
25	M42×2	606	26.00	17.60
40	M52×2	819	38.00	26.00
50	M68×2	1097	50.00	40.50

All dimensions in [mm]

BBS thread (sterile orbital), DIN 11866 line B: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option BBC				
DN	G	L	U	di
8	M26×1.5	362	14.00	8.31
15	M30×2	466	18.10	12.00
25	M42×2	606	29.70	17.60
40	M56×2	825	44.30	26.00
50	M68×2	1103	56.30	40.50

All dimensions in [mm]

SMS 1145 thread



Engineering unit mm (in)

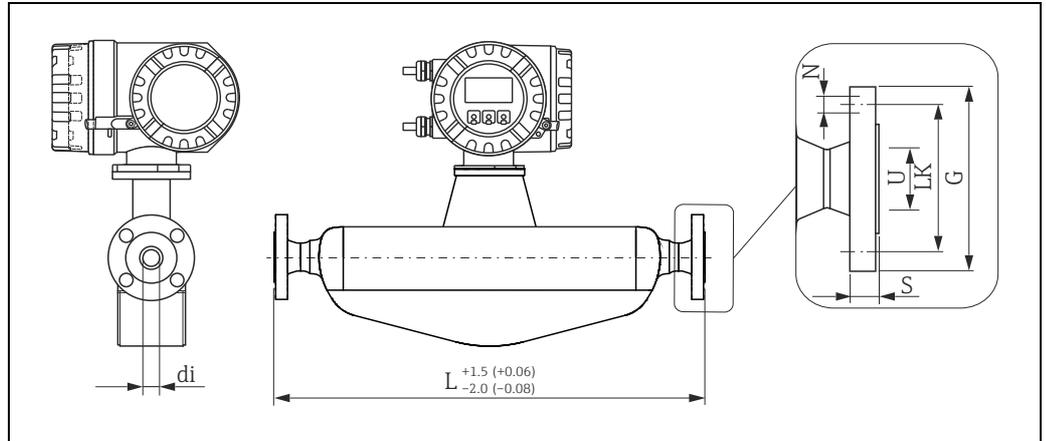
SMS 1145 thread: 1.4435 (316L) Surface roughness: Ra_{max} 0.75 μm or Ra_{max} 0.38 μm electropolished Order code for "Process connection", option FSD				
DN	G	L	U	di
8	Rd 40 × 1/6"	362	22.50	8.31
15	Rd 40 × 1/6"	466	22.50	12.00
25	Rd 40 × 1/6"	606	22.50	17.60
40	Rd 60 × 1/6"	829	35.50	26.00
50	Rd 70 × 1/6"	1107	48.50	40.50

All dimensions in [mm]

Process connections in US units

Flange according to ASME B16.5, Cl 150

Flange according to ASME B16.5, Cl 300



Engineering unit mm (in)

Flange according to ASME B16.5, Cl 150: 1.4404 (F316/F316L)							
Surface roughness (flange): Ra 3.2 to 6.3 µin							
Order code for "Process connection", option AAZ							
DN	G	L	N	S	LK	U	di
3/8" ¹⁾	3.50	13.23	4 × Ø0.62	0.67	2.38	0.62	0.33
1/2"	3.50	17.32	4 × Ø0.62	0.67	2.38	0.62	0.47
1"	4.25	22.83	4 × Ø0.62	0.69	3.12	1.05	0.69
1 1/2"	5.00	32.26	4 × Ø0.62	0.73	3.88	1.61	1.02
2"	6.00	42.17	4 × Ø0.75	0.99	4.75	2.07	1.59

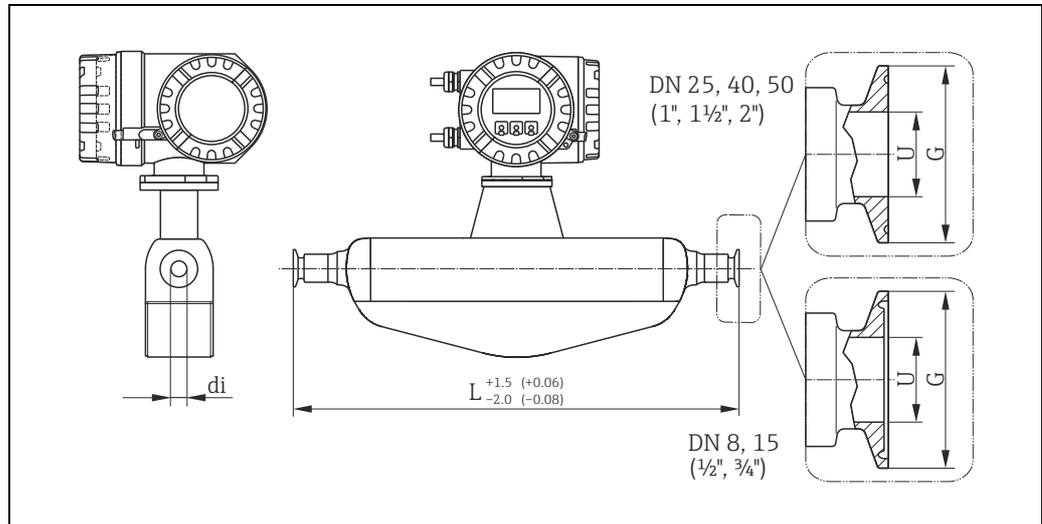
¹⁾ DN 3/8" with DN 1/2" flange as standard
All dimensions in [in]

Flange according to ASME B16.5, Cl 300: 1.4404 (F316/F316L)							
Surface roughness (flange): Ra 3.2 to 6.3 µin							
Order code for "Process connection", option ABZ							
DN	G	L	N	S	LK	U	di
3/8" ¹⁾	3.75	13.23	4 × Ø0.62	0.65	2.62	0.62	0.33
1/2"	3.75	17.32	4 × Ø0.62	0.65	2.62	0.62	0.47
1"	4.88	22.83	4 × Ø0.75	0.71	3.50	1.05	0.69
1 1/2"	6.12	32.26	4 × Ø0.88	0.97	4.50	1.61	1.02
2"	6.50	42.17	8 × Ø0.75	1.09	5.00	2.07	1.59

¹⁾ DN 3/8" with DN 1/2" flange as standard
All dimensions in [in]

Tri-Clamp, DIN 11866 line C, ASME BPE
 Tri-Clamp 1", DIN 11866 line C, ASME BPE
 Tri-Clamp ¾", DIN 11866 line C, ASME BPE
 Tri-Clamp ½", DIN 11866 line C, ASME BPE

All Tri-Clamp connections correspond to the relevant ASME BPE hygienic clamp dimensions.



A0022148

Engineering unit mm (in)

Tri-Clamp, DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra _{max} 30 µm or Ra _{max} 15 µm electropolished Order code for "Process connection", option FTM					
DN	Clamp	G	L	U	di
¾"	½"	0.98	14.25	0.37	0.33
½"	¾"	0.98	18.35	0.62	0.47
1"	1"	1.98	23.86	0.87	0.69
1 ½"	1 ½"	1.98	32.20	1.37	1.02
2"	2"	2.52	43.15	1.87	1.59

All dimensions in [in]

Tri-Clamp 1", DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra _{max} 30 µm or Ra _{max} 15 µm electropolished Order code for "Process connection", option FAB)					
DN	Clamp	G	L	U	di
¾"	1"	1.98	14.25	0.87	0.33
½"	1"	1.98	18.35	0.87	0.47

All dimensions in [in]

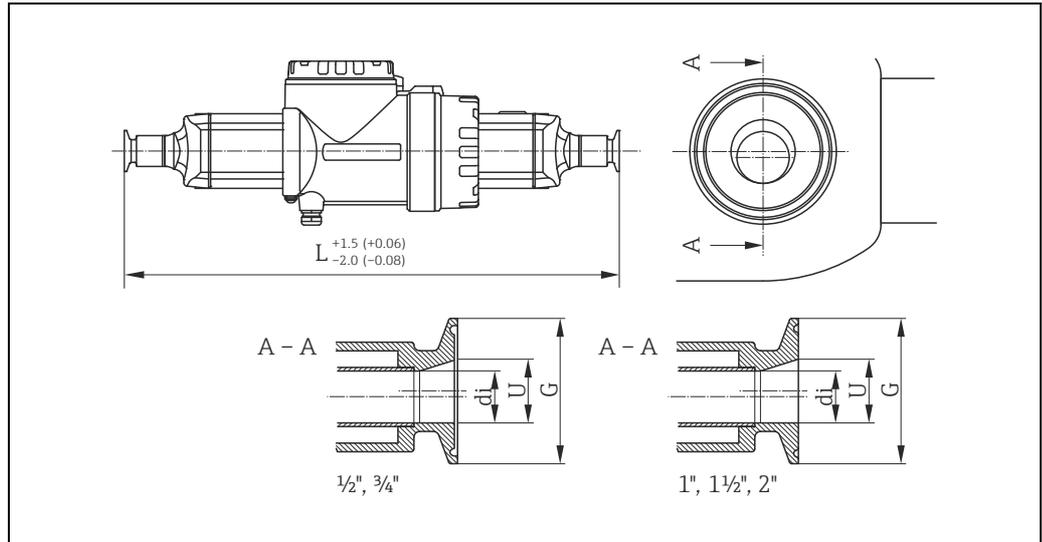
Tri-Clamp ¾", DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra _{max} 30 µm or Ra _{max} 15 µm electropolished Order code for "Process connection", option FPE					
DN	Clamp	G	L	U	di
¾"	¾"	0.98	14.25	0.62	0.33

All dimensions in [in]

Tri-Clamp 1/2", DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra_{max} 30 μ m or Ra_{max} 15 μ m electropolished Order code for "Process connection", option FUG						
DN	Clamp	G	L	U	di	
1/2"	1/2"	0.98	18.35	0.37	0.47	

All dimensions in [in]

Tri-Clamp eccentric, DIN 11866 line C, ASME BPE



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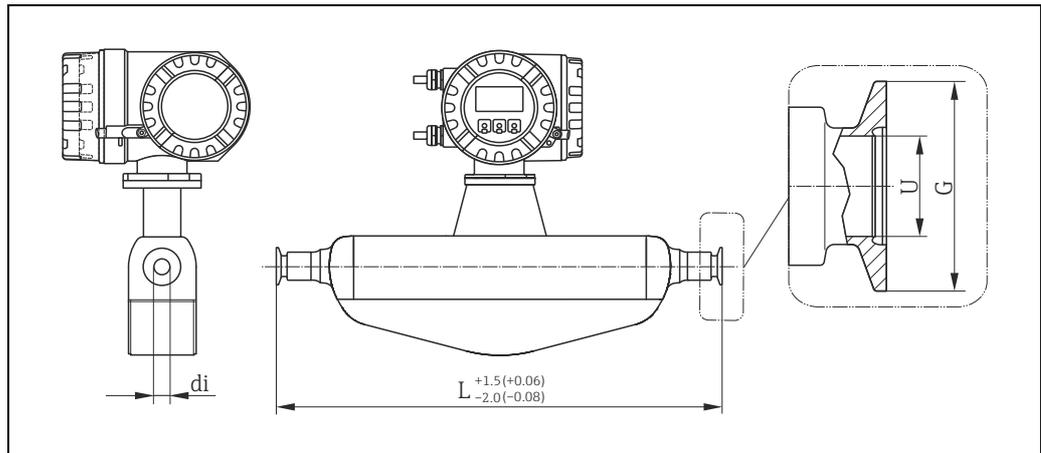
Engineering unit mm (in)

Tri-Clamp eccentric, DIN 11866 line C, ASME BPE: 1.4435 (316L) Surface roughness: Ra_{max} 30 μ m or Ra_{max} 15 μ m electropolished						
DN	Order code for "Process connection", option	Clamp	G	L	U	di
3/8"	ETA	1/2"	0.98	14.25	0.37	0.33
1/2"	ETB	3/4"	0.98	18.35	0.62	0.47
1"	ETC	1"	1.98	23.86	0.87	0.69
1 1/2"	ETD	1 1/2"	1.98	32.18	1.37	1.02
2"	ETE	2"	2.52	43.43	1.87	1.59

All dimensions in [in]

Further information refer to "Eccentric clamps" → 18.

Neumo BioConnect clamp, DIN 11866 line A, clamp form R

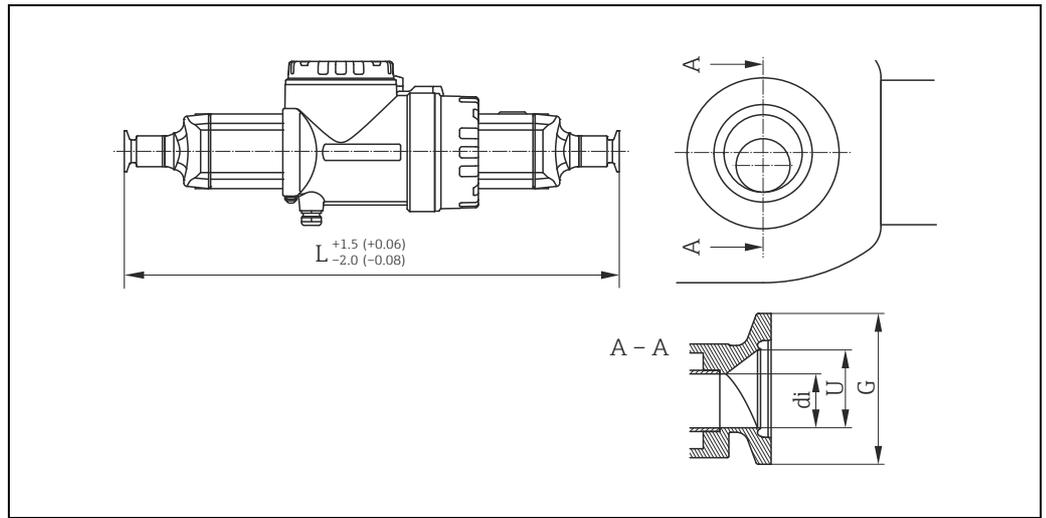


Engineering unit mm (in)

Neumo BioConnect clamp, DIN 11866 line A, clamp form R: 1.4435 (316L) Surface roughness: Ra_{max} 30 μ m or Ra_{max} 15 μ m electropolished Order code for "Process connection", option BCD				
DN	G	L	U	di
3/8"	0.98	14.25	0.89	0.33
1/2"	0.98	18.35	0.89	0.47
1"	1.98	23.86	0.89	0.69
1 1/2"	2.51	32.24	1.40	1.02
2"	3.04	43.18	1.91	1.59

All dimensions in [in]

Neumo BioConnect clamp eccentric, DIN 11866 line A, clamp form R



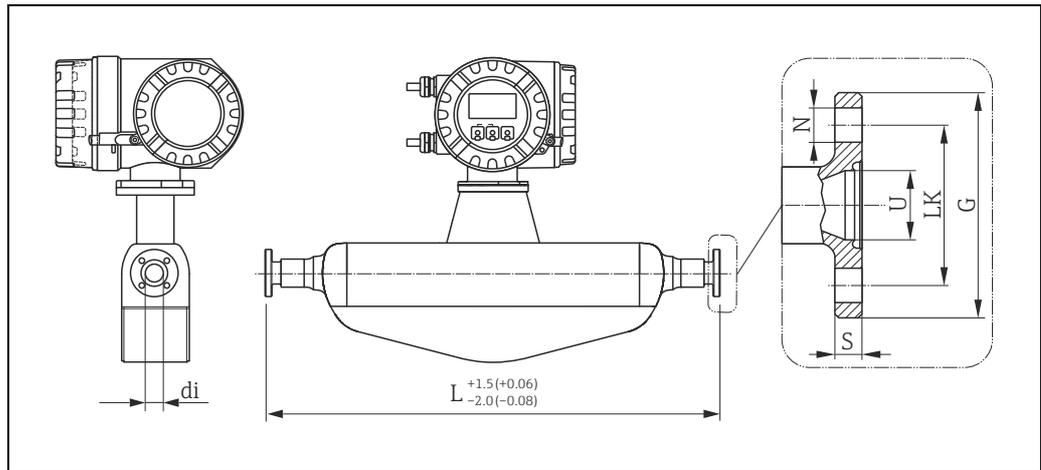
A0022185

Engineering unit mm (in)

Neumo BioConnect clamp eccentric, DIN 11866 line A, clamp form R: 1.4435 (316L)				
Surface roughness: Ra _{max} 30 µin or Ra _{max} 15 µin electropolished				
Order code for "Process connection", option BED				
DN	G	L	U	di
½"	0.98	14.25	0.39	0.33
¾"	0.98	18.35	0.63	0.47
1"	0.98	24.02	1.02	0.69
2"	0.98	43.39	1.97	1.59

All dimensions in [in]

Neumo BioConnect flange, DIN 11866 line A, flange form R



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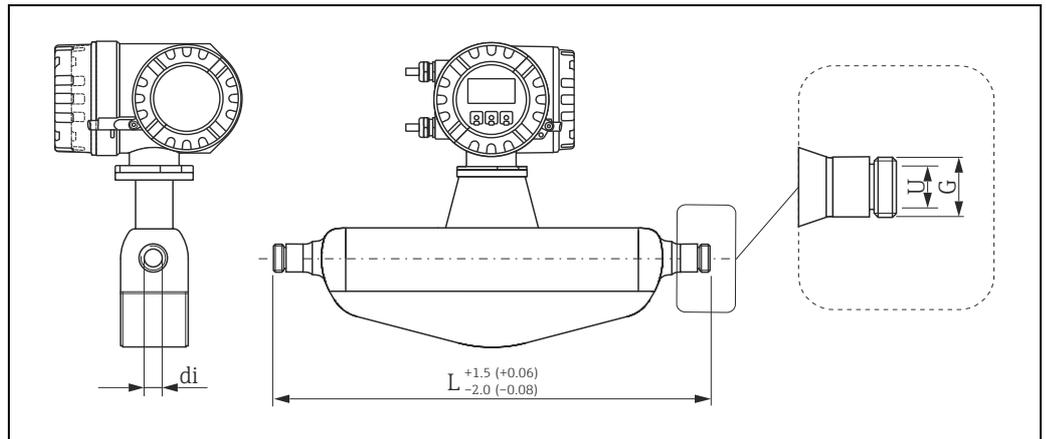
Engineering unit mm (in)

Neumo BioConnect flange, DIN 11866 line A, flange form R: 1.4435 (316L)
 Surface roughness: Ra_{max} 30 μ m or Ra_{max} 15 μ m electropolished
 Order code for "Process connection", option BFD

DN	G	L	N	S	LK	U	d_i
½"	2.56	15.12	4 × Ø 0.35	0.39	1.77	0.39	0.33
¾"	2.95	19.21	4 × Ø 0.35	0.39	2.17	0.63	0.47
1"	3.35	24.65	4 × Ø 0.35	0.47	2.56	1.02	0.69
1½"	3.94	33.07	4 × Ø 0.35	0.47	3.15	1.50	1.02
2"	4.33	44.09	4 × Ø 0.35	0.55	3.54	1.97	1.59

All dimensions in [in]

SMS 1145 thread



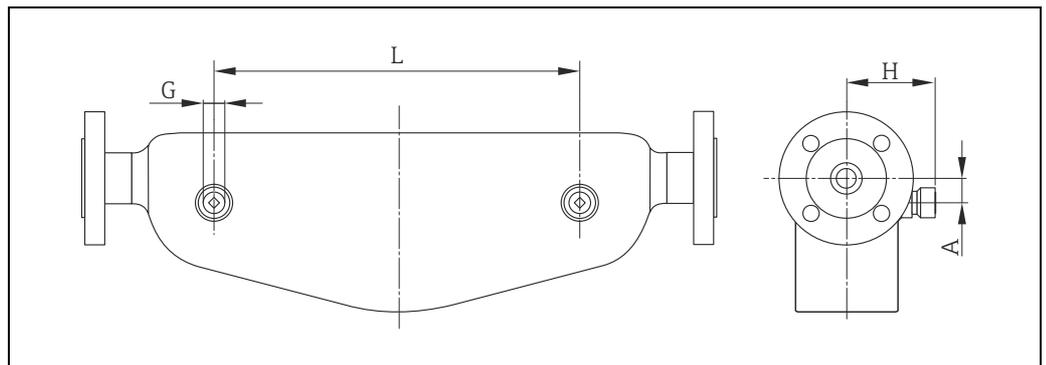
Engineering unit mm (in)

SMS 1145 thread: 1.4435 (316L)
Surface roughness: Ra_{max} 30 µm or Ra_{max} 15 µm electropolished
Order code for "Process connection", option FSD

DN	G	L	U	di
3/8"	Rd 40 × 1/6"	14.25	0.89	0.33
1/2"	Rd 40 × 1/6"	18.35	0.89	0.47
1"	Rd 40 × 1/6"	23.86	0.89	0.69
1 1/2"	Rd 60 × 1/6"	32.64	1.40	1.02
2"	Rd 70 × 1/6"	43.58	1.91	1.59

All dimensions in [in]

Purge connections, secondary containment monitoring



DN		G	A		H		L	
[mm]	[in]		[mm]	[in]	[mm]	[in]	[mm]	[in]
8	3/8"	1/2"-NPT	25	0.98	82	3.23	110	4.34
15	1/2"	1/2"-NPT	25	0.98	82	3.23	204	8.04
25	1"	1/2"-NPT	25	0.98	82	3.23	348	13.54
40	1 1/2"	1/2"-NPT	45	1.77	102	4.02	526	20.70
50	2"	1/2"-NPT	58	2.28	119.5	4.70	763	30.04

Weight

- Compact version: see table below
- Remote version
 - Sensor: see table below
 - Wall-mount housing: 5 kg (11 lb)

Weight in SI units

DN [mm]	8	15	25	40	50
Compact version	13	15	21	43	80
Remote version	11	13	19	41	78

All values (weight) refer to devices with EN/DIN PN 40 flanges.
Weight information in [kg]

Weight in US units

DN [in]	3/8"	1/2"	1"	1 1/2"	2"
Compact version	29	33	46	95	176
Remote version	24	29	42	90	172

All values (weight) refer to devices with EN/DIN PN 40 flanges.
Weight information in [lb]

Materials**Transmitter housing**

Compact version

- Powder coated die-cast aluminum
- Stainless steel housing: stainless steel, 1.4301 (304)
- Window material: glass or polycarbonate

Remote version

- Remote field housing: powder-coated die-cast aluminum
- Wall-mount housing: powder coated die-cast aluminum
- Window material: glass

Sensor housing, containment

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

Connection housing, sensor (remote version)

Stainless steel, 1.4301 (304)

Process connections

- Flanges according to EN 1092-1 (DIN 2501); Flanges according to ASME B16.5; JIS B2220 flange: stainless steel, 1.4404 (316/316L);
- All other process connections: stainless steel, 1.4435 (316L)

Measuring tubes

- Stainless steel, 1.4435 (316L)

Process connections

- Flanges:
 - according to EN 1092-1 (DIN 2501)
 - according to ASME B16.5
 - JIS B2220
 - DIN 11864-2A
 - Neumo BioConnect
 - BBS
- Threaded connection:
 - DIN 11864-1A
 - DIN 11851
 - SMS 1145
 - ISO 2853
 - BBS
- Clamp connection:
 - Tri-Clamp
 - DIN 11864-3A
 - DIN 32676
 - ISO 2852
 - Neumo BioConnect
 - BBS
- Eccentric clamp connection:
 - To be used to ensure complete drainability when mounted horizontally
 - Tri-Clamp
 - DIN 11864-3A
 - DIN 32676
 - ISO 2852
 - Neumo BioConnect
 - BBS

Surface roughness

Surface roughness of process wetted parts.

Wetted parts surface finish (measuring tube and process connection)

- $Ra_{max} = 0.76 \mu\text{m}$ (30 μin) mechanically polished
- $Ra_{max} = 0.38 \mu\text{m}$ (15 μin) electropolished
- Delta ferrite <1%

Operability

Local operation**Display elements**

- Liquid-crystal display: backlit, two lines (Promass 80) or four lines (Promass 83) with 16 characters per line
- Selectable display of different measured values and status variables
- At ambient temperatures below $-20 \text{ }^\circ\text{C}$ ($-4 \text{ }^\circ\text{F}$) the readability of the display may be impaired.

Operating elements

Promass 80:

- Local operation with three keys (\square \oplus \square)
- Quick Setup menus for straightforward commissioning

Promass 83:

- Local operation with three optical keys (\square \oplus \square)
- Application-specific Quick Setup menus for straightforward commissioning

Language group

Language groups available for operation in different countries:

Valid until software version 3.01.xx			
Order code	Option		Content
Power Supply; Display	WEA	Western Europe and America	English, German, Spanish, Italian, French, Dutch and Portuguese
	EES	Eastern Europe and Scandinavia	English, Russian, Polish, Norwegian, Finnish, Swedish and Czech
	SEA	South and East Asia	English, Japanese, Indonesian
	only Promass 83		
	CN	China	English, Chinese

Valid as of software version 3.07.xx (only Promass 83)		
Order code	Option	Content
Power Supply; Display	P, Q	English, German, Spanish, Italian, French
	R, S	English, Russian, Portuguese, Dutch, Czech
	T, U	English, Japanese, Swedish, Norwegian, Finnish
	4, 5	English, Chinese, Indonesian, Polish

You can change the language group via the operating program "FieldCare".

Remote operation**Promass 80**

Remote operation via HART, PROFIBUS PA

Promass 83

Remote operation via HART, PROFIBUS PA/DP, FOUNDATION fieldbus, Modbus RS485

Certificates and approvals

CE mark

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.

C-Tick symbol

The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)"

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI etc.) can be supplied by your Endress+Hauser Sales Center on request. All information relevant to explosion protection is available in separate Ex documents that you can order as necessary.

Hygienic compatibility

- 3A approval
- EHEDG tested (except from BBS)
- ASME BPE Certificate of Compliance to relevant scope

The scope is based on the ASME BPE 2005 Standard and is subject to revisions based on changes made in the Standard. The measuring device fulfills the requirements of Parts: GR, SD, DT, MJ, and SF that are deemed relevant to a Coriolis Mass Flow measuring system.

Functional safety

SIL -2: accordance IEC 61508/IEC 61511-1 (FDIS)

"4 to 20 mA" output according to the following order code:

A, B, C, D, E, L, M, R, S, T, U, W, 0, 2, 3, 4, 5, 6, 8

See also "Terminal assignment" →  8

IQ/OQ documentation package	<p>The package consist of a set of two main documents which apply to Promass 83P:</p> <ul style="list-style-type: none"> ■ IQ (Installation Qualification) ■ OQ (Operational Qualification) <p>The installation and operational qualification will provide documented verification of the proper installation and operation of a Promass 83P. The installation and operation will be evaluated based on adherence to Endress+Hauser and process design specifications, conformance to the client's stated requirements, and compliance with current Good Manufacturing Practices.</p>
Flow calibration	<ul style="list-style-type: none"> ■ Factory calibration, standard 2-point or 5 point: Verification of the measuring accuracy with adjustment of the meter on a production flow rig. Accuracy and linearity are both recorded, the meter is supplied with a calibration certificate. ■ SCS/A2LA/CNAS calibration, standard 5-point: Traceable calibration with adjustment of the meter on an accredited flow rig. Measuring uncertainty of the calibration rig has been officially verified and based on international standards. Accreditation of calibration facility is according to ISO/IEC 17025 (Reinach, Cernay, Greenwood, Aurangabad and Suzhou). The calibration certificate bears the stamp of the calibration laboratory and are signed by the certified operator and countersigned by the head of the facility.
TSE compliance	<p>Endress+Hauser declare, that no material with animal origin or ingredients of animal origin are being used during the entire production of Promass sensors produced in our Reinach/ Switzerland, Cernay/ France, Greenwood/ USA or Aurangabad/ India production facilities.</p> <p>In addition we do not use any material of animal origin during the polishing processes. Endress+Hauser therefore can confirm to TSE compliance.</p>
Additional test and Inspections	<p>The following tests and inspection are offered as standard:</p> <ul style="list-style-type: none"> ■ MTR (Material Test Reports) or EN 10204 3.1 material Inspection certificate ■ Pressure test for the measuring tube and a type test for the secondary containment ■ Cleaned from Oil and Grease ■ Roughness measurement ■ Delta Ferrite measurement <p>The above mentioned tests and inspections are available on a CoC (Certificate of compliance) or an EN 10204 3.1 certificate. Additional inspections and tests are available upon request please contact your local Endress+Hauser sales organization for further information.</p>
HART certification	<p>The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the HCF (Hart Communication Foundation). The device thus meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified in accordance with HART Revisions 5 and 7 (device certification number: available on request) ■ The measuring device can also be operated with certified devices of other manufacturers (interoperability).
FOUNDATION Fieldbus certification	<p>The flow device has successfully passed all the test procedures carried out and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified to FOUNDATION Fieldbus Specification ■ The device meets all the specifications of the FOUNDATION Fieldbus H1. ■ Interoperability Test Kit (ITK), revision status 5.01 (device certification number: on request) ■ The device can also be operated with certified devices of other manufacturers ■ Physical Layer Conformance Test of the Fieldbus Foundation
PROFIBUS DP/PA certification	<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"> ■ Certified in accordance with PROFIBUS Profile Version 3.0 (device certification number: available on request) ■ The device can also be operated with certified devices of other manufacturers (interoperability)

Modbus certification	The measuring device meets all the requirements of the Modbus/TCP conformity test and has the "Modbus/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the "Modbus/TCP Conformance Test Laboratory" of the University of Michigan.
Pressure Equipment Directive	<p>The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.</p> <ul style="list-style-type: none"> ■ With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC. ■ Devices with this identification (with PED) are suitable for the following types of fluid: <ul style="list-style-type: none"> - Fluids of Group 1 and 2 with a steam pressure greater than, or smaller and equal to 0.5 bar (7.3 psi) - Unstable gases ■ Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.
Other standards and guidelines	<ul style="list-style-type: none"> ■ EN 60529 Degrees of protection by housing (IP code) ■ EN 61010-1 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures ■ EN 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems ■ IEC/EN 61326 "Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements) ■ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment ■ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal ■ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics

Ordering Information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

Product Configurator - the tool for individual product configuration

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

Accessories

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

Device-specific accessories

For the Transmitter

Accessories	Description
Transmitter	Transmitter for replacement or for stock. Use the order code to define the following specifications: <ul style="list-style-type: none"> ▪ Approvals ▪ Degree of protection, version ▪ Cable entries, ▪ Display, power supply, operation ▪ Software ▪ Outputs, inputs
Inputs/outputs for Proline Promass 83 HART	Conversion kit with appropriate plug-in point modules for converting the input/output configuration in place to date to a new version.
Software packages for Proline Promass 83	Software add-ons on F-Chip, can be ordered individually: <ul style="list-style-type: none"> ▪ Advanced diagnostics ▪ Batching functions ▪ Concentration measurement
Mounting set for transmitter	Mounting set for wall-mount housing (remote version). Suitable for: <ul style="list-style-type: none"> ▪ Wall mounting ▪ Pipe mounting ▪ Installation in control panel Mounting set for aluminum field housing: Suitable for pipe mounting (3/4" to 3")

For the Sensor

Accessories	Description
Heating jacket	Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids. If using oil as a heating medium, please consult with Endress+Hauser. For details, see Operating Instructions BA00099D

Communication-specific accessories

Accessories	Description
HART Communicator Field Xpert handheld terminal	Handheld terminal for remote parameterization and for obtaining measured values via the current output HART (4 to 20 mA). Contact your Endress +Hauser representative for more information.
Commubox FXA195 HART	The Commubox FXA195 connects intrinsically safe smart transmitters with the HART protocol with the USB port of a personal computer. This enables remote operation of the transmitter with operating software (e.g. FieldCare). Power is supplied to the Commubox via the USB port.

Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> ■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections ■ Graphic illustration of the calculation results <p>Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.</p> <p>Applicator is available:</p> <ul style="list-style-type: none"> ■ Via the Internet: https://wapps.endress.com/applicator ■ On CD-ROM for local PC installation
W@M	<p>Life cycle management for your plant.</p> <p>W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.</p> <p>W@M is available:</p> <ul style="list-style-type: none"> ■ Via the Internet: www.endress.com/lifecyclemanagement ■ On CD-ROM for local PC installation
Fieldcheck	<p>Tester/simulator for testing flowmeters in the field.</p> <p>When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.</p>
FieldCare	<p>FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.</p>
FXA193	<p>Service interface from the measuring device to the PC for operation via FieldCare.</p>

System components

Accessories	Description
Memograph M graphic display recorder	<p>The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.</p>

Documentation

- Flow measuring technology (FA00005D)
- Technical Information
 - Promass 80A, 83A (TI00054D)
 - Promass 80E, 83E (TI00061D)
 - Promass 80F, 83F (TI00101D)
 - Promass 80H, 83H (TI00074D)
 - Promass 80I, 83I (TI00075D)
 - Promass 80S, 83S (TI00076D)
- Operating Instructions/Description of Device Functions
 - Promass 80 HART (BA00057D/BA00058D)
 - Promass 80 PROFIBUS PA (BA00072D/BA00073D)
 - Promass 83 HART (BA00059D/BA00060D)
 - Promass 83 FOUNDATION Fieldbus (BA00065D/BA00066D)
 - Promass 83 PROFIBUS DP/PA (BA00063D/BA00064D)
 - Promass 83 Modbus (BA00107D/BA00108D)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IECEx NEPSI
- Functional safety manual Promass 80, 83 (SD00077D)

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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 SCHNEIDER AUTOMATION, INC.

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