Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promass 80P, 83P

Coriolis Mass Flow Measuring System
The single-tube system with a "fit-and-forget" design: hygienic – drainable – complying with the requirements, codes and standards ASME BPE, ISPE, FDA, EHEDG, 3-A

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

- Extremely accurate measurement of liquids and gases found in Life Sciences Industries processes such as: Water purification, WFI, Fermentation processes, Media preparation, batch verification, batch fermenter, Sterilization process, cleaning agents and solvents. Fast recovery from CIP/SIP.
- Process up to +200 °C and 63 bar
- Mass flow measurement up to 70 t/h

Certification for highly regulated industries:
- ASME BPE Certificate of Compliance to relevant scope, 3A, EHEDG
- Inspection certificates: EN 10204, MTR for material, roughness, and delta ferrite.

Approvals for:
- ATEX, FM, CSA, TIIS, IECEx, NEPSI
- HART, PROFIBUS PA/DP, FOUNDATION Fieldbus, MODBUS
- Pressure Equipment Directive, SIL-2

Your benefits
The Promass measuring devices are suitable for use in PAT applications for the continuous monitoring of critical quality process variables such as mass flow, volume flow, density and temperature.

The uniform **Proline transmitter concept** includes software options for batching and concentration measurement for extended range of application.

The **Promass sensors**, tried and tested in over 100 000 applications, offer:
- Material selected according to ASME BPE and BN2 guidelines, EN 1.4435/ASTM 316L, low delta ferrite
- Wetted surfaces: Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished
- Accredited flow calibration according to ISO/SCS/IEC 17025/A2LA, traceable density calibration
- Fully welded sensor design, no seals or gaskets
- Electropolished exterior: "Hygienic design" for higher corrosion resistance and easier cleanability
- Complete drainability, even in horizontal lines

TI078D/06/en/07.08
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Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Measuring principle

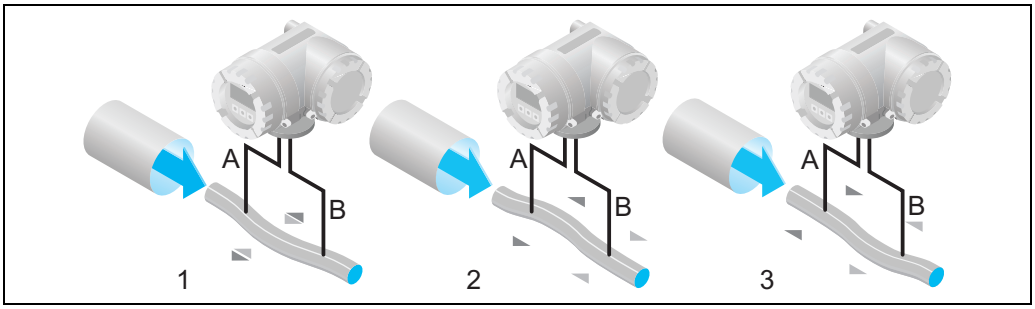
The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present when both translational and rotational movements are superimposed.

$F_C = 2 \cdot \Delta m\ (v \cdot \omega)$
F_C = Coriolis force
Δm = moving mass
ω = rotational velocity
v = radial velocity in 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.

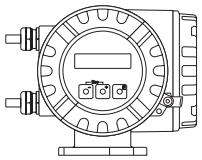
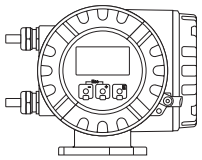
Temperature measurement

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.

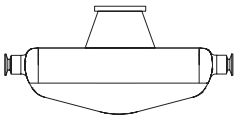
Measuring system

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.

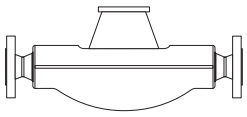
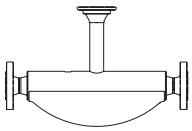
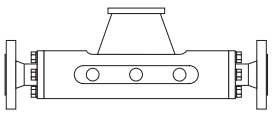
Transmitter

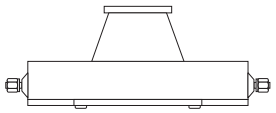
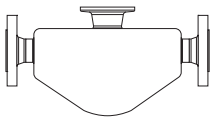
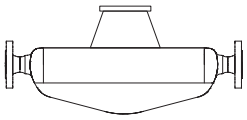
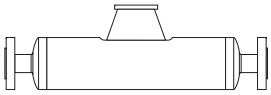
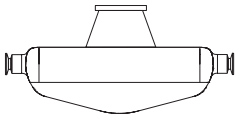
Promass 80  a0003671	■ Two-line liquid-crystal display ■ Operation with push buttons
Promass 83  a0003672	■ Four-line liquid-crystal display ■ Operation with "Touch control" ■ Application-specific Quick Setup ■ Mass flow, volume flow, density and temperature measurement as well as calculated variables (e.g. fluid concentrations)

Sensor

P  a0006828	■ Single bent tube, minimal shear stress on fluid. Hygienic design with documents for Life Science Industries applications, low pressure loss, for fluid temperatures up to 200 °C ■ Nominal diameters DN 8 to 50 ■ Material: Stainless Steel EN 1.4435/ ASTM 316L	Documentation No. TI 078D/06

Other sensors can be found in the separate documentation

F  a0003673	■ Universal sensor for fluid temperatures up to 200 °C. ■ Nominal diameters DN 8 to 250 ■ Material: Stainless Steel EN 1.4539 / ASTM 904L and EN 1.4404 and ASTM 316L or Alloy C-22 DIN 2.4602	Documentation No. TI 053D/06
F (High-temperature)  a0003675	■ Universal high-temperature sensor for fluid temperatures up to 350 °C. ■ Nominal diameters DN 25, 50, 80 ■ Material: Alloy C-22, DIN 2.4602	
M  a0003676	■ Robust sensor for extreme process pressures, high requirements for the secondary containment and fluid temperatures up to 150 °C ■ Nominal diameters DN 8 to 80 ■ Material: titanium, Ti, Ti Grade 2, Ti Grade 9	

A  a0003679	■ Single-tube system for highly accurate measurement of very small flows ■ Nominal diameters DN 1 to 4 ■ Material: Stainless Steel or EN 1.4539 / ASTM 904L or Alloy C-22 DIN 2.4602	Documentation No. TI 054D/06
E  a0002271	■ General purpose sensor, ideal replacement for volumetric flowmeters. ■ Nominal diameters DN 8 to 50 ■ Material: Stainless Steel EN 1.4539 / ASTM 904L and EN 1.4404 / ASTM 316L	Documentation No. TI 061D/06
H  a0003677	■ Single bent tube. Low pressure loss and chemically resistant material ■ Nominal diameters DN 8 to 50 ■ Material: zirconium 702/R 60702	Documentation No. TI 074D/06
I  a0003678	■ Straight single-tube instrument. Minimal shear stress on fluid, hygienic design, low pressure loss ■ Nominal diameters DN 8 to 80 ■ Material: titanium, Ti Grade 2, Ti Grade 9	Documentation No. TI 075D/06
S  a0006828	■ Single bent tube. Hygienic design, low pressure loss, for fluid temperatures up to 150 °C ■ Nominal diameters DN 8 to 50 ■ Material: Stainless Steel, EN 1.4539 / ASTM 904L and EN 1.4435 and ASTM 316L	Documentation No. TI 076D/06

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 $\dot{m}_{max(F)}$
8	0 to 2000 kg/h
15	0 to 6500 kg/h
25	0 to 18000 kg/h
40	0 to 45000 kg/h
50	0 to 70000 kg/h

Measuring ranges for gases

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

$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div 160$ [kg/m³]

$\dot{m}_{max(G)}$ = max. full scale value for gas [kg/h]
$\dot{m}_{max(F)}$ = max. full scale value for liquid [kg/h]
$\rho_{(G)}$ = Gas density in [kg/m³] at operating conditions

DN	x
8	60
15	80
25	90
40	90
50	90

Here, $_{mmax(G)}$ can never be greater than $_{mmax(F)}$

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:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div x$ [kg/m³] = 70000 kg/h · 60.3 kg/m³ ÷ 90 kg/m³= 46900 kg/h

Recommended full scale values

See information in the "Limiting flow" section → Page 22 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 k**Ω**, galvanically isolated.
Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start, batching start/stop (optional).

Status input (auxiliary input) with PROFIBUS DP

U = 3 to 30 V DC, R_i = 3 k**Ω**, galvanically isolated.
Switch level: ±3…±30 V DC, independent of polarity.
Configurable for: positive zero return, error message reset, zero point adjustment start, batching start/stop (optional), totalizer reset for batching (optional).

Status input (auxiliary input) with MODBUS RS485

U = 3 to 30 V DC, R_i = 3 k**Ω**, galvanically isolated.
Switch level: ±3…±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 A
- 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.f.s./°C, resolution: 0.5 µA
- 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 × Analog Input, 1 × Totalizer
- Output data: Mass flow, Volume flow, Density, Temperature, Totalizer
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Totalizer control
- Bus address can be configured via miniature switches or via the local display (optional)

Promass 83

Current output:

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% o.f.s./°C, resolution: 0.5 µA
- Active: 0/4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
- Passive: 4 to 20 mA; supply voltage U_S 18 to 30 V DC; $R_i \geq 150\ \Omega$

Pulse/frequency output:

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

PROFIBUS DP interface:

- PROFIBUS DP in accordance with EN 50170 Volume 2
- Profile Version 3.0
- Data transmission rate: 9.6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Signal encoding: NRZ Code
- Function blocks: 6 × 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→ Page 12

PROFIBUS PA interface:

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

MODBUS interface:

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

FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Data transmission rate: 31.25 kBit/s
- Current consumption: 12 mA
- Permitted supply voltage: 9 to 32 V
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Bus connection with integrated reverse polarity protection
- Signal encoding: Manchester II
- ITK Version 4.01
- Function blocks: 7 × Analog Input, 1 × Digital Output, 1 × PID
- 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

Current output:
Failsafe mode selectable (e.g. in accordance with NAMUR Recommendation NE 43)

Pulse/frequency output:
Failsafe mode selectable

Status output (Promass 80):

Nonconductive in the event of a fault or if the power supply fails

Relay output (Promass 83):

Dead in the event of a fault or if the power supply fails

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

Status output (Promass 80):

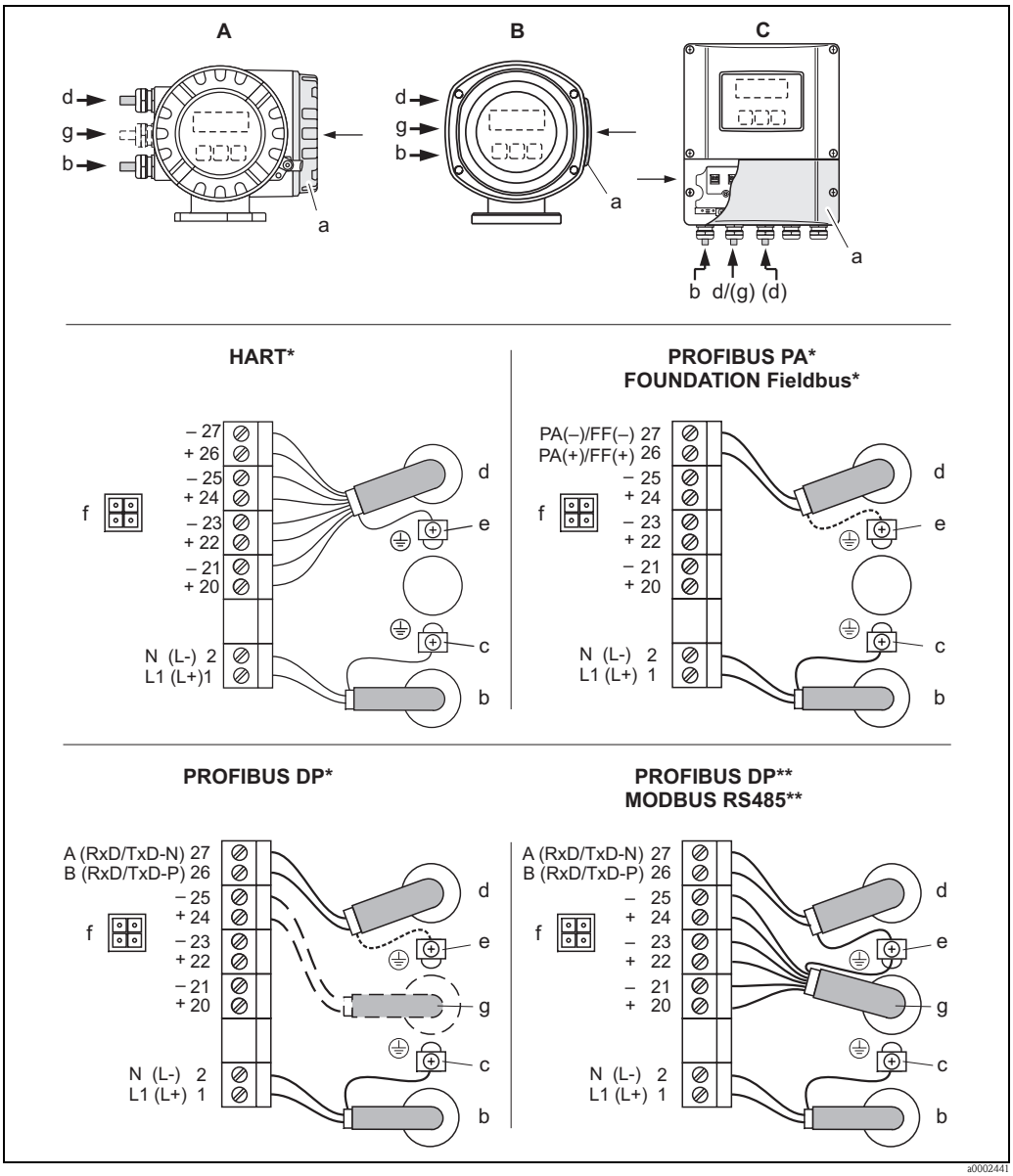
Open collector, max. 30 V DC / 250 mA, galvanically isolated.
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.

Relay output (Promass 83):

Normally closed (NC or break) or normally open (NO or make) contacts available (factory setting: relay 1 = NO, relay 2 = NC), max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated.

Power supply

Electrical connection
Measuring unit



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 → Page 12
Fieldbus cable:
Terminal No. 26: DP / PA (+) / FF (+) / MODBUS RS485 / (PA, FF: with reverse polarity protection)
Terminal No. 27: DP / PA (–) / FF (–) / MODBUS RS485 / (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 → Page 12
g Cable for external termination (only for PROFIBUS DP with permanent assignment communication board):
Terminal No. 24: +5 V
Terminal No. 25: DGND

Electrical connection, terminal assignment

Promass 80

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

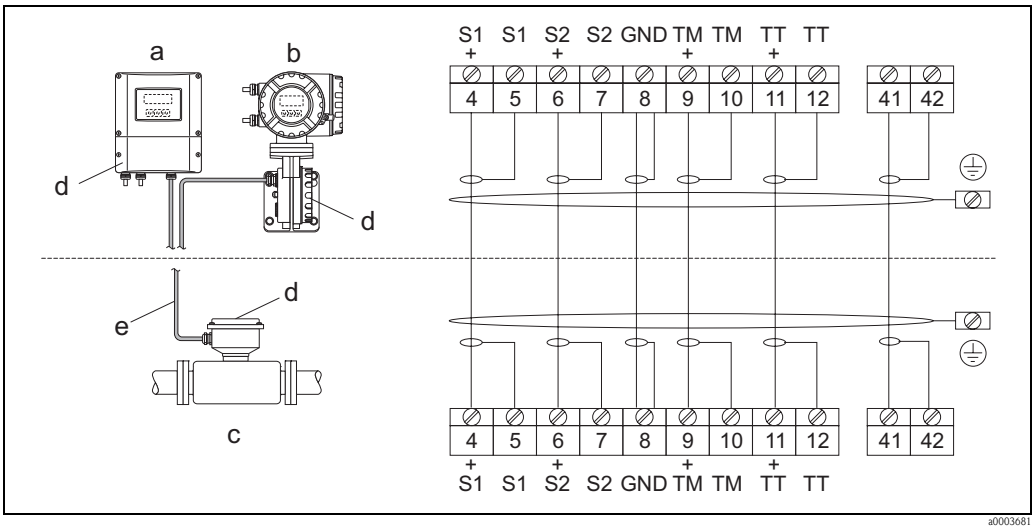
Promass 83

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

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

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

Electrical connection Remote version



Connecting the remote version

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

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

Supply voltage

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

Cable entries

Power-supply and signal cables (inputs/outputs):
- Cable entry M20 × 1.5 (8 to 12 mm)
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm)
- Thread for cable entries, ½" NPT, G ½"

Cable specification Remote version

- 6 × 0.38 mm² (PVC cable with common shield and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km
- Capacitance: core/shield: ≤ 420 pF/m
- Cable length: max. 20 m
- Permanent operating temperature: max. +105 °C

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.

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.)

Potential equalization

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

Performance characteristics

Reference operating conditions

Error limits following ISO/DIS 11631:
- 20 to 30 °C; 2 to 4 bar
- Accuracy based on accredited calibration rigs according to ISO 17025
- Zero point calibrated under operating conditions
- Field density calibrated (or special density calibration)

Maximum measured error

The following values refer to the pulse/frequency output. Measured error at the current output is typically ±5 A.

o.r. = of reading

Mass flow (liquid):

Promass 80
±0.15% ± [(zero point stability ÷ measured value) · 100]% o.r.

Promass 83
±0.10% ± [(zero point stability ÷ measured value) · 100]% o.r.

Mass flow (gas)

±0.50% ± [(zero point stability ÷ measured value) ·100]% o.r.

Volume flow (liquid)

Promass 80

±0.30% ± [(zero point stability ÷ measured value) ·100]% o.r.

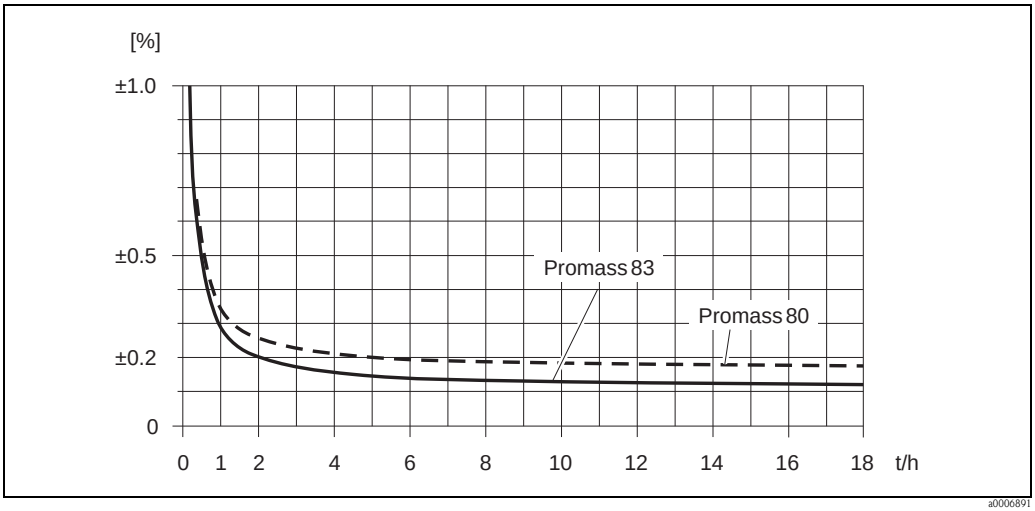
Promass 83

±0.25% ± [(zero point stability ÷ measured value) ·100]% o.r.

Zero point stability:

DN	Maximum full scale value	Zero point stability
	[kg/h]	[kg/h]
8	2000	0.20
15	6500	0.65
25	18000	1.8
40	45000	4.5
50	70000	7.0

Sample calculation



Max. measured error in % of measured value (example: Promass 80P, 83P / DN 25)

Calculation example (mass flow, liquid):
Given: Promass 83P/ DN 25, flow measured value = 8000 kg/h
Max. measured error: ±0.10% ± [(zero point stability ÷ measured value) · 100]% o.r.
Max. measured error: ±0.10% ±1.8 kg/h ÷ 8000 kg/h · 100% = ±0.12%

Density (liquid)

1 g/cc = 1 kg/l

Standard calibration:

±0.01 g/cc

Special density calibration (optional), calibration range: 0.8 to 2.0 g/cc, 5 to 80 °C:

±0.002 g/cc

After field density calibration or under reference conditions:

±0.0005 g/cc

Temperature

±0.5 °C ±0.005 · T (T = fluid temperature in °C)

Repeatability

Mass flow (liquid):

±0.05% ± [½ ·(zero point stability ÷ measured value) ·100]% o.r.

Mass flow (gas):

±0.25% ± [½ ·(zero point stability ÷ measured value) ·100]% o.r.

Volume flow (liquid):

±0.20% ± [½ ·(zero point stability ÷ measured value) ·100]% o.r.

o.r. = of reading
Zero point stability: see "Max. measured error"→ Page 14 ff.

Calculation example (mass flow, liquid):
Given: Promass 83P / DN 25, flow measured value = 8000 kg/h
Repeatability: ±0.05% ± [½ ·(zero point stability ÷ measured value) · 100]% o.r.
Repeatability: ±0.05% ±½ · 1.8 kg/h ÷ 8000 kg/h · 100% = ±0.061%

Density measurement (liquid)

1 g/cc = 1 kg/l

±0.00025 g/cc

Temperature measurement

±0.25 °C ±0.0025 · T (T = fluid temperature in °C)

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 ±0.0002% of the full scale value / °C.

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	% o.r./bar
8	–0.002
15	–0.006
25	–0.005
40	–0.005
50	–0.005

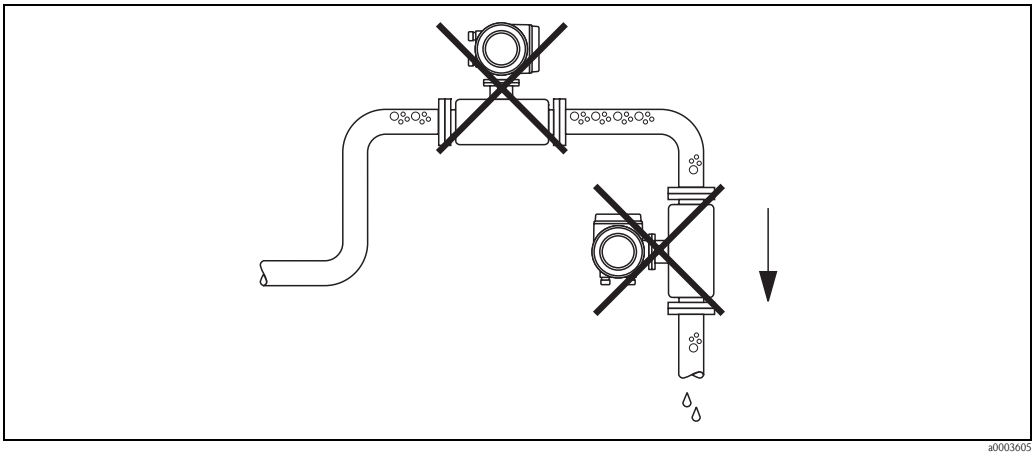
Operating conditions: Installation

Installation instructions

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

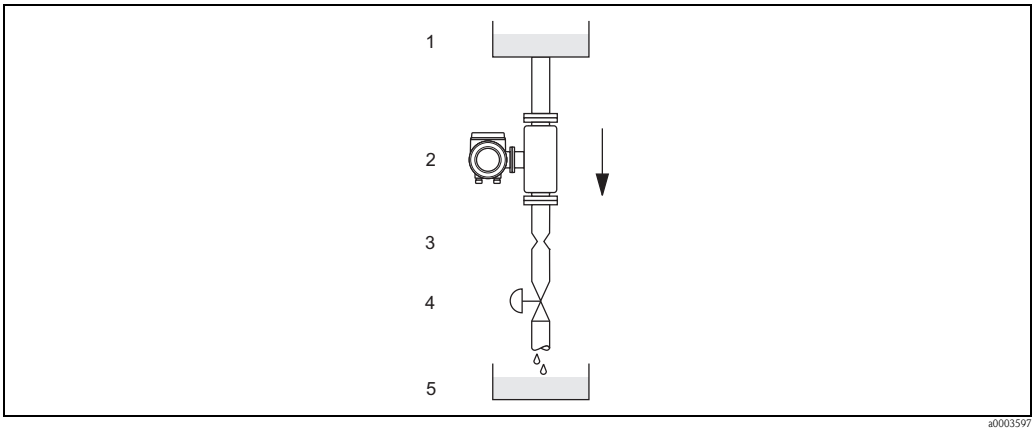
Mounting location

Entrained air or gas bubbles in the measuring tube can result in an increase in measuring errors.
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), 4 = Valve, 5 = Batching tank

DN	8	15	25	40	50
Ø Orifice plate, pipe restriction [mm]	6	10	14	22	28

Orientation

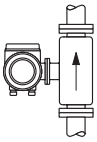
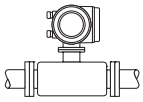
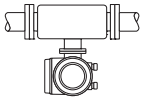
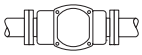
Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction of fluid flow through the pipe).

Vertical (view 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 (view H1 to H3)

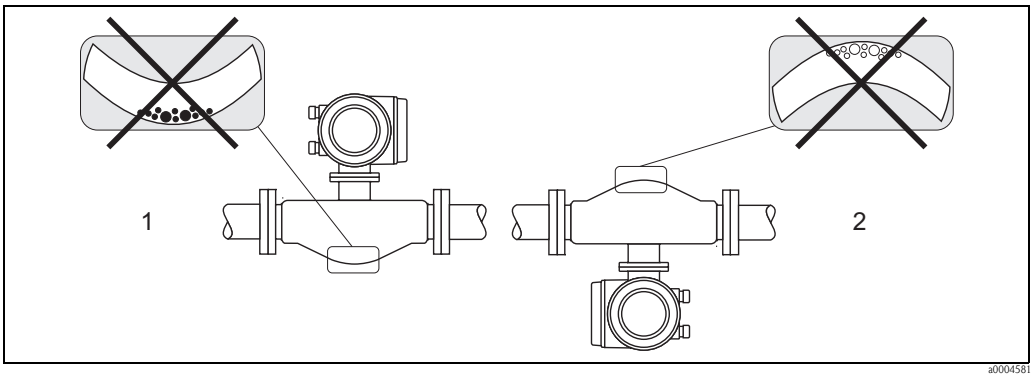
The transmitter can be installed in any orientation in a horizontal pipe run.

	Standard, compact	Standard, remote
Fig. V: Vertical orientation  a0004572	✔✔	✔✔
Fig. H1: Horizontal orientation Transmitter head up  a0004576	✔✔	✔✔
Fig. H2: Horizontal orientation Transmitter head down  a0004580	✔✔ ①	✔✔ ①
Fig. H3: Horizontal orientation Transmitter head to the side  A0007558	✔✔	✔✔
✔✔ = Recommended orientation ✔ = Orientation recommended in certain situations ✘ = Impermissible orientation		

① = To ensure that the maximum permitted ambient temperature for the transmitter (–20 to +60 °C, optionally –40 to +60 °C) is not exceeded, for low-temperature fluids, we recommend the horizontal orientation with the transmitter head up (Fig. H1) or the vertical orientation (Fig. V).

Special installation instructions for Promass P

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

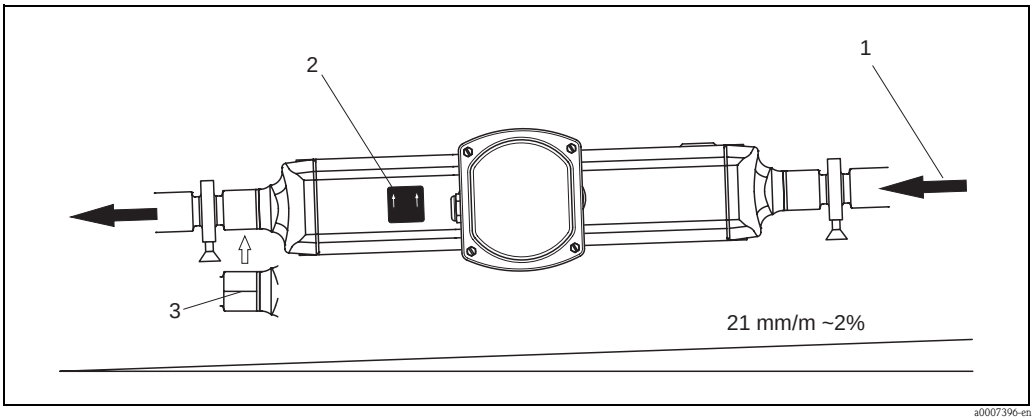


Horizontal installation for sensors with a bent measuring tube

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

Special installation instruction for Promass P with Eccentric Tri-clamps

Eccentric Tri-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.

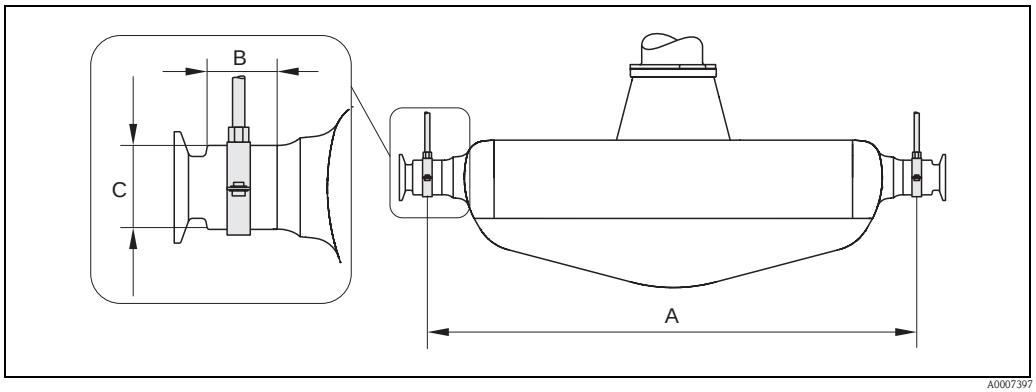


When lines are pitched in a specific direction and at a specific slope: as per hygienic guidelines (21 mm/m or approximatley 2%). Gravity can be used to achieve complete drainability.

1 The arrow indicates the direction of flow (direction of fluid flow through the pipe).
2 The label shows the installation orientation for horizontal drainability.
3 The underside of the process connection is indicated by a scribed line. This line indicates the lowest point of the eccentric process connection.

Special installation instruction for Promass P, with 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.



Promass P, mounted with mounting clamp

DN	8	15	25	40	50
A	298	402	542	750	1019
B	33	33	33	36.5	44.1
C	28	28	38	56	75

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.

Caution!
- Risk of electronics overheating! Make sure that the maximum permissible ambient temperature for the transmitter is not exceeded. Consequently, make sure that the adapter between 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. → Page 18
- With a fluid temperature between 200 °C to 350 °C the remote version is preferable to the high-temperature version.
- 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 $d \geq 0.35$ mm
- Information on permitted temperature ranges → Page 22

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

Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs.

Length of connecting cable

Max. 20 meters (remote version)

System pressure

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.
In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapor pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.

Therefore, the following locations should be preferred for installation:
- Downstream from pumps (no danger of vacuum)
- At the lowest point in a vertical pipe

Operating conditions: Environment

Ambient temperature range

Standard: –20 to +60 °C (sensor, transmitter)
Optional: –40 to +60 °C (sensor, transmitter)

Note!
- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- At ambient temperatures below –20 °C the readability of the display may be impaired.

Storage temperature

–40 to +80 °C, preferably +20 °C

Degree of protection

Standard: IP 67 (NEMA 4X) for transmitter and sensor

Shock resistance

According to IEC 68-2-31

Vibration resistance

Acceleration up to 1 g, 10 to 150 Hz, following IEC 68-2-6

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR recommendation NE 21

Operating conditions: Process

Fluid temperature range

Sensor

–50 to +200 °C

Fluid pressure range (nominal pressure)

Flanges:

According to DIN PN 40 to 63 / according to ASME B16.5 Cl 150, Cl 300 / JIS 10K, 20K

Pressure ranges of secondary containment:

DN 8 to 25: 25 bar
DN 40: 16 bar
DN 50: 10 bar

Warning!
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 purging (gas detection). Dimensions → Page 24 ff.

Limiting flow

See information in the "Measuring range" section → Page 6

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).
- 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 → Page 6

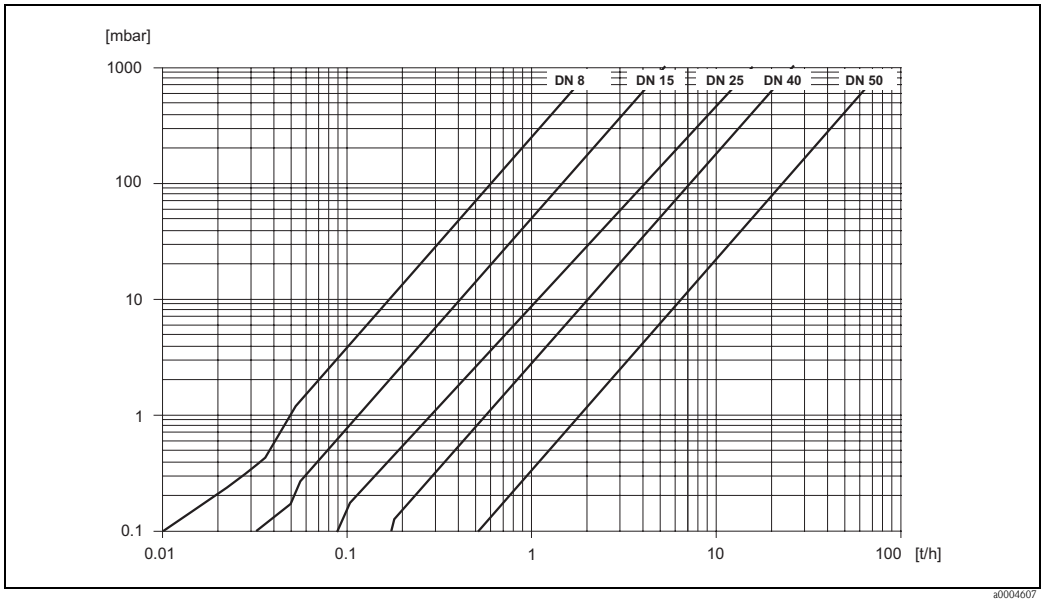
Pressure loss

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

Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ a0003381
$Re \geq 2300$ *	$\Delta p = K \cdot n^{0.25} \cdot \dot{m}^{1.75} \cdot r^{-0.75} + \frac{K3 \cdot \dot{m}^2}{\rho}$ a0004631
$Re < 2300$	$\Delta p = K1 \cdot \nu \cdot \dot{m} + \frac{K3 \cdot \dot{m}^2}{\rho}$ a0004633
Δp = pressure loss [mbar] ν = kinematic viscosity [m²/s] $\dot{m}$ = mass flow [kg/s]	ρ = fluid density [kg/m³] d = inside diameter of measuring tubes [m] K to K3 = constants (depending on nominal diameter)
* To compute the pressure loss for gases, always use the formula for $Re \geq 2300$.	

Pressure loss coefficients for Promass P

DN	d [m]	K	K1	K3
8	$8.31 \cdot 10^{-3}$	$8.78 \cdot 10^{6}$	$3.53 \cdot 10^{7}$	$1.30 \cdot 10^{6}$
15	$12.00 \cdot 10^{-3}$	$1.81 \cdot 10^{6}$	$9.99 \cdot 10^{6}$	$1.87 \cdot 10^{5}$
25	$17.60 \cdot 10^{-3}$	$3.67 \cdot 10^{5}$	$2.76 \cdot 10^{6}$	$4.99 \cdot 10^{4}$
40	$26.00 \cdot 10^{-3}$	$8.00 \cdot 10^{4}$	$7.96 \cdot 10^{5}$	$1.09 \cdot 10^{4}$
50	$40.50 \cdot 10^{-3}$	$1.41 \cdot 10^{4}$	$1.85 \cdot 10^{5}$	$1.20 \cdot 10^{3}$
Pressure loss data includes interface between measuring tube and piping				

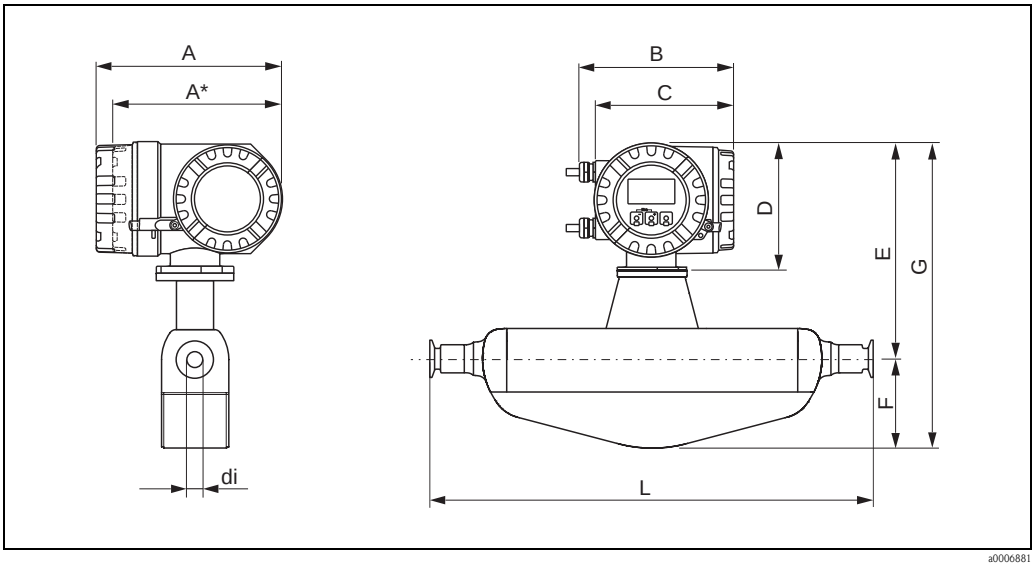


Pressure loss diagram for water

Mechanical construction

Design / dimensions

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



a0006881

A	A*	B	C	D
227	207	187	168	160

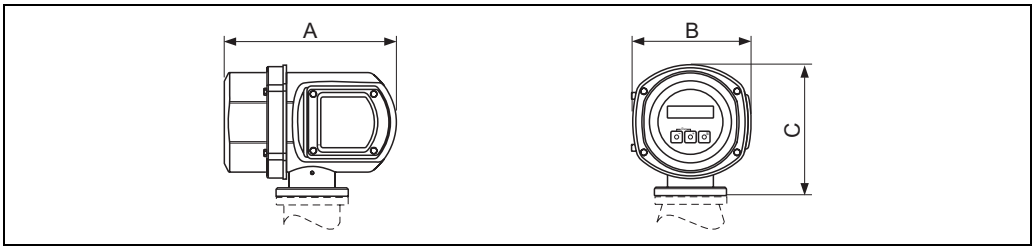
All dimensions in [mm];
* Blind version (without local display)

DN	E	F	G	L	di
8	280	108	388	*	*
15	280	108	388	*	*
25	280	121	401	*	*
40	304	173	477	*	*
50	315	241	556	*	*

All dimensions in [mm];
* dependent on respective process connection
→ For dimensions, see the following pages

Note!
Dimensions for transmitters II2G/Zone 1 → Page 26.

Transmitter compact version, Stainless Steel field housing

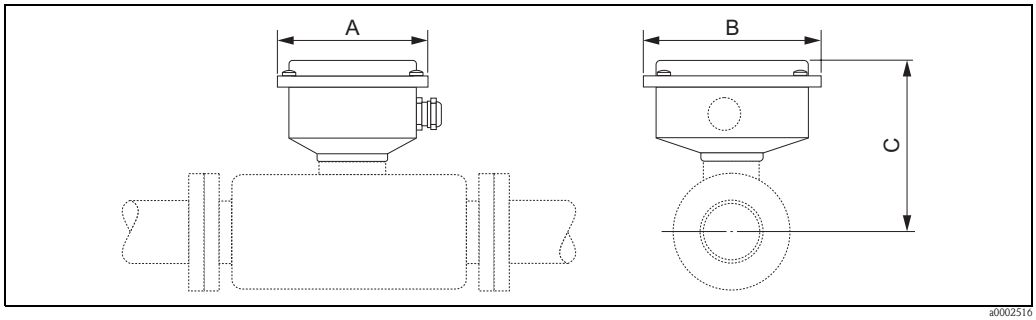


a0002245

A	B	C
225	153	168

All dimensions in [mm]

Dimensions: Remote version

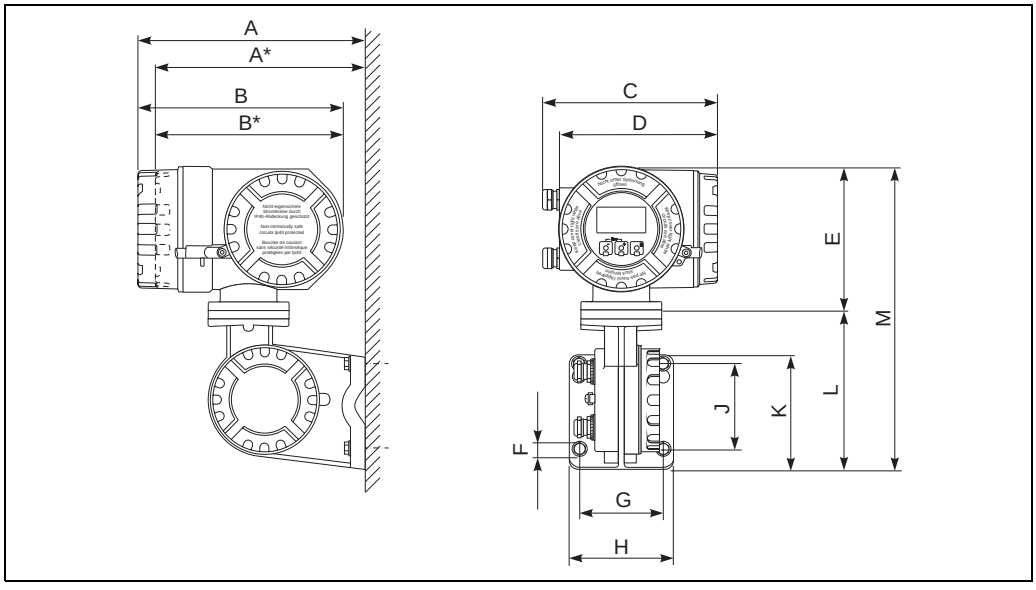


T = dimension B in the compact version (with corresponding nominal diameter) minus 153 mm

DN	A	B	C
8	118.5	137.5	113
15	118.5	137.5	113
25	118.5	137.5	113
40	118.5	137.5	118
50	118.5	137.5	130

All dimensions in [mm]

Transmitter connection housing remote version (II2G/Zone 1)



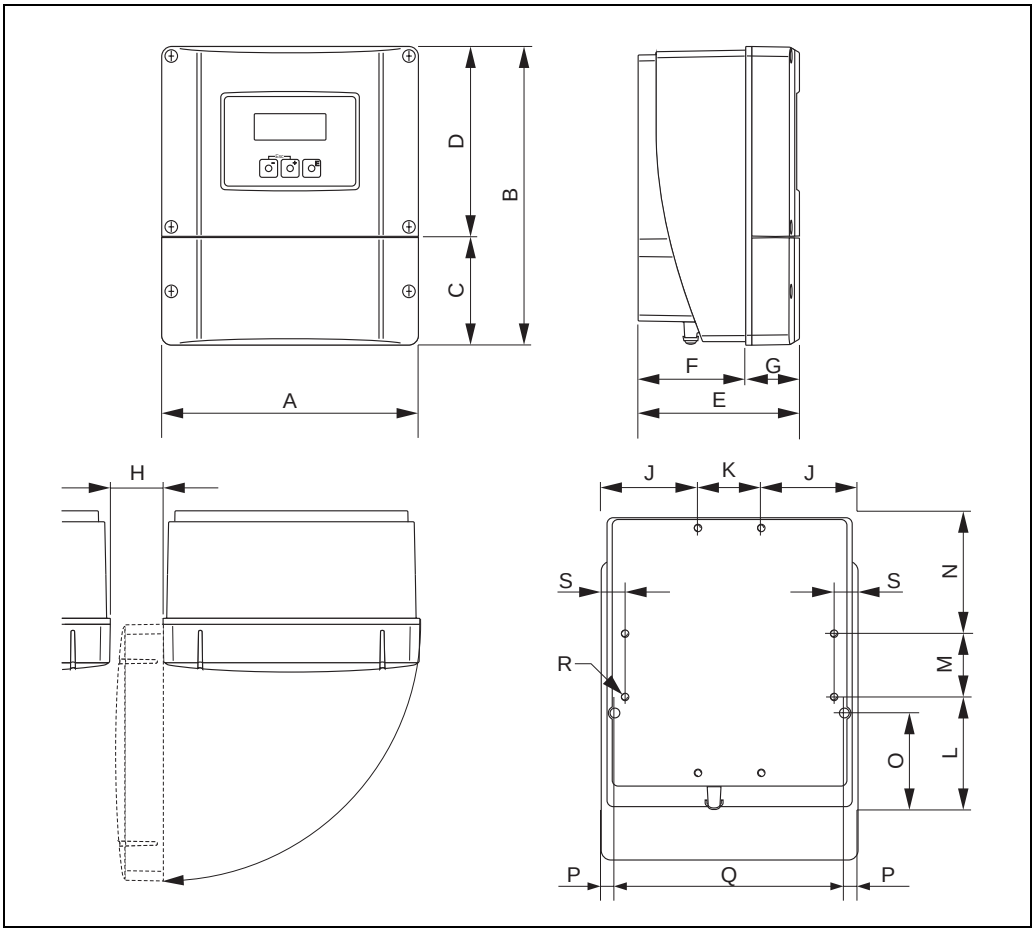
A	A*	B	B*	C	D	E
265	242	240	217	206	186	167

* Blind version (without local display)

F	G	H	J	K	L	M
∅ 8.6 (M8)	100	123	100	133	188	355

All dimensions in [mm]

Transmitter wall-mount housing (non Ex-zone and II3G/Zone 2)

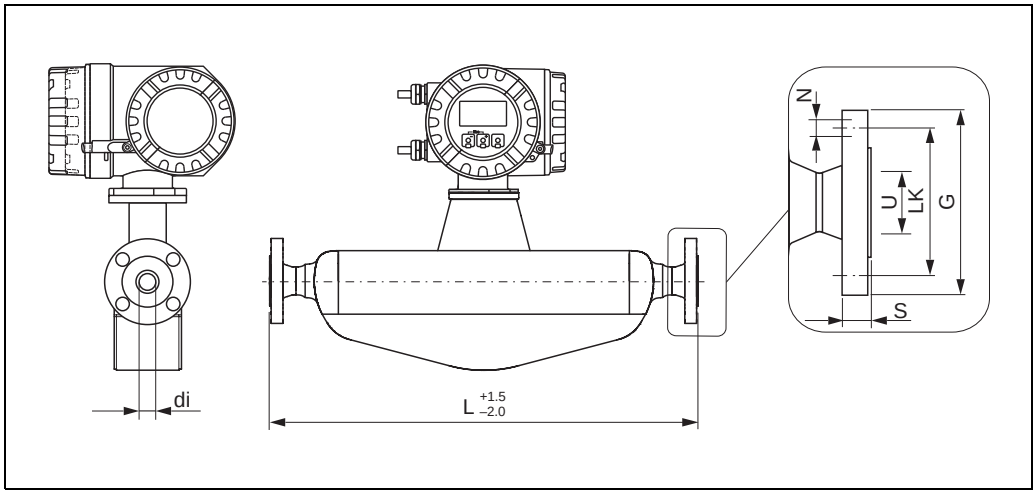


a0001150

A	B	C	D	E	F	G	H	J
215	250	90.5	159.5	135	90	45	>50	81
K	L	M	N	O	P	Q	R	S
53	95	53	102	81.5	11.5	192	8xM5	20

All dimensions in [mm]

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



a0006883-en

Flange according to EN 1092-1 (DIN 2501) / PN 40: 1.4404/316L/316

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

DN	G	L	N	S	LK	U	di
8 [1]	95.0	336	4 × Ø14	17.0	65.0	17.30	8.31
15	95.0	440	4 × Ø14	20	65	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

All dimensions in [mm]; Further dimensions → Page 25 ff.
[1] DN 8 with DN 15 flanges as standard

Flange according to EN 1092-1 (DIN 2501) / PN 63: 1.4404/316L/316

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 0.8 to 3.2 µm

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]; Further dimensions → Page 25 ff.

Flange according to ASME B16.5 / Cl 150: 1.4404/316L/316

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN		G	L	N	S	LK	U	di
8 [1]	3/8"	88.9	336	4 × Ø15.7	17.1	60.5	15.70	8.31
15	½"	88.9	440	4 × Ø15.7	17.1	60.5	15.70	12.00
25	1"	108.0	580	4 × Ø15.7	17.6	79.2	26.70	17.60
40	1 ½"	127.0	794	4 × Ø15.7	18.6	98.6	40.90	26.00
50	2"	152.4	1071	4 × Ø19.1	25.1	120.7	52.60	40.50

All dimensions in [mm]; Further dimensions → Page 25 ff.
[1] DN 8 with DN 15 flanges as standard

Flange according to ASME B16.5 / Cl 300: 1.4404/316L/316

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN		G	L	N	S	LK	U	di
8 [1]	3/8"	95.2	336	4 × Ø15.7	16.6	66.5	15.70	8.31
15	½"	95.2	440	4 × Ø15.7	16.6	66.5	15.70	12.00
25	1"	123.9	580	4 × Ø19.1	18.1	88.9	26.70	17.60
40	1 ½"	155.4	794	4 × Ø22.3	24.6	114.3	40.90	26.00
50	2"	165.1	1071	8 × Ø19.1	27.6	127.0	52.60	40.50

All dimensions in [mm]; Further dimensions → Page 25 ff.
[1] DN 8 with DN 15 flanges as standard

Flange JIS B2220 / 20K: 1.4404/316L/316

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	95	336	4 × Ø15	16	70	15.00	8.31
15	95	440	4 × Ø15	16	70	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	41.50

All dimensions in [mm]; Further dimensions → Page 25 ff.
[1] DN 8 with DN 15 flanges as standard

Flange JIS B2220 / 40K: 1.4404/316L/316

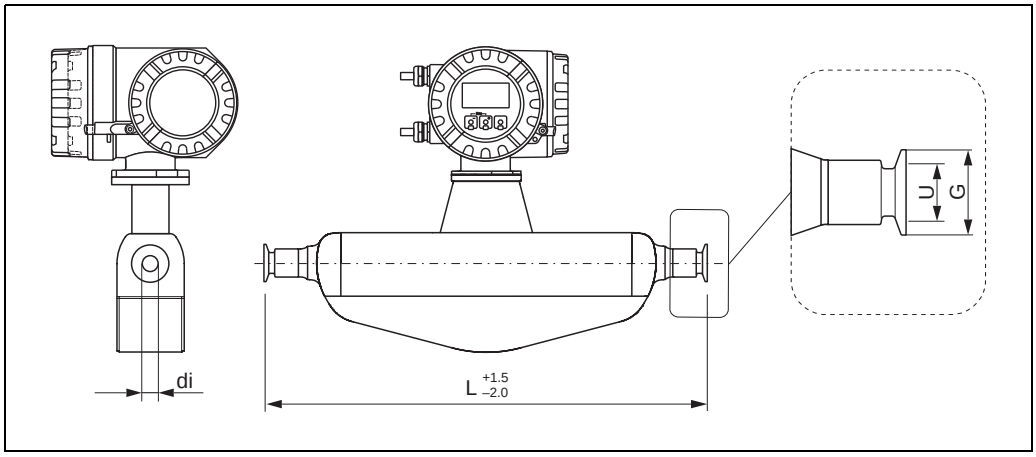
Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	115	336	4 × Ø19	21	80	15.00	8.31
15	115	440	4 × Ø19	21	80	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

All dimensions in [mm]; Further dimensions → Page 25 ff.
[1] DN 8 with DN 15 flanges as standard

Tri-Clamp

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



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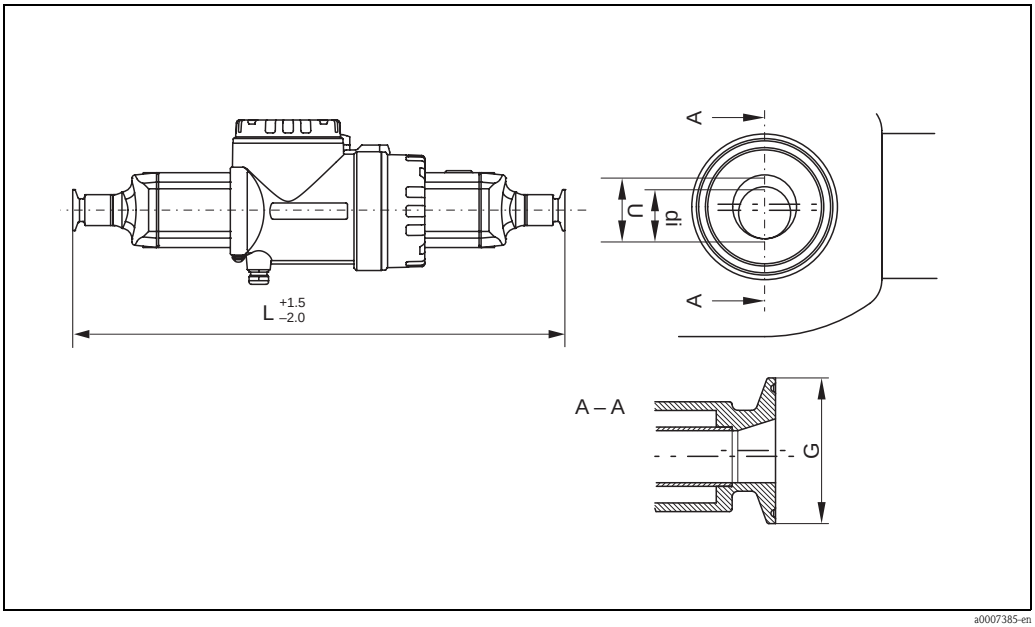
Standard ½", ¾", 1", 1½", 2" Tri-Clamp: 1.4435/316L					
DN	Clamp	G	L	U	di
8	½"	25.0	362	9.40	8.31
15	3/4"	25.0	466	15.75	12.00
25	1"	50.4	606	22.10	17.60
40	1½"	50.4	818	34.80	26.00
50	2"	63.9	1096	47.50	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished					

Option ½" Tri-Clamp: 1.4435/316L					
DN	Clamp	G	L	U	di
15	½"	25.0	466	9.40	12.00
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished					

Option ¾" Tri-Clamp: 1.4435/316L					
DN	Clamp	G	L	U	di
8	3/4"	25.0	362	15.75	8.31
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished					

Option 1" Tri-Clamp: 1.4435/316L					
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]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished					

Eccentric Tri-Clamps



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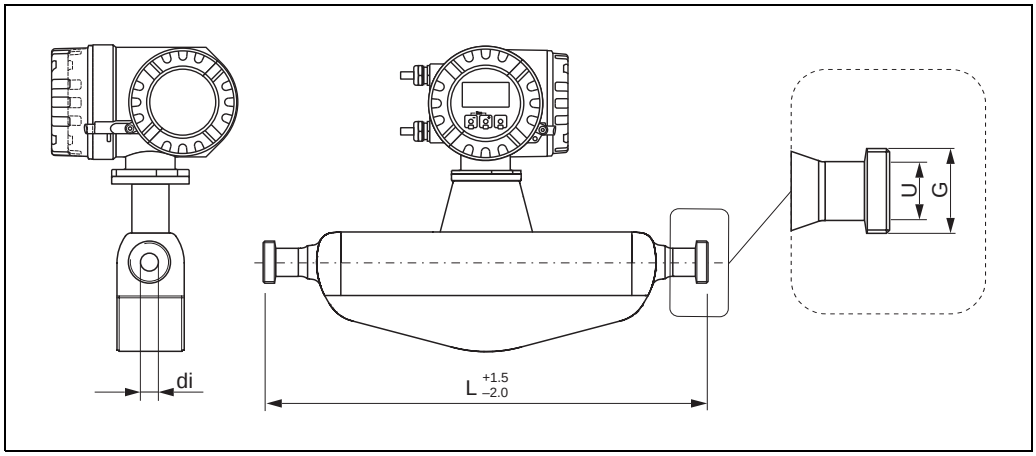
Eccentric Tri-Clamps: 1.4435/316L					
DN	Clamp	G	L	U	di
8	½"	25.0	362	9.4	8.31
15	3/4"	25.0	466	15.75	12.00
25	1"	50.4	606	22.1	17.60
40	1½"	50.4	825	34.8	26.00
50	2"	63.9	1103	47.5	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished					

Note!
Further information refer to "Special installation instruction for Promass P with Eccentric Tri-clamps"
→ Page 19

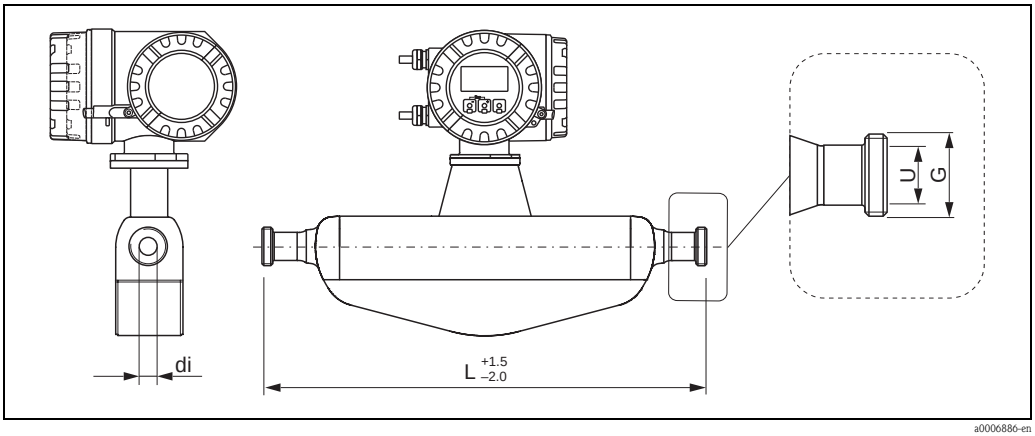
DIN 11851 (threaded hygienic connection)



Threaded hygienic connection DIN 11851: 1.4435/316L				
DN	G	L	U	di
8	Rd 34 × 1/8"	362	16.00	8.31
15	Rd 34 × 1/8"	466	16.00	12.00
25	Rd 52 × 1/6"	606	26.00	17.60
40	Rd 65 × 1/6"	825	38.00	26.00
50	Rd 78 × 1/6"	1107	50.00	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

Threaded hygienic connection Rd 28 × 1/8" DIN 11851: 1.4435/316L				
DN	G	L	U	di
8	Rd 28 × 1/8"	362	10.00	8.31
15	Rd 28 × 1/8"	466	10.00	12.00
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

DIN 11864-1 Form A (threaded hygienic connection)



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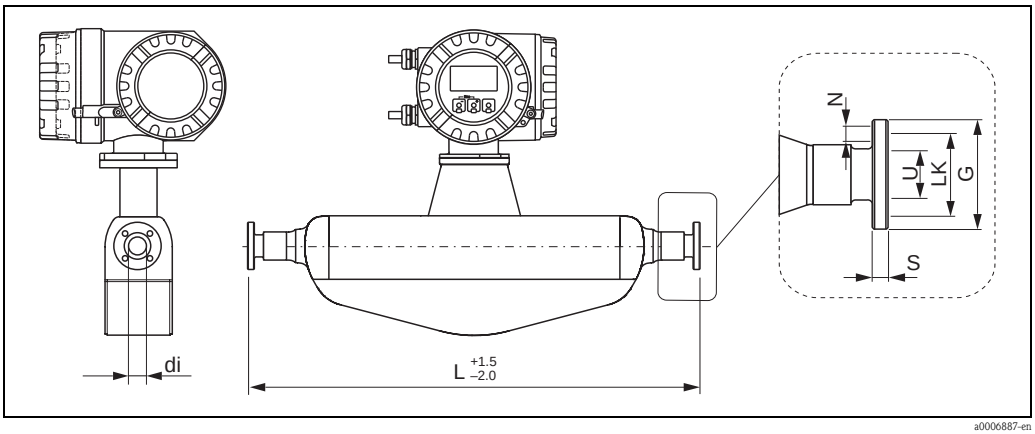
Threaded hygienic connection DIN 11864-1 Form A: 1.4435/316L				
DN	G	L	U	di
8	Rd 34 × 1/8"	362	16.00	8.31
15	Rd 34 × 1/8"	466	16.00	12.00
25	Rd 52 × 1/6"	620	26.00	17.60
40	Rd 65 × 1/6"	825	38.00	26.00
50	Rd 78 × 1/6"	1107	50.00	40.50

All dimensions in [mm]; Further dimensions → Page 25 ff.
Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished

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



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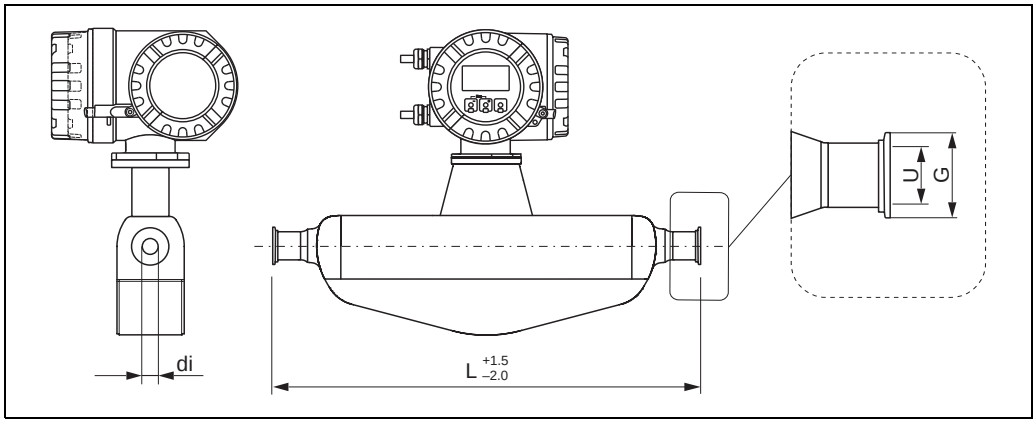
DIN 11864-2 Form A (flat flange with groove): 1.4435/316L							
DN	G	L	N	S	LK	U	di
8	59.0	384	4 × Ø9	10	42	16.00	8.31
15	59.0	488	4 × Ø9	10	42	16.00	12.00
25	70	626	4 × Ø9	10	53	26.00	17.60
40	82	840	4 × Ø9	10	65	38.00	26.00
50	94	1120	4 × Ø9	10	77	50.00	40.50

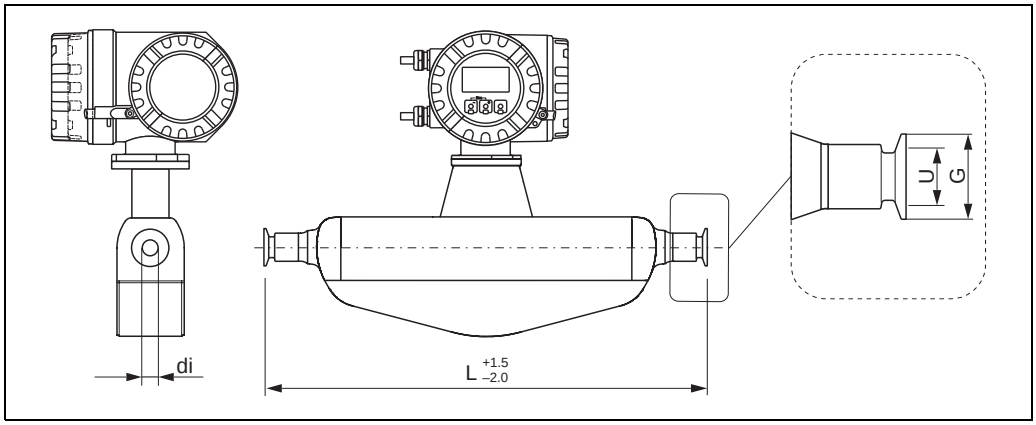
All dimensions in [mm]; Further dimensions → Page 25 ff.
Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished

DIN 11864-3 Form A (clamp)



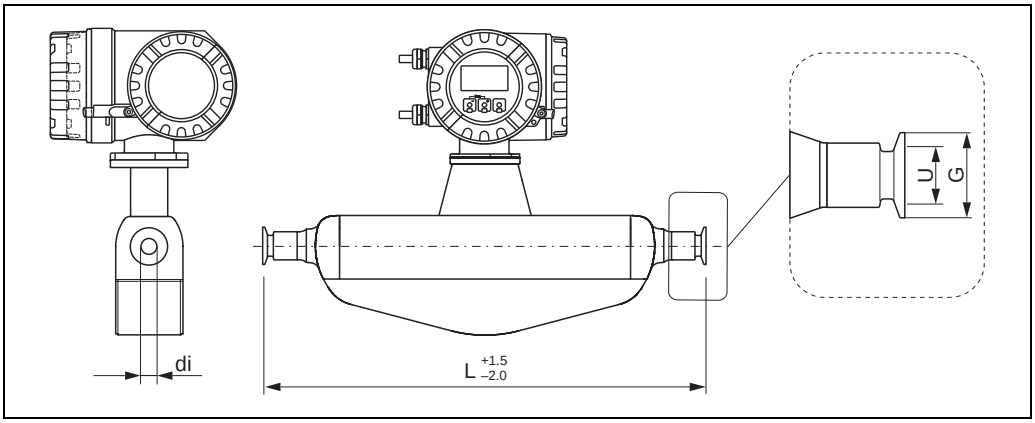
Clamp DIN 11864-3 Form A: 1.4435/316L				
DN	G	L	U	di
8	34.0	370	16.05	8.31
15	34.0	474	16.05	12.00
25	50.5	614	26.05	17.60
40	64.0	825	38.05	26.00
50	77.5	1096	50.05	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

DIN 32676 (clamp)



Clamp DIN 32676: 1.4435/316L				
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]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

ISO 2852 (clamp)



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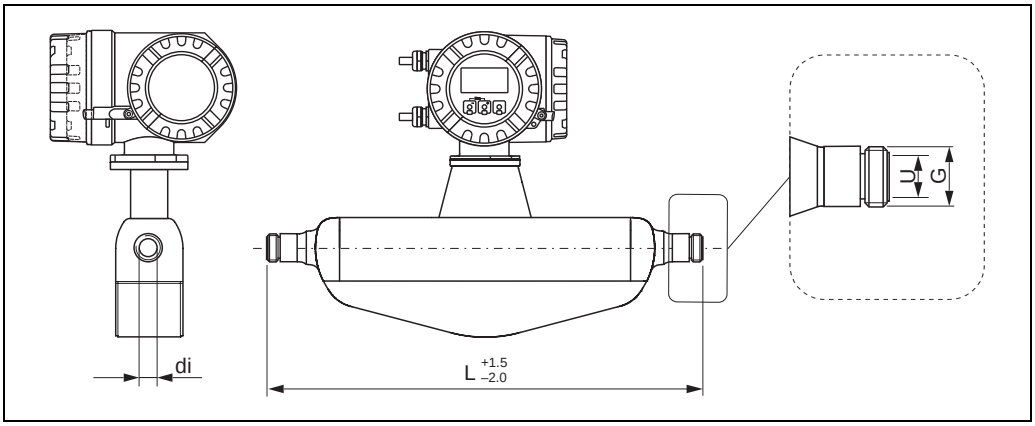
Clamp ISO 2852: 1.4435/316L				
DN	G	L	U	di
8	50.5	362	22.60	8.31
15	50.5	466	22.60	12.00
25	50.5	606	22.60	17.60
40	50.5	818	35.60	26.00
50	64.0	1096	48.60	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

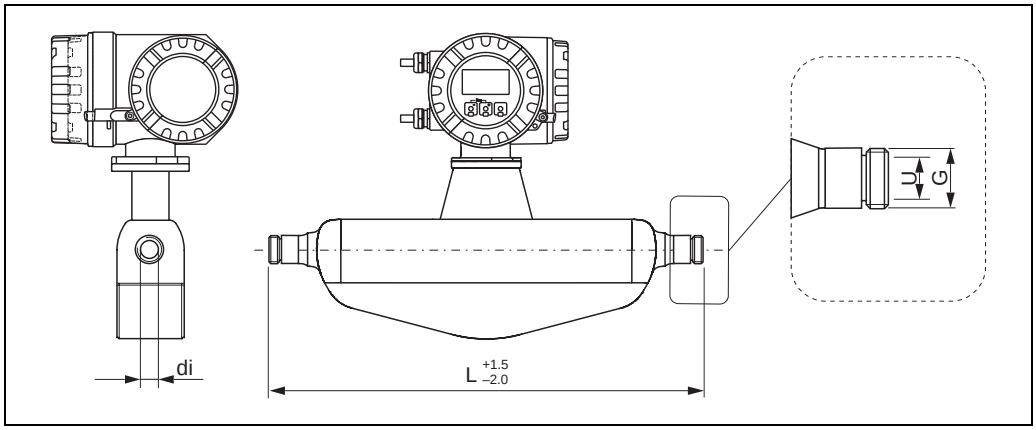
ISO 2853 (threaded hygienic connection)



a0006889-en

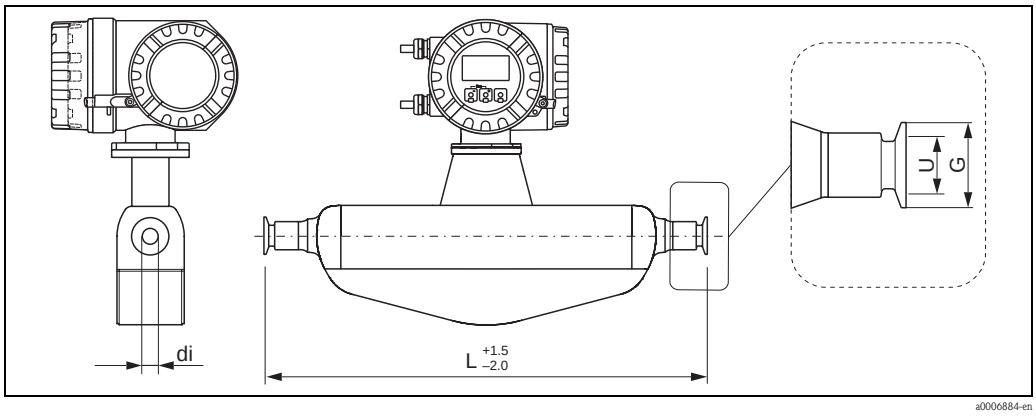
Threaded hygienic connection ISO 2853: 1.4435/316L				
DN	G	L	U	di
8	37.13	370	22.60	8.31
15	37.13	474	22.60	12.00
25	37.13	614	22.60	17.60
40	50.65	829	35.60	26.00
50	64.1	1107	48.60	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

SMS 1145 (threaded hygienic connection)



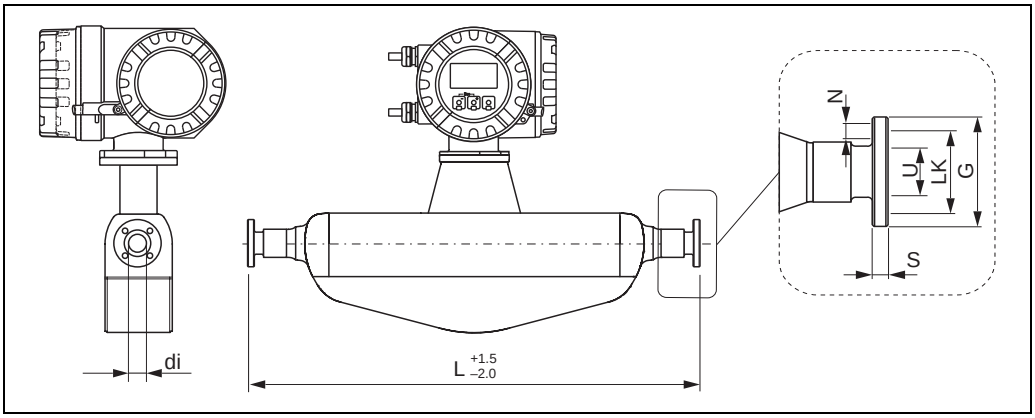
Threaded hygienic connection SMS 1145: 1.4435/316L				
DN	G	L	U	di
8	Rd 40 × 1/6"	362	22.50	8.31
15	Rd 40 × 1/6"	466	22.50	12.00
25	Rd 40 × 1/6"	606	22.50	17.60
40	Rd 60 × 1/6"	829	35.50	26.00
50	Rd 70 × 1/6"	1107	48.50	40.50
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

Neumo BioConnect (clamp)



Neumo BioConnect Clamp: 1.4435/316L				
DN	G	L	U	di
8	25	362	10.00	8.31
15	25	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]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

Neumo BioConnect (flange)

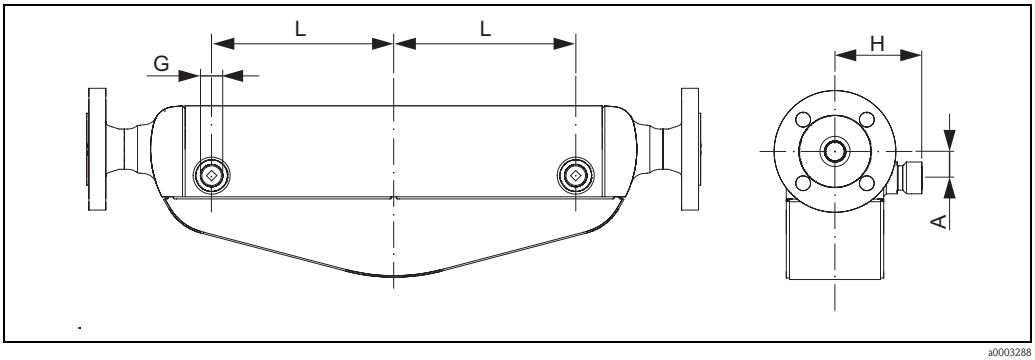


a0006887-en

Neumo BioConnect flange: 1.4435/316L							
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]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished							

Purge connections / secondary containment monitoring

Caution!
The secondary containment is filled with dry nitrogen (N_2). 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.



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DN	L	H	A	G
8	55	82	25	½" NPT
15	102	82	25	½" NPT
25	172	82	25	½" NPT
40	263	102	45	½" NPT
50	381.5	119.5	58	½" NPT
All dimensions in [mm]; Further dimensions → Page 25 ff. Version available Ra_{max} = 0.76 µm or Ra_{max} = 0.38 µm electropolished				

Weight

- Compact version: see table below
- Remote version
  - Sensor: see table below
  - Wall-mount housing: 5 kg

DN	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].

Materials

Transmitter housing:

Transmitter housing compact
- Compact housing: powder coated die-cast aluminium
- Stainless steel field housing: 1.1.4301/ASTM 304
- Window material: glass or polycarbonate

Transmitter housing remote
- Field housing: powder-coated die-cast aluminium
- Wall-mount housing: powder coated die-cast aluminium
- Window material: glass

Sensor housing / containment:

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

Connection housing, sensor (remote version):

- Stainless Steel 1.4301/ASTM 304

Process connections

All hygienic process connection are 3A approved and EHEDG certified
All Tri-Clamp connections correspond to the relevant ASME BPE hygienic clamp dimensions

Stainless Steel 1.4435/316L
- DIN 11864-2 Form A (flat flange with groove)
- Flange Neumo BioConnect
- Threaded hygienic connection:
  - DIN 11864-1, Form A
  - DIN 11851
  - SMS 1145
  - ISO 2853
- Tri-Clamp
- Tri-Clamp (Eccentric)
- Clamp aseptic according to
  - DIN 11864-3, Form A
  - DIN 32676
  - ISO 2852
  - Neumo BioConnect

Stainless Steel 1.4404/316/316L
- Flanges according to EN 1092-1 (DIN 2501)
- Flanges according to ASME B16.5
- Flanges JIS B2220

Measuring tubes:

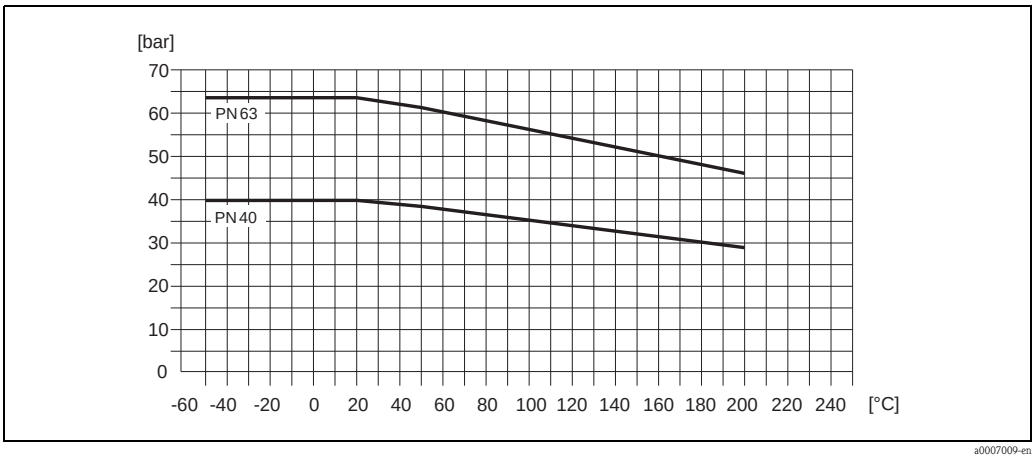
- Stainless Steel 1.4435/316L
- Wetted parts surface finish (measuring tube and process connection)
- Finish quality:
  - Ra_{max} = 0.76 µm (mechanically polished)
  - Ra_{max} = 0.38 µm (electropolished)
- Delta ferrite < 1%

Material load curves

Warning!
The following material loade curves refer to the entire sensor and not just the process conection.

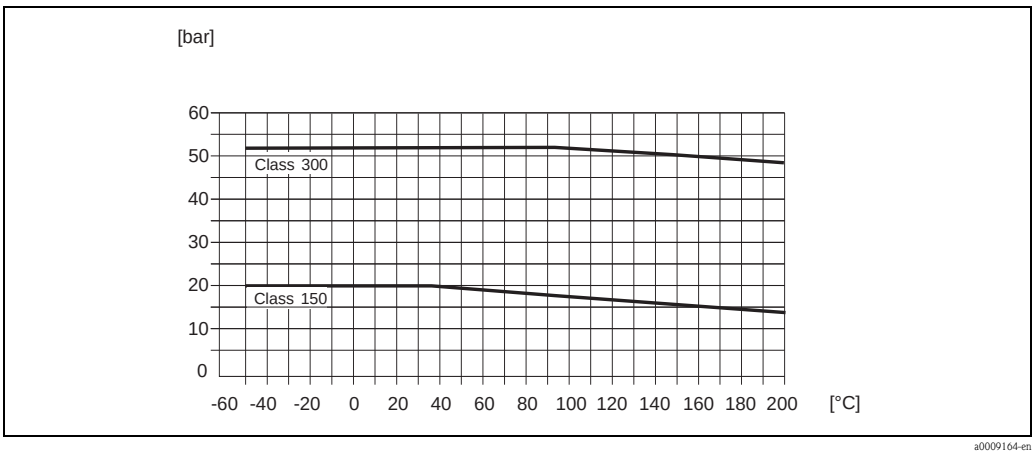
Flange connection according to EN 1092-1 (DIN 2501)

Flange material: 1.4404



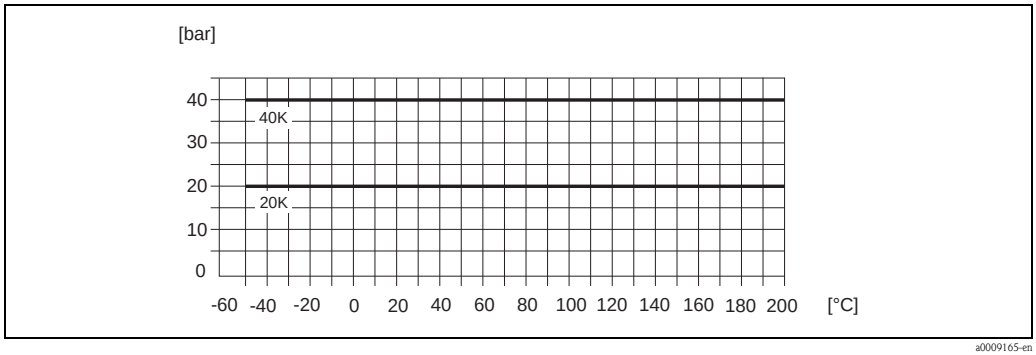
Flange connection according to ASME B16.5

Flange material: 316/316L



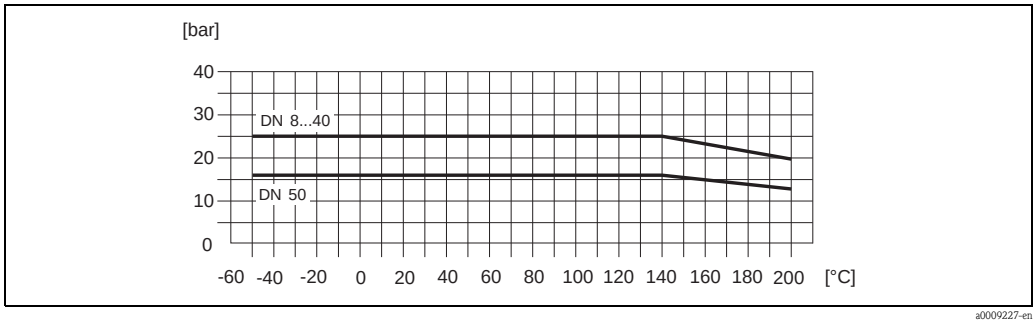
Flange connection to JIS B2220

Flange material: 1.4404/316/316L



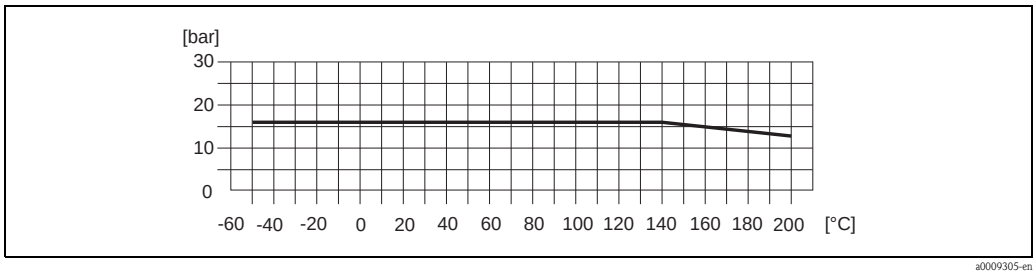
DIN 11864-2 Form A (flat flange with groove)

Flange material: 1.4435/316L



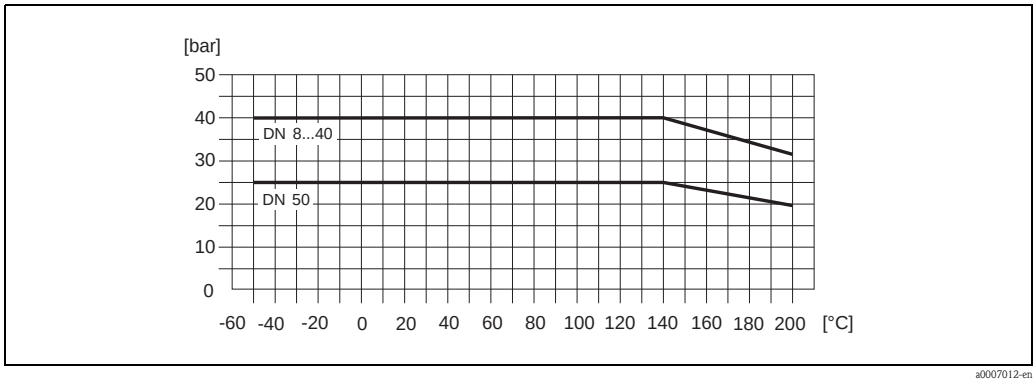
Neumo BioConnect Flange (flat flange)

Flange material: 1.4435/316L



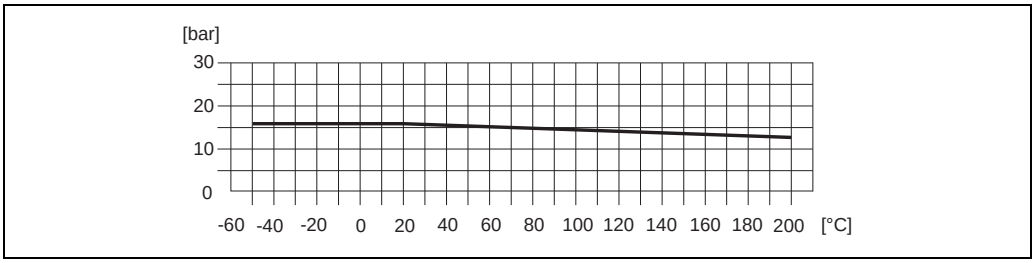
DIN 11864-1 Form A (threaded hygienic connection), DIN 11864-3 Form A (clamp)

Connection material: 1.4435/316L



ISO 2853 (threaded hygienic connection)

Connection material: 1.4435/316L



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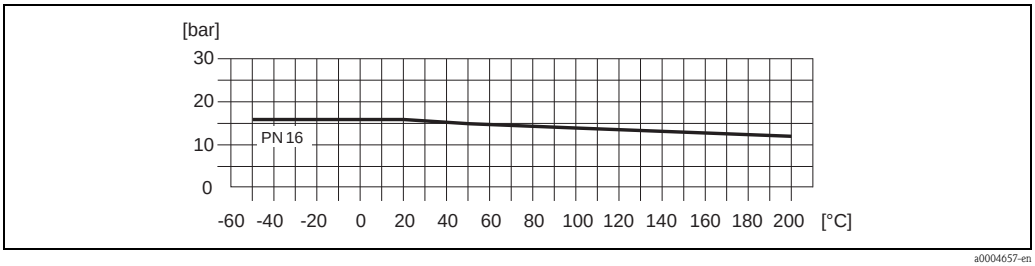
DIN 11851 / SMS 1145 (threaded hygienic connection)

Flanschwerkstoff: 1.4435/316L



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Tri-Clamp, ISO 2852 (clamp), DIN 32676 (clamp) and Neumo BioConnect (clamp)

PC = 16 bar
The clamp connections are suitable up to a maximum pressure of 16 bar. Please observe the operating limits of the clamp and seal used as they could be under 16 bar. The clamp and seal do not form part of the scope of supply.

Process connections

See Page 38 → Materials → Process connections

Human interface

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 °C the readability of the display may be impaired.

Unified control concept for both types of transmitter

Promass 80:

- Local operation with three keys (–, +, E)
- Quick Setup menus for straightforward commissioning

Promass 83:

- Local operation with three optical keys (−/+/E)
- Application-specific Quick Setup menus for straightforward commissioning

Language groups

Note!
The language group is changed using the "FieldCare" operating program.

Language groups available for operation in different countries:

- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe/Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish and Czech
- South and Eastern Asia (SEA):
  English, Japanese, Indonesian

Only Promass 83:

- China (CN):
  English, Chinese

Remote operation

Promass 80:

Remote operation via HART, PROFIBUS PA

Promass 83:

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

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
- ASME BPE Certificate of Compliance to relevant scope

The scope is based on the ASME BPE 2005 Standard and is subject to revisions based an 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.

Flow calibration

- 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

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.
In addition we do not use any material of animal origin during the polishing processes.
Endress+Hauser therefore can confirm to TSE compliance.

Additional test and Inspections

The following tests and inspection are offered as standard:
- 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

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.

FOUNDATION Fieldbus certification

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:

- Certified to FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus H1.
- Interoperability Test Kit (ITK), revision status 4.0 (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

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:

- 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.

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- 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

Pressure Equipment Directive

Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. For larger nominal diameters, optional approvals according to Cat. II/III are available when required (depends on fluid and process pressure).

Functional safety

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

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

Promass 80

Promass80***-************A
Promass80***-************D
Promass80***-************S
Promass80***-************T
Promass80***-************8

Promass 83

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

Ordering information

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

Accessories

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

Documentation

- Flow measurement (FA005D/06)
- Technical Information Promass 80F, 80M, 83F, 83M (TI053D/06)
- Technical Information Promass 80E, 83E (TI061D/06)
- Technical Information Promass 80A, 83A (TI054D/06)
- Technical Information Promass 80H, 83H (TI074D/06)
- Technical Information Promass 80I, 83I (TI075D/06)
- Technical Information Promass 80S, 83S (TI076D/06)
- Operating Instructions Promass 80 (BA057D/06)
- Operating Instructions Promass 80 PROFIBUS PA (BA072D/06)
- Operating Instructions Promass 83 (BA059D/06)
- Operating Instructions Promass 83 FOUNDATION Fieldbus (BA065D/06)
- Operating Instructions Promass 83 PROFIBUS DP/PA(BA063D/06)
- Operating Instructions Promass 83 MODBUS (BA107D/06)
- Description of Device Functions Promass 80 (BA058D/06)
- Description of Device Functions Promass 80 PROFIBUS PA (BA073D/06)
- Description of Device Functions Promass 83 (BA060D/06)
- Description of Device Functions Promass 83 FOUNDATION Fieldbus (BA066D/06)
- Description of Device Functions Promass 83, PROFIBUS DP/PA (BA064D/06)
- Description of Device Functions Promass 83 MODBUS (BA108D/06)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IECEx, NEPSI
- Functional safety manual Promass 80, 83 (SD077D/06)

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FOUNDATION™ Fieldbus
Registered trademark of the Fieldbus FOUNDATION, Austin, USA

MODBUS®
Registered trademark of the MODBUS Organization

BioConnect®
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