

Technical Information

Proline Promass 80/83 F, M

Coriolis Mass Flow Measuring System

The universal and multivariable flowmeter for liquids and gases



Application

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

- Extremely accurate measurement of liquids and gases such as oils, lubricants, fuels, liquefied gases, solvents, foodstuffs and compressed gases (CNG)
- Fluid temperatures up to +350 C
- Process pressures up to 350 bar
- Mass flow measurement up to 2200 t/h

Approvals for hazardous area:

- ATEX, FM, CSA, TIIS

Approvals in the food industry/hygiene sector:

- 3A, FDA

Connection to all common process control systems:

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

Relevant safety aspects:

- Secondary containment (up to 100 bar), Pressure Equipment Directive, SIL-2

Features and benefits

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

The **Proline transmitter concept** comprises:

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

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

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

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Function and system design

Measuring principle

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

$$F_C = 2 \cdot \Delta m (v \cdot \omega)$$

F_C = Coriolis force

Δm = moving mass

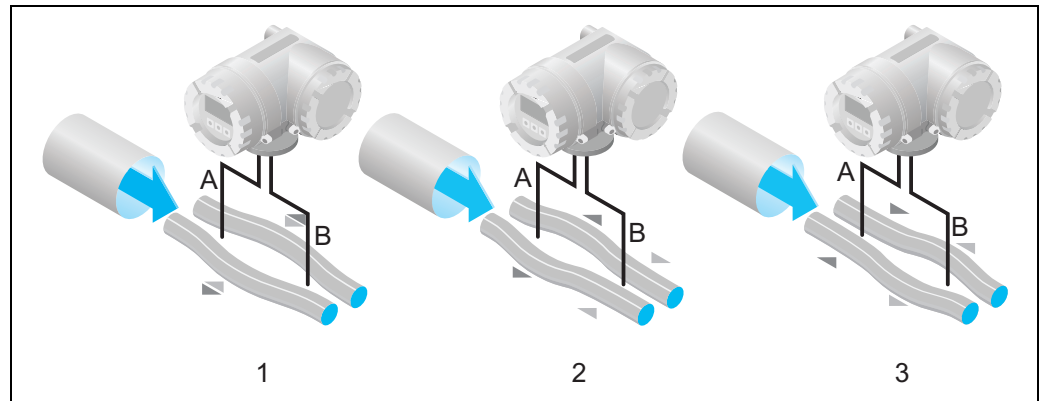
ω = rotational velocity

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.

In the Promass F and M sensors, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):

- At zero flow, in other words when the fluid is at a standstill, the two tubes oscillate in phase (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



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

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

Density measurement

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

Temperature measurement

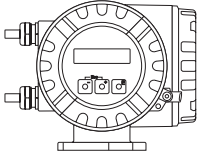
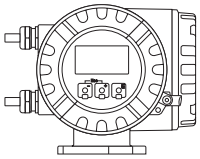
The temperature of the measuring tubes is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output.

Measuring system

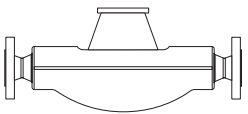
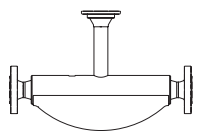
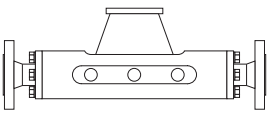
The measuring system consists of a transmitter and a sensor. Two versions are available:

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

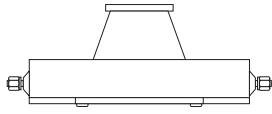
Transmitter

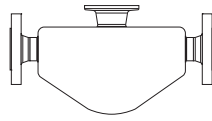
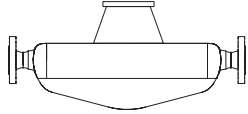
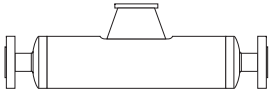
<p>Promass 80</p>  <p style="text-align: right; font-size: small;">a0003671</p>	<ul style="list-style-type: none"> ■ Two-line liquid-crystal display ■ Operation with push buttons
<p>Promass 83</p>  <p style="text-align: right; font-size: small;">a0003672</p>	<ul style="list-style-type: none"> ■ Four-line 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>F</p>  <p style="text-align: right; font-size: small;">a0003673</p>	<ul style="list-style-type: none"> ■ Universal sensor for fluid temperatures up to 200 °C. ■ Nominal diameters DN 8 to 250 ■ Tube material: stainless steel or Alloy C-22 	<p>Documentation No. TI 053D/06/en</p>
<p>F (High-temperature)</p>  <p style="text-align: right; font-size: small;">a0003675</p>	<ul style="list-style-type: none"> ■ Universal high-temperature sensor for fluid temperatures up to 350 °C. ■ Nominal diameters DN 25, 50, 80 ■ Tube material: Alloy C-22 	
<p>M</p>  <p style="text-align: right; font-size: small;">a0003676</p>	<ul style="list-style-type: none"> ■ 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 ■ Tube material: titanium 	

Additional sensors in separate documentation

<p>A</p>  <p style="text-align: right; font-size: small;">a0003679</p>	<ul style="list-style-type: none"> ■ Single-tube system for highly accurate measurement of very small flows ■ Nominal diameters DN 1 to 4 ■ Tube material: stainless steel or Alloy C-22 	<p>Documentation No. TI 054D/06/en</p>
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<p>E</p>  <p>a0002271</p>	<ul style="list-style-type: none"> ■ General purpose sensor, ideal replacement for volumetric flowmeters. ■ Nominal diameters DN 8 to 50 ■ Tube material: stainless steel 	<p>Documentation No. TI 061D/06/en</p>
<p>H</p>  <p>a0003677</p>	<ul style="list-style-type: none"> ■ Single bent tube. Low pressure loss and chemically resistant material ■ Nominal diameters DN 8 to 50 ■ Tube material: zirconium 	<p>Documentation No. TI 052D/06/en</p>
<p>I</p>  <p>a0003678</p>	<ul style="list-style-type: none"> ■ Straight single-tube instrument. Minimal shear stress on fluid, hygienic design, low pressure loss. ■ Nominal diameters DN 8 to 80 ■ Tube material: titanium 	

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) $m_{\min(F)}$ to $m_{\max(F)}$
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
80	0 to 180000 kg/h
100 (only Promass F)	0 to 350000 kg/h
150 (only Promass F)	0 to 800000 kg/h
250 (only Promass F)	0 to 2200000 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:

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

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

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

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

$$x = 160 \text{ (Promass F DN 8 to 100, Promass M); } x = 250 \text{ (Promass F DN 150 to 250)}$$

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

Calculation example for gas:

- Sensor type: Promass F, 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 = 160 (for Promass F DN 50)

Max. possible full scale value:

$$m_{\max(G)} = m_{\max(F)} \cdot \rho_{(G)} : x \text{ [kg/m}^3\text{]} = 70000 \text{ kg/h} \cdot 60.3 \text{ kg/h} : 160 \text{ kg/m}^3 = 26400 \text{ kg/h}$$

Recommended measuring ranges:

See information in the “Limiting flow” Section → Page 21 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).

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% of full scale value/C, resolution: 0.5 μA

- Active: 0/4 to 20 mA, R_L < 700 Ω (for HART: R_L ≥ 250 Ω)
- Passive: 4 to 20 mA; supply voltage U_s 18 to 30 V DC; R_i ≥ 150 Ω

Pulse/frequency output:

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

- Frequency output: end 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 can be selected, pulse width adjustable (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
- Permissible 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 x Analog Input, 1 x 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 set at the measuring device via miniature switches or the onsite 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% of full scale value/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: end 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 can be selected, pulse width adjustable (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 x Analog Input, 3 x Totalizer
- Output data: Mass flow, Volume flow, Corrected volume flow, Density, Reference density, Temperature, Totalizer 1 to 3
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Totalizer control
- Bus address can be set at the measuring device via miniature switches or the onsite display (optional)
- Available output combination → Page 10

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
- Permissible 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 x Analog Input, 3 x Totalizer
- Output data: Mass flow, Volume flow, Corrected volume flow, Density, Reference density, Temperature, Totalizer 1 to 3
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Totalizer control
- Bus address can be set at the measuring device via miniature switches or the onsite display (optional)
- Available output combination → Page 10

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 baudrate: 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
- Available output combination → Page 10

FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Data transmission rate: 31.25 kBit/s
- Current consumption: 12 mA
- Permissible 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 x Analog Input, 1 x Digital Output, 1 x PID
- Output data: Mass flow, Volume flow, Corrected volume flow, Density, Reference density, Temperature, Totalizer 1 to 3
- Input data: Positive zero return (ON/OFF), Zero point adjustment, Measuring mode, Reset totalizer
- Link master function (LM) 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.

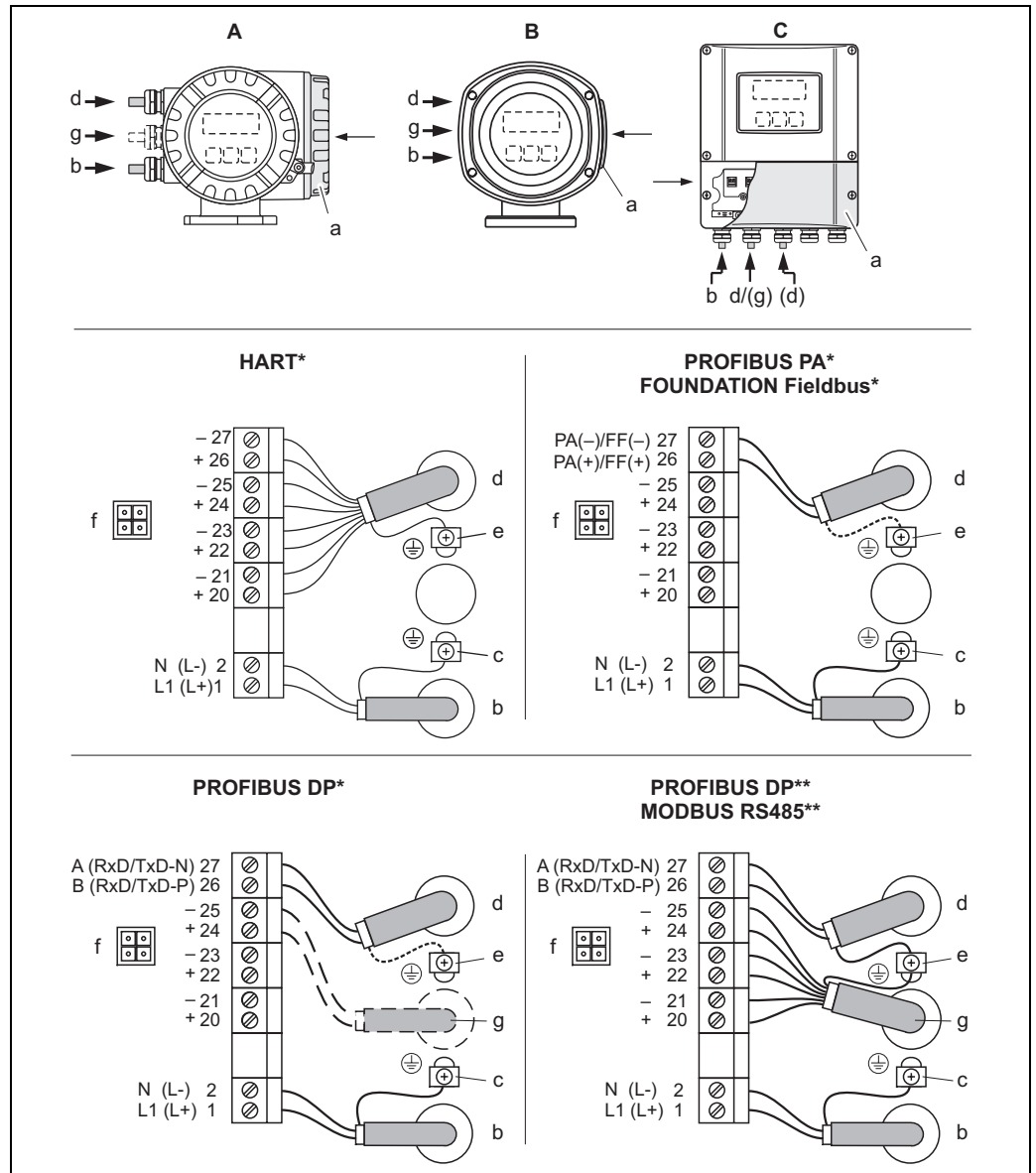
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.

Relay output (only 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



a0002441

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 boards

**) Flexible communication boards

a Cover of the connection compartment

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 10

Fieldbus cable:

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

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

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

f Service connector for connecting service interface FXA 193 (FieldCheck, ToF Tool - Fieldtool Package)

g Signal cable: See Terminal assignment → Page 10

Cable for external termination (only for PROFIBUS DP with fixed 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

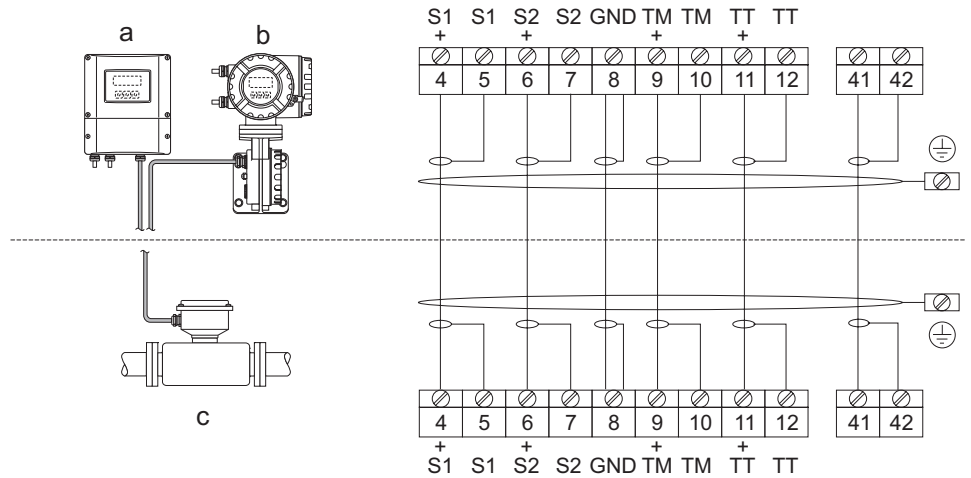
Promass 83

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 (-)
<i>Fixed communication boards (permanent assignment)</i>				
83***_*****A	-	-	Frequency output	Current output HART
83***_*****B	Relay output	Relay output	Frequency output	Current output HART
83***_*****F	-	-	-	PROFIBUS PA, Ex i
83***_*****G	-	-	-	FOUNDATION Fieldbus Ex i
83***_*****H	-	-	-	PROFIBUS PA
83***_*****J	-	-	+5V (ext. termination)	PROFIBUS DP
83***_*****K	-	-	-	FOUNDATION Fieldbus
83***_*****Q	-	-	Status input	MODBUS RS485
83***_*****R	-	-	Current output 2 Ex i, active	Current output 1 Ex i active, HART
83***_*****S	-	-	Frequency output Ex i, passive	Current output Ex i Active, HART
83***_*****T	-	-	Frequency output Ex i, passive	Current output Ex i Passive, HART
83***_*****U	-	-	Current output 2 Ex i, passive	Current output 1 Ex i passive, HART
<i>Flexible communication boards</i>				
83***_*****C	Relay output 2	Relay output 1	Frequency output	Current output HART
83***_*****D	Status input	Relay output	Frequency output	Current output HART
83***_*****E	Status input	Relay output	Current output 2	Current output 1 HART
83***_*****L	Status input	Relay output 2	Relay output 1	Current output HART

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
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



Connection of 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 Flange version remote version

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

a0003681

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 x 1.5 (8 to 12 mm)
 ■ Thread for cable entries, 1/2" NPT, G 1/2"

Connecting cable for remote version:

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

Cable specifications, remote version

- 6 x 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
- 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 EN 61326/A1, 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 measuring system data if the power supply fails
- HisotROM/S-DAT: exchangeable data storage chip with sensor specific data (nominal diameter, serial number, calibration factor, zero point, etc.)

Potential equalization

No measures necessary.

Performance characteristics

Reference operating conditions

Error limits following ISO/DIS 11631:

- 20 °C to 30 °C; 2 to 4 bar
- Calibration systems as per national norms
- 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. The additional measured error at the current output is typically ±5 µA.

o.r. = of reading

Mass flow (liquid):

Promass 80 F, M:

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

Promass 83 F, M:

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

Mass flow (gas):

Promass 80/83 F:

$\pm 0.35\% \pm [(zero\ point\ stability : measured\ value) \cdot 100]\% o.r.$

Promass 80/83 M:

$\pm 0.50\% \pm [(zero\ point\ stability : measured\ value) \cdot 100]\% o.r.$

Volume flow (liquid)

Promass 80 F:

$\pm 0.20\% \pm [(zero\ point\ stability : measured\ value) \cdot 100]\% o.r.$

Promass 83 F:

$\pm 0.15\% \pm [(zero\ point\ stability : measured\ value) \cdot 100]\% o.r.$

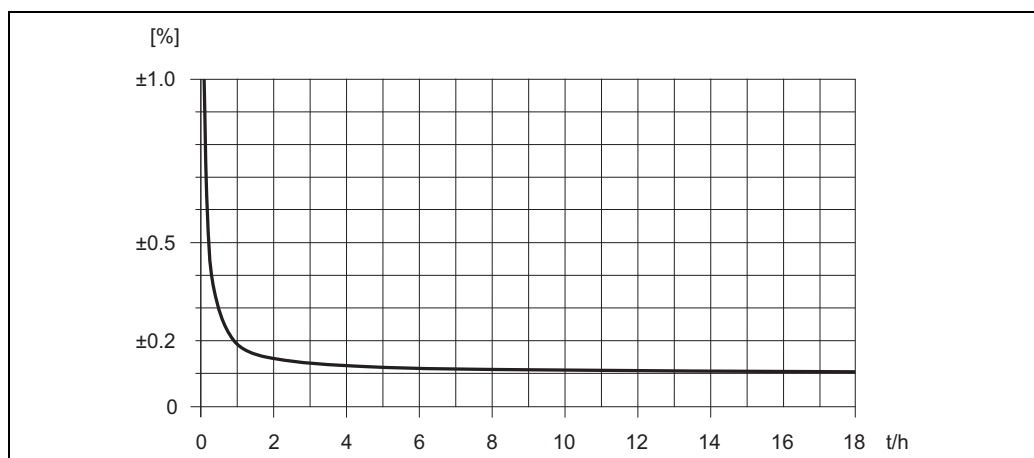
Promass 80/83 M:

$\pm 0.25\% \pm [(zero\ point\ stability : measured\ value) \cdot 100]\% o.r.$

Zero point stability (Promass F, M):

DN	Max. full scale value [kg/h] or [l/h]	Zero point stability		
		Promass F [kg/h] or [l/h]	Promass F (high-temperature) [kg/h] or [l/h]	Promass M [kg/h] or [l/h]
8	2000	0.030	–	0.100
15	6500	0.200	–	0.325
25	18000	0.540	1.80	0.90
40	45000	2.25	–	2.25
50	70000	3.50	7.00	3.50
80	180000	9.00	18.00	9.00
100	350000	14.00	–	–
150	800000	32.00	–	–
250	2200000	88.00	–	–

Sample calculation



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

Calculation example (mass flow, liquid):

Given: Promass 83 F / DN 25, measured value flow = 8000 kg/h

Max. measured error: $\pm 0.10\% \pm [(zero\ point\ stability : measured\ value) \cdot 100]\%$ o.r.

Max. measured error: $\pm 0.10\% \pm 0.54\ kg/h : 8000\ kg/h \cdot 100\% = \pm 0.107\%$

Density (liquid)

1 g/cc = 1 kg/l

Standard calibration:

Promass F

$\pm 0.01\ g/cc$

Promass M

$\pm 0.02\ g/cc$

*Special density calibration (optional), not for high-temperature version
(calibration range = 0.8 to 1.8 g/cc, 5 °C to 80 °C):*

Promass F

$\pm 0.001\ g/cc$

Promass M

$\pm 0.002\ g/cc$

After field density calibration or under reference conditions:

Promass F

$\pm 0.0005\ g/cc$

Promass M

$\pm 0.0010\ g/cc$

Temperature

Promass F, M:

$\pm 0.5\ ^\circ C \pm 0.005 \cdot T$ (T = medium temperature in °C)

Repeatability

Mass flow (liquid):

$\pm 0.05\% \pm [1/2 \cdot (zero\ point\ stability : measured\ value) \cdot 100]\%$ o.r.

Mass flow (gas):

$\pm 0.25\% \pm [1/2 \cdot (zero\ point\ stability : measured\ value) \cdot 100]\%$ o.r.

Volume flow (liquid):

Promass F:

$\pm 0.05\% \pm [1/2 \cdot (zero\ point\ stability : measured\ value) \cdot 100]\%$ o.r.

Promass M:

$\pm 0.10\% \pm [1/2 \cdot (zero\ point\ stability : measured\ value) \cdot 100]\%$ o.r.

o.r. = of reading

Zero point stability: see "Max. measured error" → Page 12 ff.

Calculation example (mass flow, liquid):

Given: Promass 83 F / DN 25, measured value flow = 8000 kg/h

Repeatability: $\pm 0.05\% \pm [1/2 \cdot (zero\ point\ stability : measured\ value) \cdot 100]\%$ o.r.

Repeatability: $\pm 0.05\% \pm 1/2 \cdot 0.54\ kg/h : 8000\ kg/h \cdot 100\% = \pm 0.053\%$

Density measurement (liquid)

1 g/cc = 1 kg/l

Promass F:

±0.00025 g/cc

Promass M:

±0.0005 g/cc

Temperature measurement

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

Influence of medium temperature

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

Influence of medium pressure

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

DN	Promass F Promass F high-temperature [% o.r./bar]	Promass M [% o.r./bar]	Promass M (high pressure) [% o.r./bar]
8	No influence	0.009	0.006
15	No influence	0.008	0.005
25	No influence	0.009	0.003
40	-0.003	0.005	-
50	-0.008	No influence	-
80	-0.009	No influence	-
100	-0.012	-	-
150	-0.009	-	-
250	-0.009	-	-

o.r. = of reading

Operating conditions: Installation

Installation instructions

Note the following points:

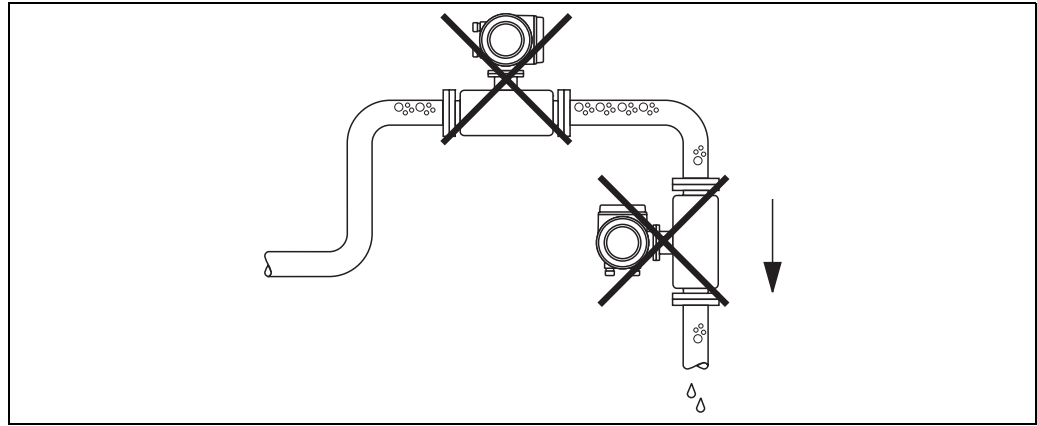
- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe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

Mounting location

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

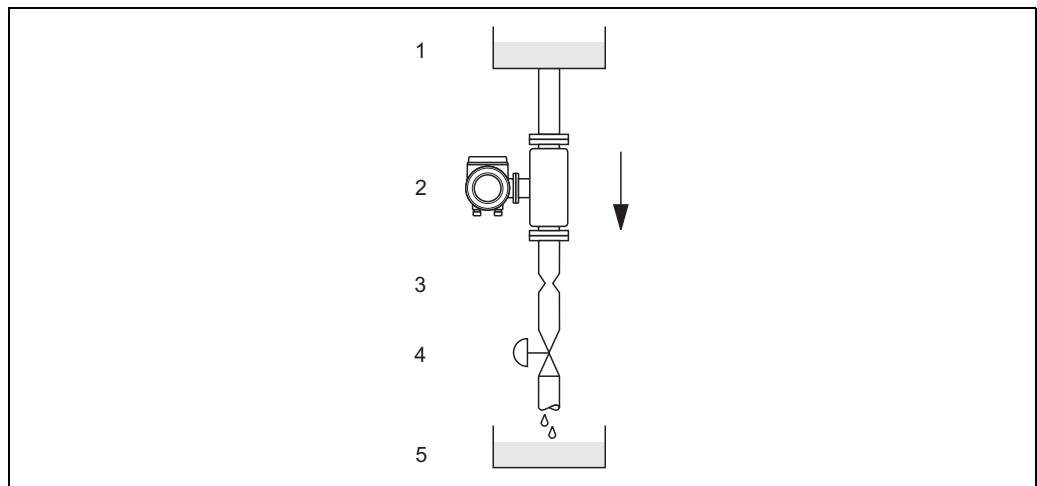
Avoid the following mounting locations in the pipe:

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



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	80	100 ¹⁾	150 ¹⁾	250 ¹⁾
∅ Orifice plate, pipe restriction [mm]	6	10	14	22	28	50	65	90	150
1) only Promass F									

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).

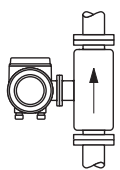
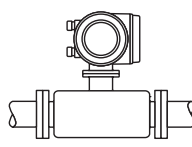
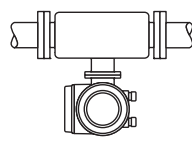
Vertical (View V)

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. The measuring tubes can be completely drained and protected against solids buildup.

Horizontal

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

Please note the special installation instructions! → Page 18

	Promass F, M Standard, compact	Promass F, M Standard, remote	Promass F High-temperature, compact	Promass F High-temperature, remote
<p>Fig. V: vertical orientation</p>  <p>a0004572</p>	✓✓	✓✓	✓✓	✓✓
<p>Fig. H1: horizontal orientation Transmitter head up</p>  <p>a0004576</p>	✓✓	✓✓	✗ (TM = >200 °C) ①	✓ (TM = >200 °C) ①
<p>Fig. H2: horizontal orientation Transmitter head down</p>  <p>a0004580</p>	✓✓ ②	✓✓ ②	✓✓ ②	✓✓ ②
<p>✓✓ = Recommended orientation ✓ = Orientation recommended in certain situations ✗ = Impermissible orientation</p>				

In order to ensure that the maximum permissible ambient temperature for the transmitter (−20 °C to +60 °C, optional −40 °C to +60 °C) is not exceeded, we recommend the following orientations:

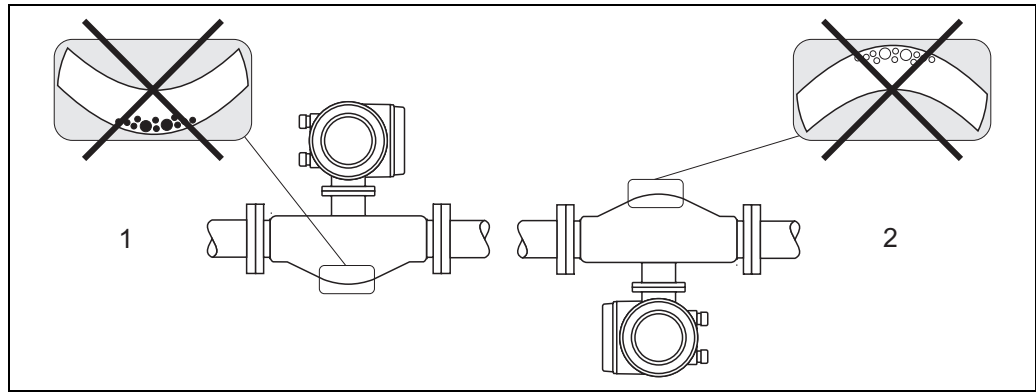
① = For fluids with very high temperatures (> 200 C), we recommend the horizontal orientation with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V).

② = For fluids with low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

Special installation instructions for Promass F

Caution!

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



Horizontal installation with Promass F

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

Heating

Some fluids require suitable measures to avoid 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.

Caution!

- Risk of electronics overheating! 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 17
- With a fluid temperature between 200 °C to 350 °C, heating is not permissible for the compact version of 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 instances, it is necessary to magnetically shield the sensor (apart from Promass M).

The secondary containment can be shielded with tin plate or electric sheets without privileged direction (e.g. V330-35A) with the following properties:

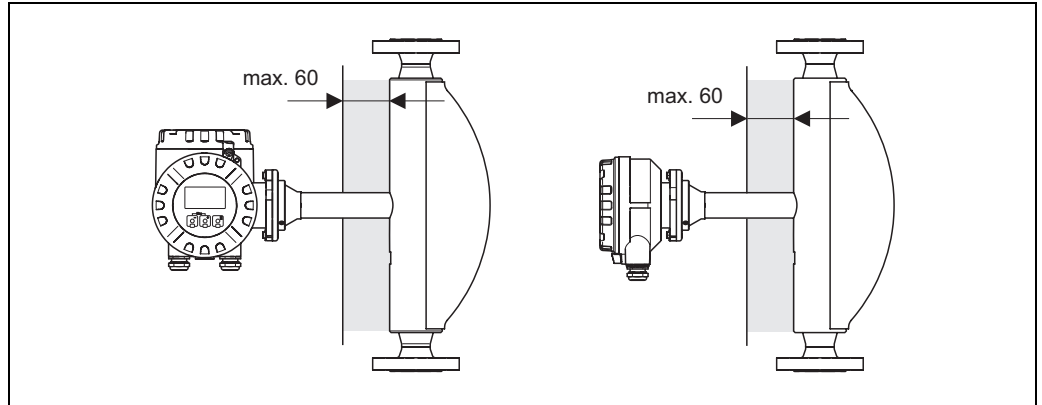
- Relative magnetic permeability $\mu_r \geq 300$
- Plate thickness $d \geq 0.35$ mm

- Information on permitted temperature ranges → Page 20

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

Thermal insulation

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



In the case of the Promass F high-temperature version, a maximum insulation thickness of 60 mm must be observed in the area of the electronics/neck.

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

Zero point adjustment

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

Calibration takes place under reference conditions. → Page 12 ff.

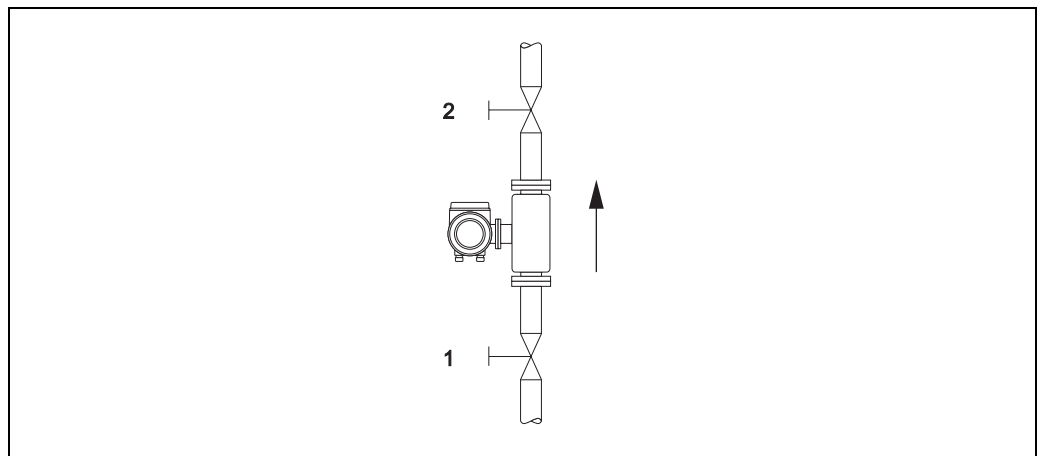
Promass therefore does **not** require zero point adjustment!

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

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

Please note the following before carrying out the adjustment:

- The adjustment can only be performed with fluids that have no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow ($v = 0$ m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
 - Normal operation → valves 1 and 2 open
 - Zero point adjustment *with* pump pressure → valve 1 open / valve 2 closed
 - Zero point adjustment *without* pump pressure → valve 1 closed / valve 2 open



Zero point adjustment and shutoff valves

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	<p>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.</p> <p>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.</p> <p>For this reason, the following mounting locations are preferred:</p> <ul style="list-style-type: none"> ■ Downstream from pumps (no risk of partial vacuum) ■ At the lowest point in a vertical pipe

Operating conditions: Environment

Ambient temperature range	<p>Standard: -20 °C to +60 °C (sensor, transmitter) Optional: -40 °C to +60 °C (sensor, transmitter)</p> <p>Note!</p> <ul style="list-style-type: none"> ■ 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 °C to +80 °C (preferably +20 °C)
Degree of protection	Standard: IP 67 (NEMA 4X) for transmitter and sensor
Shock resistance	In accordance with IEC 68-2-31
Vibration resistance	Acceleration up to 1 g, 10 to 150 Hz, following IEC 68-2-6
Electromagnetic compatibility (EMC)	To EN 61326/A1 (IEC 1326) and NAMUR Recommendation NE 21

Operating conditions: Process

Medium temperature range	<p>Sensor</p> <p><i>Promass F:</i> -50 °C to +200 °C</p> <p><i>Promass F (high-temperature version):</i> -50 °C to +350 °C</p> <p><i>Promass M:</i> -50 °C to +150 °C</p> <p>Seals:</p> <p><i>Promass F:</i> No internal seals</p>
---------------------------------	--

Promass M:

Viton -15 °C to +200 °C; EPDM -40 °C to +160 °C; silicone -60 °C to +200 °C; Kalrez -20 °C to +275 °C; FEP sheathed (not for gas applications): -60 °C to +200 °C

**Medium pressure range
(nominal pressure)**

Flanges:

Promass F:
DIN PN 16 to 100 / ANSI CI 150, CI
300, CI 600 / JIS 10K, 20K, 40K, 63K

Promass F (high-temperature version):
DIN PN 40, 64, 100 / ANSI CI 150,
CI 300, CI 600 / JIS 10K, 20K, 63K

Promass M:
DIN PN 40 to 100 / ANSI CI 150, CI
300, CI 600 / JIS 10K, 20K, 40K, 63K

Promass M (high-pressure version):

Measuring tubes, connector, couplings: max. 350 bar

Pressure ranges of secondary containment:

Promass F:

DN 8 to 50: 40 bar or 600 psi; DN 80: 25 bar or 375 psi;
DN 100 to 150: 16 bar or 250 psi; DN 250: 10 bar or 150 psi

Promass M:

100 bar or 1500 psi

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 circulation and/or gas detection. Dimensions
→ Page 27 ff.

Limiting flow

See information in the “Measuring range” Section → Page 5

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

- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as fluids with entrained solids (flow velocity <1 m/s).
- 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 5

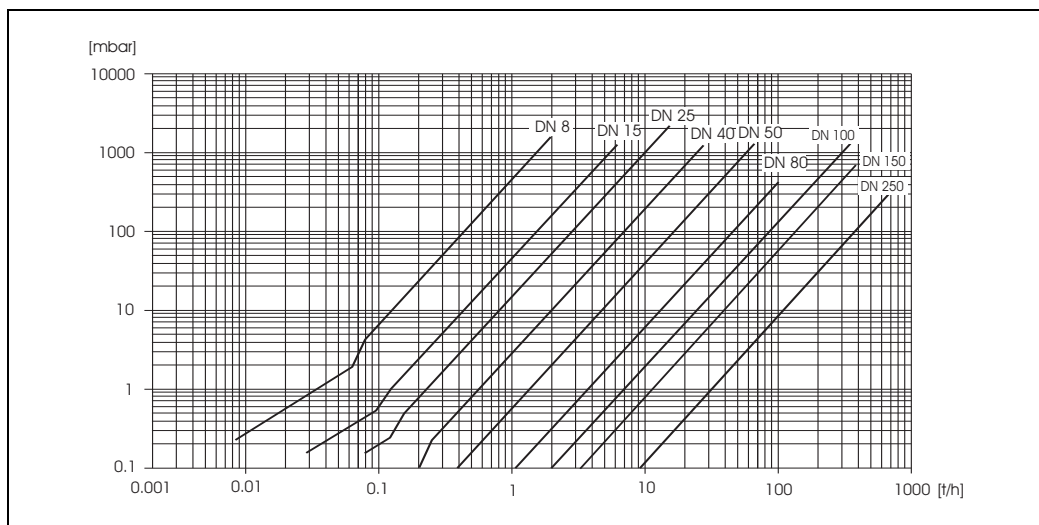
Pressure loss

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

Reynolds number	$Re = \frac{2 \cdot m}{\pi \cdot d \cdot v \cdot \rho}$	a0004623
$Re \geq 2300$ ¹⁾	$\Delta p = K \cdot v^{0.25} \cdot m^{1.85} \cdot \rho^{-0.86}$	a0004626
$Re < 2300$	$\Delta p = K1 \cdot v \cdot m + \frac{K2 \cdot v^{0.25} \cdot m^2}{\rho}$	a0004628
Δp = pressure loss [mbar] v = kinematic viscosity [m ² /s] m = mass flow [kg/s] ρ = fluid density [kg/m ³] d = inside diameter of measuring tubes [m] K to $K2$ = constants (depending on nominal diameter)		
¹⁾ To compute the pressure loss for gases, always use the formula for $Re \geq 2300$.		

Pressure loss coefficient for Promass F

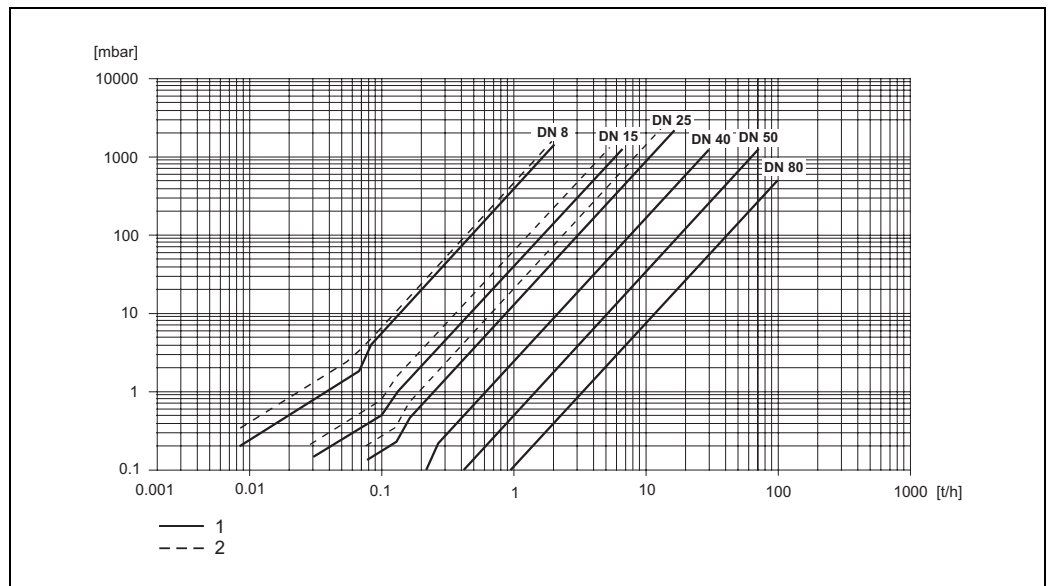
DN	d [m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^7$	$9.60 \cdot 10^7$	$1.90 \cdot 10^7$
15	$8.30 \cdot 10^{-3}$	$5.80 \cdot 10^6$	$1.90 \cdot 10^7$	$10.60 \cdot 10^5$
25	$12.00 \cdot 10^{-3}$	$1.90 \cdot 10^6$	$6.40 \cdot 10^6$	$4.50 \cdot 10^5$
40	$17.60 \cdot 10^{-3}$	$3.50 \cdot 10^5$	$1.30 \cdot 10^6$	$1.30 \cdot 10^5$
50	$26.00 \cdot 10^{-3}$	$7.00 \cdot 10^4$	$5.00 \cdot 10^5$	$1.40 \cdot 10^4$
80	$40.50 \cdot 10^{-3}$	$1.10 \cdot 10^4$	$7.71 \cdot 10^4$	$1.42 \cdot 10^4$
100	$51.20 \cdot 10^{-3}$	$3.54 \cdot 10^3$	$3.54 \cdot 10^4$	$5.40 \cdot 10^3$
150	$68.90 \cdot 10^{-3}$	$1.36 \cdot 10^3$	$2.04 \cdot 10^4$	$6.46 \cdot 10^2$
250	$102.26 \cdot 10^{-3}$	$3.00 \cdot 10^2$	$6.10 \cdot 10^3$	$1.33 \cdot 10^2$



Pressure loss diagram for water

Pressure loss coefficient for Promass M

DN	d [m]	K	K1	K2
8	$5.53 \cdot 10^{-3}$	$5.2 \cdot 10^7$	$8.6 \cdot 10^7$	$1.7 \cdot 10^7$
15	$8.55 \cdot 10^{-3}$	$5.3 \cdot 10^6$	$1.7 \cdot 10^7$	$9.7 \cdot 10^5$
25	$11.38 \cdot 10^{-3}$	$1.7 \cdot 10^6$	$5.8 \cdot 10^6$	$4.1 \cdot 10^5$
40	$17.07 \cdot 10^{-3}$	$3.2 \cdot 10^5$	$1.2 \cdot 10^6$	$1.2 \cdot 10^5$
50	$25.60 \cdot 10^{-3}$	$6.4 \cdot 10^4$	$4.5 \cdot 10^5$	$1.3 \cdot 10^4$
80	$38.46 \cdot 10^{-3}$	$1.4 \cdot 10^4$	$8.2 \cdot 10^4$	$3.7 \cdot 10^4$
High-pressure version				
8	$4.93 \cdot 10^{-3}$	$6.0 \cdot 10^7$	$1.4 \cdot 10^8$	$2.8 \cdot 10^7$
15	$7.75 \cdot 10^{-3}$	$8.0 \cdot 10^6$	$2.5 \cdot 10^7$	$1.4 \cdot 10^6$
25	$10.20 \cdot 10^{-3}$	$2.7 \cdot 10^6$	$8.9 \cdot 10^6$	$6.3 \cdot 10^5$



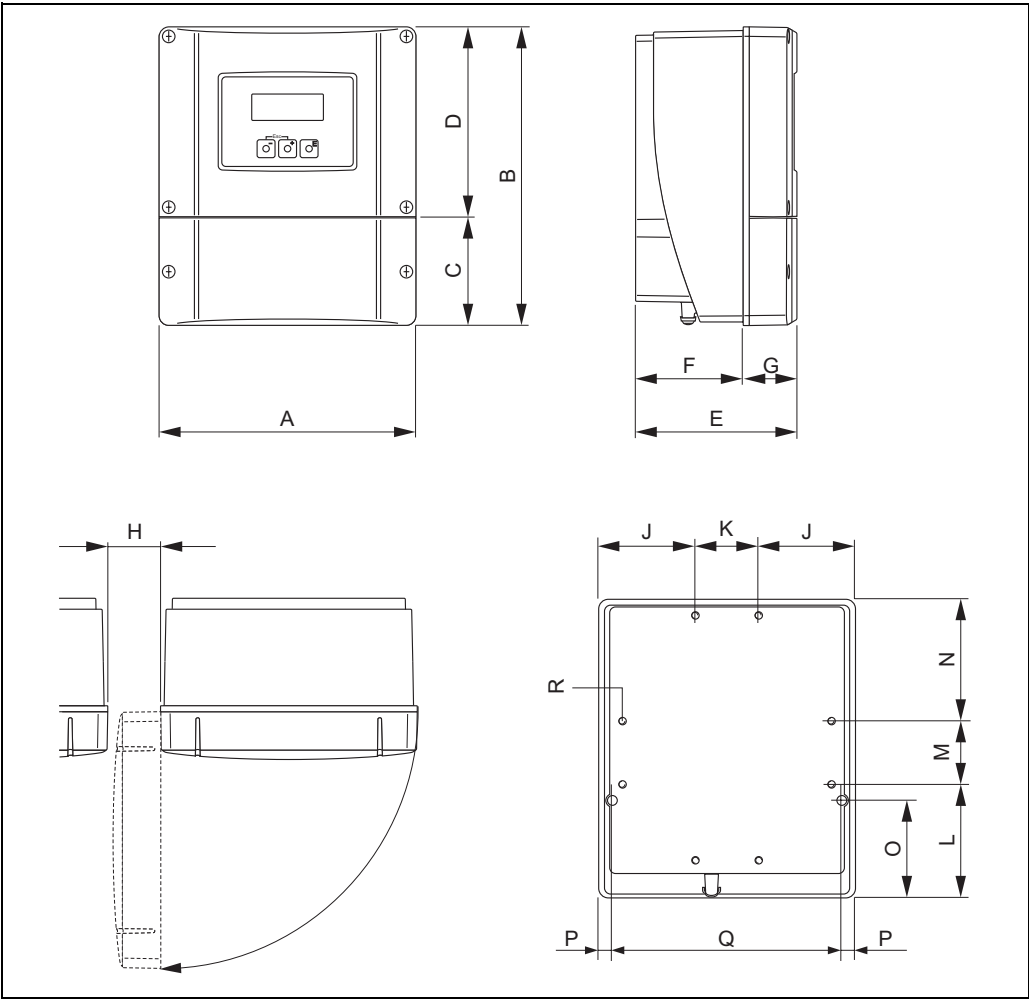
Pressure loss diagram for water

- 1 Promass M
- 2 Promass M (high-pressure version)

Mechanical construction

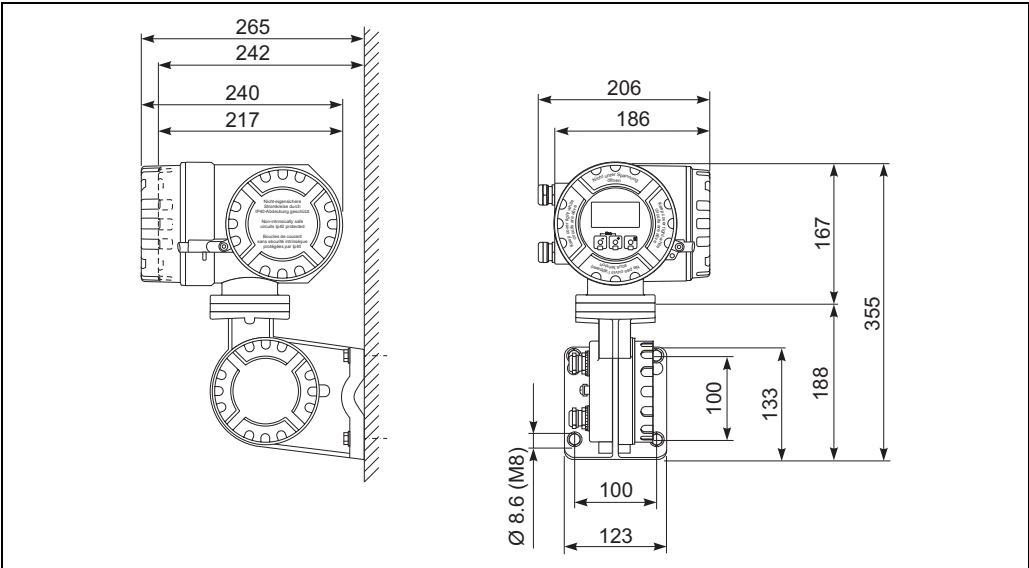
Design, dimensions

Dimensions: Wall-mount housing (non hazardous area and II3G / zone 2)



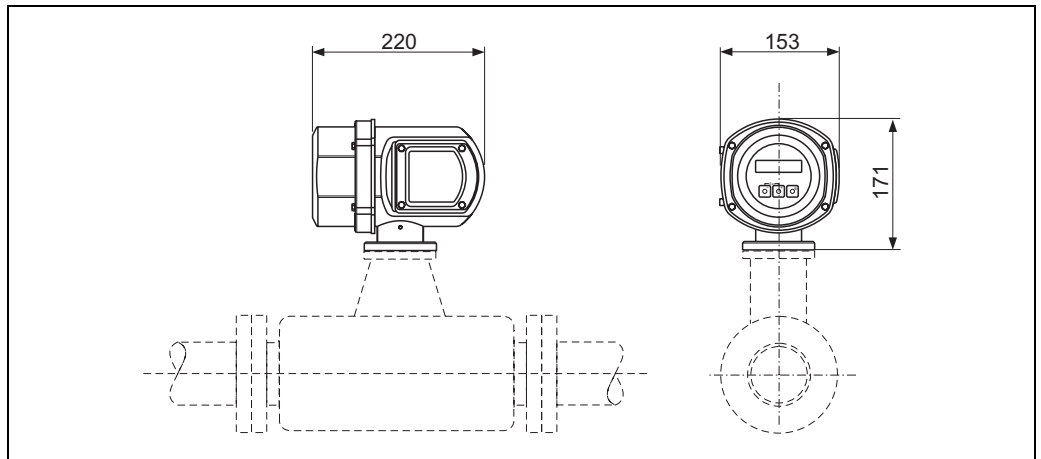
a0001150

Dimensions: Remote field housing (II2G / zone 1)



a0002128

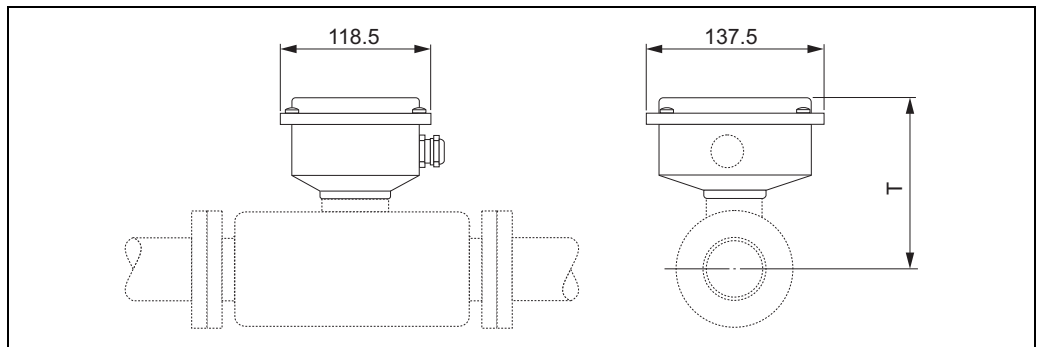
Dimensions: Stainless steel field housing



a0002245

Dimensions: Stainless steel field housing

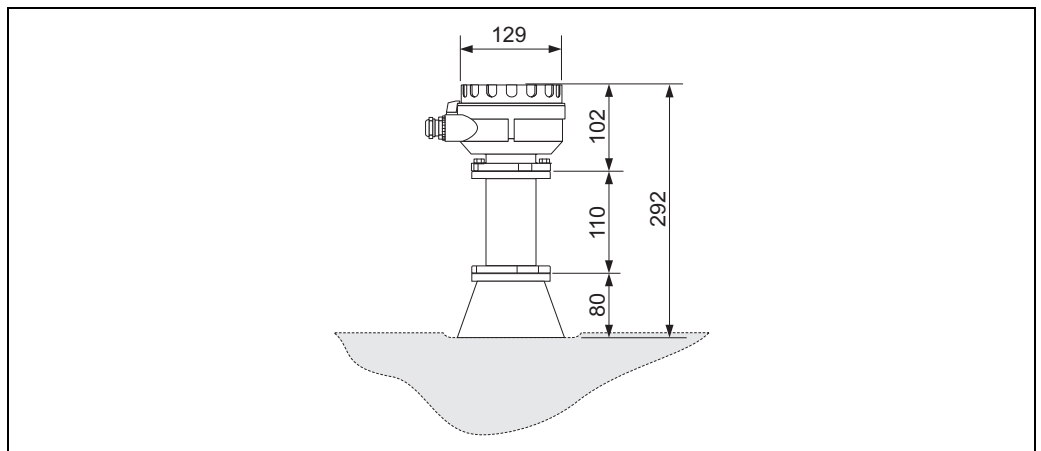
Dimensions: Remote version



a0002516

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

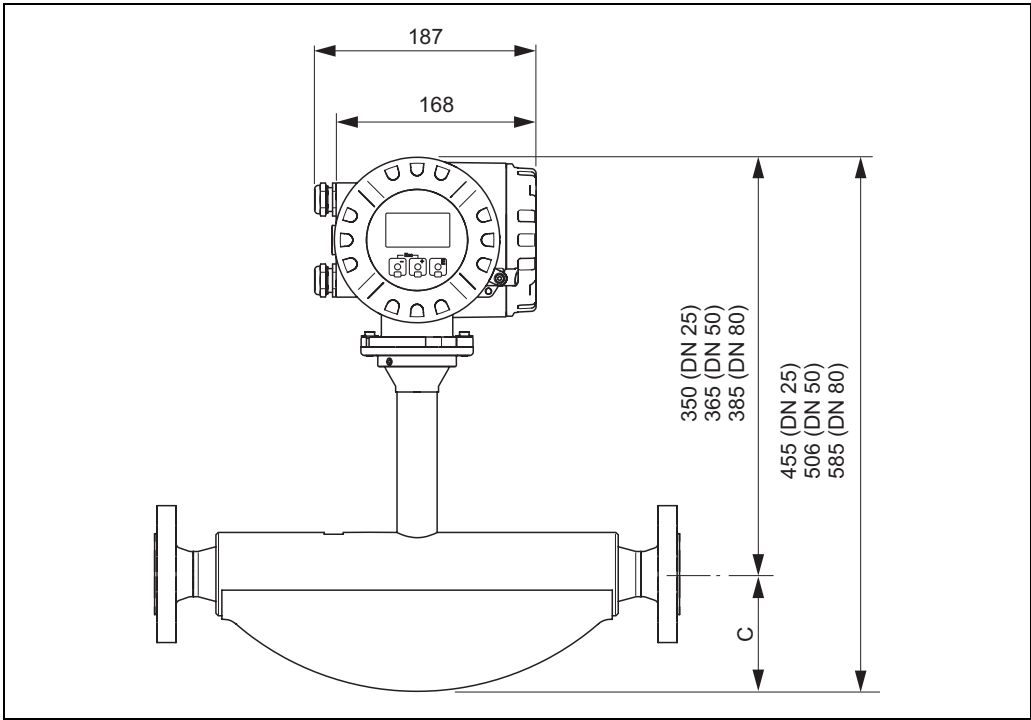
Dimensions: Remote version for heating



a0002517

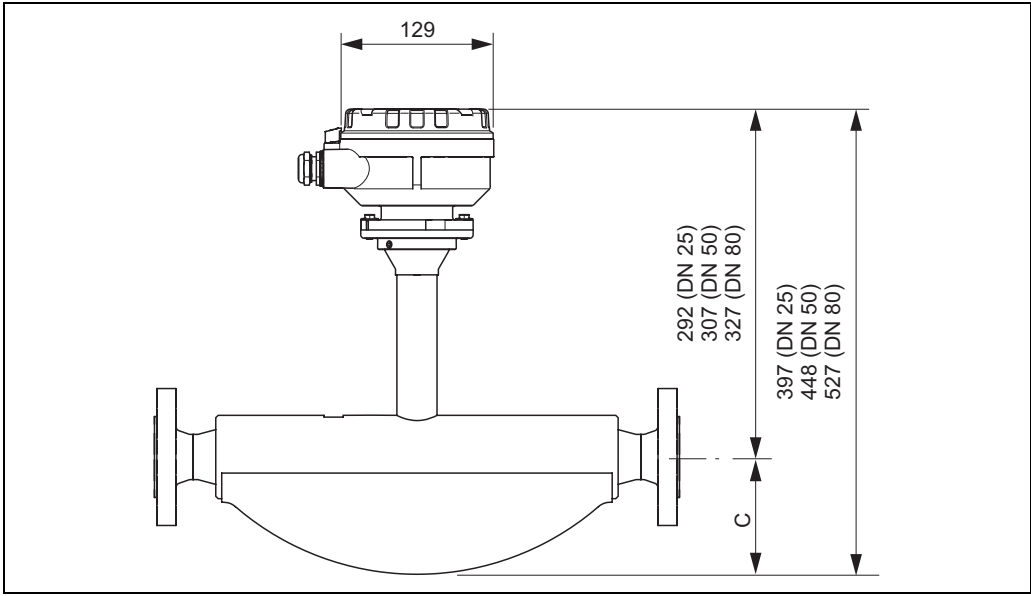
Dimensions of sensor connection housing, remote version for heating ("long-necked" version)

Dimensions: High-temperature version (compact)



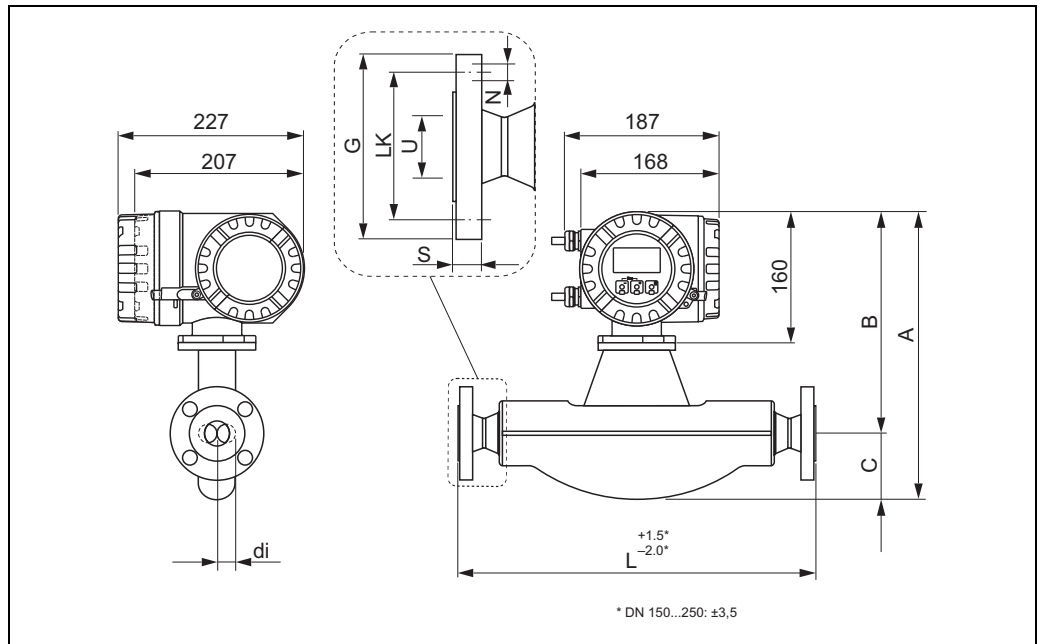
The dimension C corresponds to the dimension of the standard version for nominal diameters DN 50 and DN 80. Exception is DN 25: here the dimension C corresponds to the dimension of nominal diameter DN 40. See Table → Page 27

Dimensions: High-temperature version (remote)



The dimension C corresponds to the dimension of the standard version for nominal diameters DN 50 and DN 80. Exception is DN 25: here the dimension C corresponds to the dimension of nominal diameter DN 40. See Table → Page 27

Dimensions, Promass F: Flange connections EN (DIN), ANSI, JIS



a0002501

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 16: 1.4404/316L

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 μm

DN	A	B	C	G	L	N	S	LK	U	di
100	571	324	247	220	1128	8 x $\text{O}18$	20	180	107.1	51.20
150	740	362	378	285	1330	8 x $\text{O}22$	22	240	159.3	68.90
250 ²⁾	938	390	548	405	1780	12 x $\text{O}26$	26	355	260.4	102.26

¹⁾ Flange with groove to EN 1092-1 Form D (DIN 2512N) available

²⁾ Not available in Alloy

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 40: 1.4404/316L, Alloy C-22

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 μm

DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	95	370	4 x $\text{O}14$	16	65	17.3	5.35
15	341	266	75	95	404	4 x $\text{O}14$	16	65	17.3	8.30
25	341	266	75	115	440	4 x $\text{O}14$	18	85	28.5	12.00
40	376	271	105	150	550	4 x $\text{O}18$	18	110	43.1	17.60
50	424	283	141	165	715	4 x $\text{O}18$	20	125	54.5	26.00
80	505	305	200	200	840	8 x $\text{O}18$	24	160	82.5	40.50
100	571	324	247	235	1128	8 x $\text{O}22$	24	190	107.1	51.20
150	740	362	378	300	1370	8 x $\text{O}26$	28	250	159.3	68.90
250 ²⁾	938	390	548	450	1850	12 x $\text{O}33$	38	385	258.8	102.26

¹⁾ Flange with groove to EN 1092-1 Form D (DIN 2512N) available

²⁾ Not available in Alloy

Flange EN 1092-1 (DIN 2501) / PN 40 (with DN 25 flanges): 1.4404/316L										
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	115	440	4 x Ø14	18	85	28.5	5.35
15	341	266	75	115	440	4 x Ø14	18	85	28.5	8.30

Flange EN 1092-1 (DIN 2501 / DIN 2512N) extension-reduction / PN 16: 1.4404/316L										
Only for nominal diameter DN 250 (on request)										
Surface roughness (flange): Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
150	938	390	548	285	1980	8 x Ø22	22	240	159.3	102.26
200	938	390	548	340	1940	12 x Ø22	24	295	207.3	102.26
300	938	390	548	460	1940	12 x Ø26	28	410	309.7	102.26

Flange EN 1092-1 (DIN 2501 / DIN 2512N) extension-reduction / PN 40: 1.4404/316L										
Only for nominal diameter DN 250 (on request)										
Surface roughness (flange): Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
150	938	390	548	300	1980	8 x Ø26	28	250	159.3	102.26
200	938	390	548	375	1940	12 x Ø30	34	320	206.5	102.26
300	938	390	548	515	1940	16 x Ø33	42	450	307.9	102.26

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 63: 1.4404/316L, Alloy C-22										
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
50	424	283	141	180	724	4 x Ø22	26	135	54.5	26.00
80	505	305	200	215	875	8 x Ø22	28	170	81.7	40.50
100	571	324	247	250	1128	8 x Ø26	30	200	106.3	51.20
150	740	362	378	345	1410	8 x Ø33	36	280	157.1	68.90
250 ²⁾	938	390	548	470	1890	12 x Ø36	46	400	255.4	102.26

¹⁾ Flange with groove to EN 1092-1 Form D (DIN 2512N) available
²⁾ Not available in Alloy

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 100: 1.4404/316L, Alloy C-22										
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	105	400	4 x Ø14	20	75	17.3	5.35
15	341	266	75	105	420	4 x Ø14	20	75	17.3	8.30
25	341	266	75	140	470	4 x Ø18	24	100	28.5	12.00
40	376	271	105	170	590	4 x Ø22	26	125	42.5	17.60
50	424	283	141	195	740	4 x Ø26	28	145	53.9	26.00
80	505	305	200	230	885	8 x Ø26	32	180	80.9	40.50
100	571	324	247	265	1128	8 x Ø30	36	210	104.3	51.20
150	740	362	378	355	1450	12 x Ø33	44	290	154.0	68.90

¹⁾ Flange with groove in accordance with EN 1092-1 Form D (DIN 2512N) available

Flange ANSI B16.5 / CI 150: 1.4404/316L, Alloy C-22											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN	A	B	C	G	L	N	S	LK	U	di	
8	3/8"	341	266	75	88.9	370	4 x Ø15.7	11.2	60.5	15.7	5.35
15	1/2"	341	266	75	88.9	404	4 x Ø15.7	11.2	60.5	15.7	8.30
25	1"	341	266	75	108.0	440	4 x Ø15.7	14.2	79.2	26.7	12.00
40	1 1/2"	376	271	105	127.0	550	4 x Ø15.7	17.5	98.6	40.9	17.60
50	2"	424	283	141	152.4	715	4 x Ø19.1	19.1	120.7	52.6	26.00
80	3"	505	305	200	190.5	840	4 x Ø19.1	23.9	152.4	78.0	40.50
100	4"	571	324	247	228.6	1128	8 x Ø19.1	23.9	190.5	102.4	51.20
150	6"	740	362	378	279.4	1398	8 x Ø22.4	25.4	241.3	154.2	68.90
250 ¹⁾	10"	938	390	548	406.4	1836.8	12 x Ø25.4	30.2	362	254.5	102.26

¹⁾ Not available in Alloy

Flange ANSI B16.5 / CI 300: 1.4404/316L, Alloy C-22											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN	A	B	C	G	L	N	S	LK	U	di	
8	3/8"	341	266	75	95.2	370	4 x Ø15.7	14.2	66.5	15.7	5.35
15	1/2"	341	266	75	95.2	404	4 x Ø15.7	14.2	66.5	15.7	8.30
25	1"	341	266	75	123.9	440	4 x Ø19	17.5	88.9	26.7	12.00
40	1 1/2"	376	271	105	155.4	550	4 x Ø22.3	20.6	114.3	40.9	17.60
50	2"	424	283	141	165.1	715	8 x Ø19	22.3	127.0	52.6	26.00
80	3"	505	305	200	209.5	840	8 x Ø22.3	28.4	168.1	78.0	40.50
100	4"	571	324	247	254.0	1128	8 x Ø22.3	31.7	200.1	102.4	51.20
150	6"	740	362	378	317.5	1417	12 x Ø22.3	36.5	269.7	154.2	68.90
250 ¹⁾	10"	938	390	548	444.5	1868.2	16 x Ø28.4	47.4	387.3	254.5	102.26

¹⁾ Not available in Alloy

Flange ANSI B16.5 / CI 600: 1.4404/316L, Alloy C-22											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	341	266	75	95.3	400	4 x Ø15.7	20.6	66.5	13.9	5.35
15	1/2"	341	266	75	95.3	420	4 x Ø15.7	20.6	66.5	13.9	8.30
25	1"	341	266	75	124.0	490	4 x Ø19.1	23.9	88.9	24.3	12.00
40	1 1/2"	376	271	105	155.4	600	4 x Ø22.4	28.7	114.3	38.1	17.60
50	2"	424	283	141	165.1	742	8 x Ø19.1	31.8	127.0	49.2	26.00
80	3"	505	305	200	209.6	900	8 x Ø22.4	38.2	168.1	73.7	40.50
100	4"	571	324	247	273.1	1158	8 x Ø25.4	48.4	215.9	97.3	51.20
150	6"	740	362	378	355.6	1467	16xØ28.4	47.8	292.1	154.2	68.90
250 ¹⁾	10"	938	390	548	508.0	1951.2	16 X Ø35.1	69.9	431.8	254.5	102.26
¹⁾ Not available in Alloy											

Flange ANSI B16.5 extension-reduction / CI 150: 1.4404/316L											
Only for nominal diameter DN 250 /10" (on request)											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN		A	B	C	G	L	N	S	LK	U	di
150	6"	938	390	548	279.4	1980	8 x Ø22.4	25.4	241.3	154.2	102.26
200	8"	938	390	548	342.9	1940	8 x Ø22.4	28.4	298.5	202.7	102.26
300	12"	938	390	548	482.6	1940	12 x Ø25.4	31.8	431.8	304.80	102.26

Flange ANSI B16.5 extension-reduction / CI 300: 1.4404/316											
Only for nominal diameter DN 250 /10" (on request)											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN		A	B	C	G	L	N	S	LK	U	di
150	6"	938	390	548	317.5	1980	12 x Ø22.4	36.5	269.7	154.2	102.26
200	8"	938	390	548	381.0	1940	12 x Ø25.4	41.1	330.2	202.7	102.26
300	12"	938	390	548	520.7	1940	16 x Ø31.7	50.8	450.8	304.80	102.26

Flange ANSI B16.5 extension-reduction / CI 600: 1.4404/316L											
Only for nominal diameter DN 250 /10" (on request)											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN		A	B	C	G	L	N	S	LK	U	di
150	6"	938	390	548	355.6	1980	12 x Ø28.4	54.2	292.1	154.2	102.26
200	8"	938	390	548	419.1	1940	12 x Ø31.8	62.0	349.3	202.7	102.26

Flange JIS B2238 / 10K: 1.4404/316L, Alloy C-22										
Surface roughness (flange): Ra 3.2 to 6.3 µm										
DN	A	B	C	G	L	N	S	LK	U	di
50	424	283	141	155	715	4 x Ø19	16	120	50	26.00
80	505	305	200	185	832	8 x Ø19	18	150	80	40.50
100	571	324	247	210	1128	8 x Ø19	18	175	100	51.20
150	740	362	378	280	1354	8 x Ø23	22	240	150	68.90
250 ¹⁾	938	390	548	400	1780	12 x Ø25	24	355	250	102.26
¹⁾ Not available in Alloy										

Flange JIS B2238 / 20K: 1.4404/316L, Alloy C-22										
Surface roughness (flange): Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	95	370	4 x Ø15	14	70	15	5.35
15	341	266	75	95	404	4 x Ø15	14	70	15	8.30
25	341	266	75	125	440	4 x Ø19	16	90	25	12.00
40	376	271	105	140	550	4 x Ø19	18	105	40	17.60
50	424	283	141	155	715	8 x Ø19	18	120	50	26.00
80	505	305	200	200	832	8 x Ø23	22	160	80	40.50
100	571	324	241	225	1128	8 x Ø23	24	185	100	51.20
150	740	362	378	305	1386	12 x Ø25	28	260	150	68.90
250 ¹⁾	938	390	548	430	1850	12 x Ø27	34	380	250	102.26
¹⁾ Not available in Alloy										

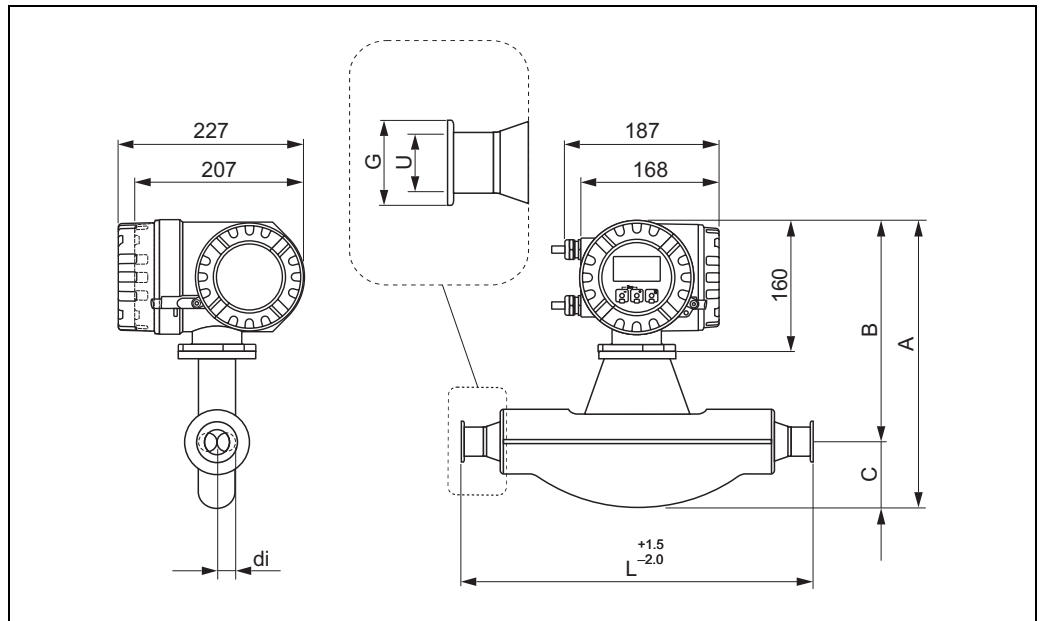
Flange JIS B2238 / 40K: 1.4404/316L, Alloy C-22										
Surface roughness (flange): Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	115	400	4 x Ø19	20	80	15	5.35
15	341	266	75	115	425	4 x Ø19	20	80	15	8.30
25	341	266	75	130	485	4 x Ø19	22	95	25	12.00
40	376	271	105	160	600	4 x Ø23	24	120	38	17.60
50	424	283	141	165	760	8 x Ø19	26	130	50	26.00
80	505	305	200	210	890	8 x Ø23	32	170	75	40.50
100	571	324	241	250	1168	8 x Ø25	36	205	100	51.20
150	740	362	378	355	1498	12 x Ø33	44	295	150	68.90

Flange JIS B2238 / 63K: 1.4404/316L, Alloy C-22										
Surface roughness (flange): Ra 1.6 to 3.2 μm										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	120	420	4 x $\text{\O}19$	23	85	12	5.35
15	341	266	75	120	440	4 x $\text{\O}19$	23	85	12	8.30
25	341	266	75	140	494	4 x $\text{\O}23$	27	100	22	12.00
40	376	271	105	175	620	4 x $\text{\O}25$	32	130	35	17.60
50	424	283	141	185	775	8 x $\text{\O}23$	34	145	48	26.00
80	505	305	200	230	915	8 x $\text{\O}25$	40	185	73	40.50
100	571	324	247	270	1168	8 x $\text{\O}27$	44	220	98	51.20
150	740	362	378	365	1528	12 x $\text{\O}33$	54	305	146	68.90

Flange JIS extension/reduction / 10K: 1.4404/316L										
Only for nominal diameter DN 250 (on request)										
Surface roughness (flange): Ra 1.6 to 3.2 μm										
DN	A	B	C	G	L	N	S	LK	U	di
150	938	390	548	280	1980	8 x $\text{\O}23$	22	240	150	102.26
200	938	390	548	330	1940	12 x $\text{\O}23$	22	290	200	102.26
300	938	390	548	445	1940	16 x $\text{\O}25$	24	400	300	102.26

Flange JIS extension/reduction / 20K: 1.4404/316L										
Only for nominal diameter DN 250 (on request)										
Surface roughness (flange): Ra 1.6 to 3.2 μm										
DN	A	B	C	G	L	N	S	LK	U	di
150	938	390	548	305	1980	12 x $\text{\O}25$	28	260	150	102.26
200	938	390	548	350	1940	12 x $\text{\O}25$	30	305	200	102.26
300	938	390	548	480	1940	16 x $\text{\O}27$	36	430	300	102.26

Dimensions, Promass F: Tri-Clamp connections



a0002515

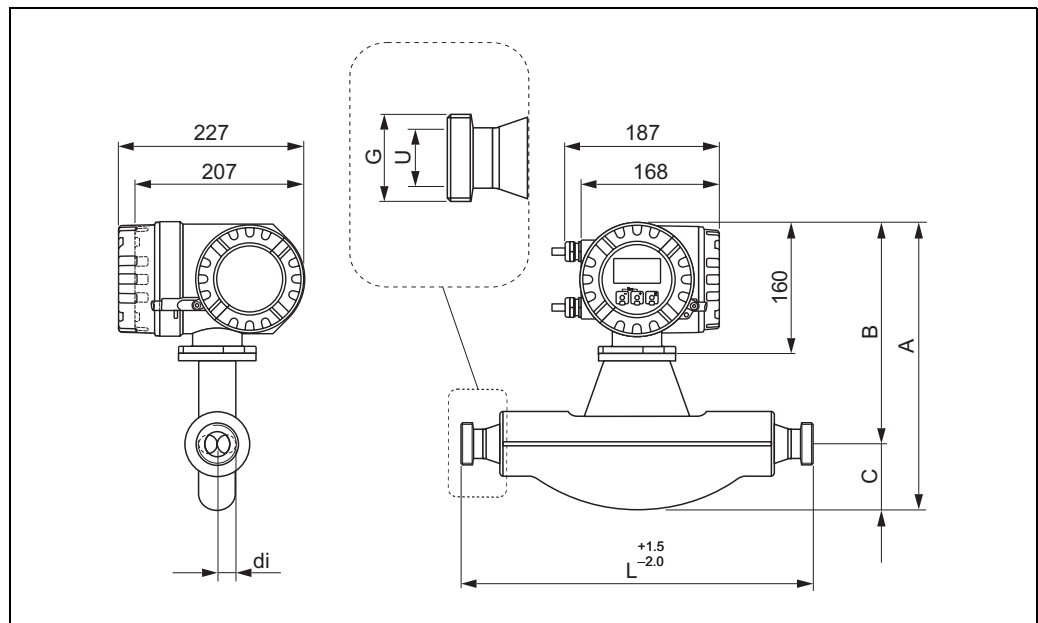
Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	341	266	75	50.4	367	22.1	5.35
15	1"	341	266	75	50.4	398	22.1	8.30
25	1"	341	266	75	50.4	434	22.1	12.00
40	1 1/2"	376	271	105	50.4	560	34.8	17.60
50	2"	424	283	141	63.9	720	47.5	26.00
80	3"	505	305	200	90.9	900	72.9	40.50
100	4"	571	324	247	118.9	1128	97.4	51.20

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

1/2" Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1/2"	341	266	75	25.0	367	9.5	5.35
15	1/2"	341	266	75	25.0	398	9.5	8.30

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

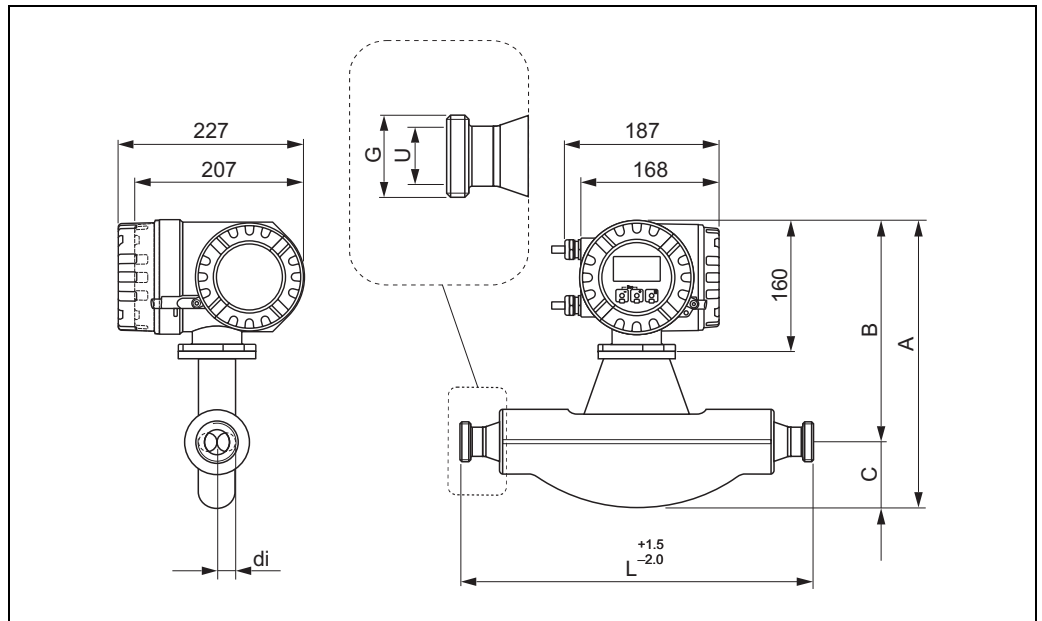
Dimensions, Promass F: DIN 11851 connections (dairy fitting)



Dairy fitting DIN 11851: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	Rd 34 x 1/8"	367	16	5.35
15	341	266	75	Rd 34 x 1/8"	398	16	8.30
25	341	266	75	Rd 52 x 1/6"	434	26	12.00
40	376	271	105	Rd 65 x 1/6"	560	38	17.60
50	424	283	141	Rd 78 x 1/6"	720	50	26.00
80	505	305	200	Rd 110 x 1/4"	900	81	40.50
100	571	324	247	Rd 130 x 1/4"	1128	100	51.20

3A version also available ($Ra \leq 0.8 \mu\text{m}/150 \text{ grit.}$)

Dimensions, Promass F: DIN 11864-1 Form A connections (couplings)

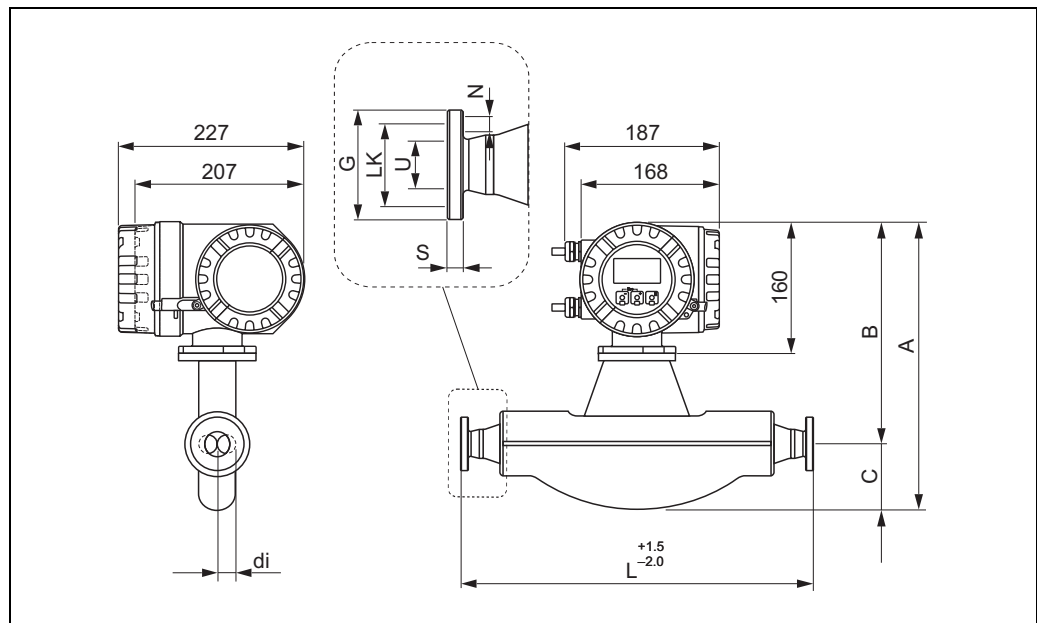


a0002521

Coupling DIN 11864-1 Form A: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	Rd 28 x 1/8"	367	10	5.35
15	341	266	75	Rd 34 x 1/8"	398	16	8.30
25	341	266	75	Rd 52 x 1/6"	434	26	12.00
40	376	271	105	Rd 65 x 1/6"	560	38	17.60
50	424	283	141	Rd 78 x 1/6"	720	50	26.00
80	505	305	200	Rd 110 x 1/4"	900	81	40.50
100	571	324	247	Rd 130 x 1/4"	1128	100	51.20

3A version also available (Ra ≤ 0.8 μm/150 grit.)

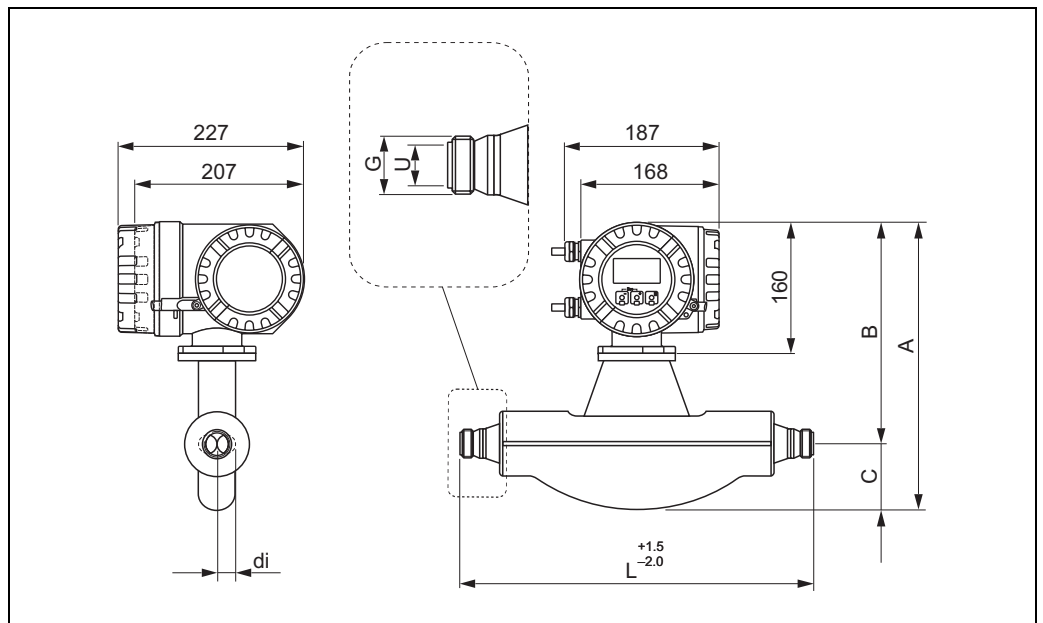
Dimensions, Promass F: Flange connections DIN 11864-2 Form A (flat flange)



a0002522

Flange DIN 11864-2 Form A (flat flange): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	341	266	75	54	387	4 x Ø9	10	37	10	5.35
15	341	266	75	59	418	4 x Ø9	10	42	16	8.30
25	341	266	75	70	454	4 x Ø9	10	53	26	12.00
40	376	271	105	82	560	4 x Ø9	10	65	38	17.60
50	424	283	141	94	720	4 x Ø9	10	77	50	26.00
80	505	305	200	133	900	8 x Ø11	12	112	81	40.50
100	571	324	247	159	1128	8 x Ø11	14	137	100	51.20
3A version also available ($Ra \leq 0.8 \mu\text{m}/150$ grit. Option: $Ra \leq 0.4 \mu\text{m}/240$ grit)										

Dimensions, Promass F: ISO 2853 connections (couplings)



a0002523

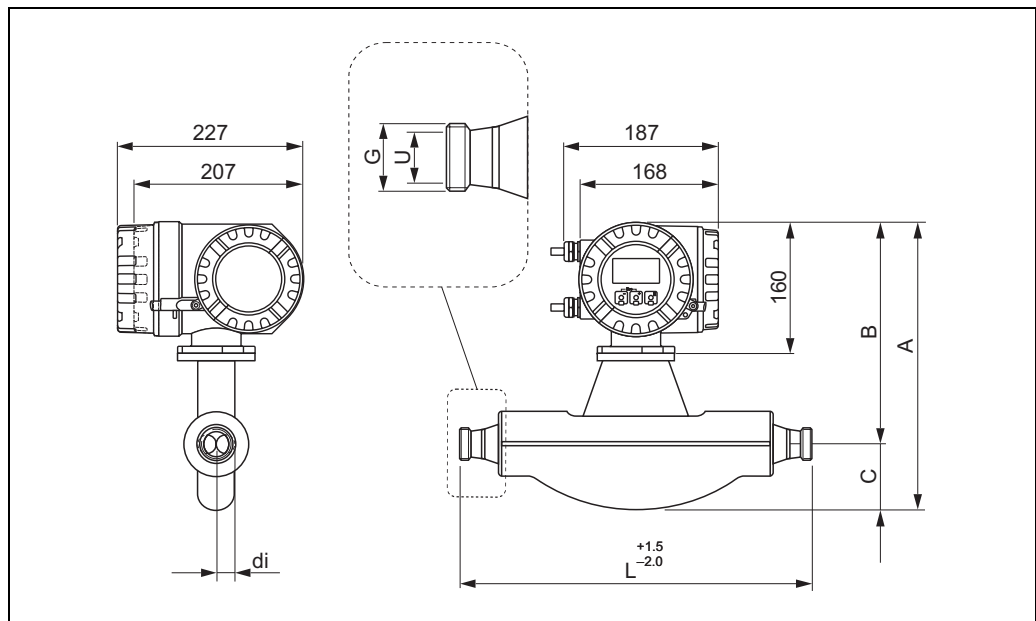
Coupling ISO 2853: 1.4404/316L

DN	A	B	C	G ¹⁾	L	N	di
8	341	266	75	37.13	367	22.6	5.35
15	341	266	75	37.13	398	22.6	8.30
25	341	266	75	37.13	434	22.6	12.00
40	376	271	105	52.68	560	35.6	17.60
50	424	283	141	64.16	720	48.6	26.00
80	505	305	200	91.19	900	72.9	40.50
100	571	324	247	118.21	1128	97.6	51.20

¹⁾ Max. thread diameter to ISO 2853 Annex A

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

Dimensions, Promass F: SMS 1145 connections (dairy fitting)

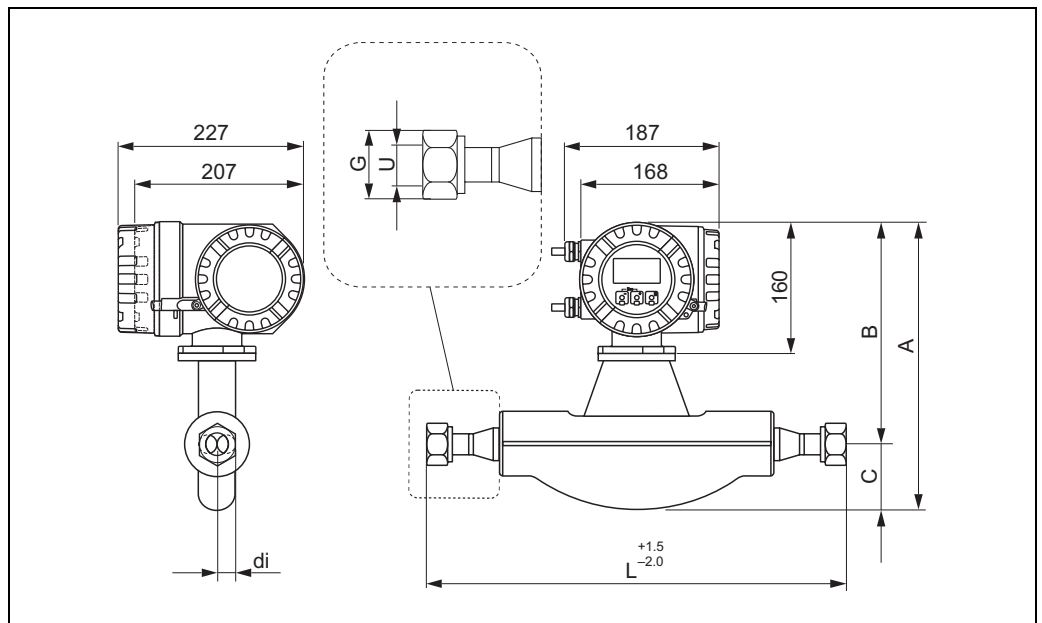


a0002524

Dairy fitting SMS 1145: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	37.13	367	22.6	5.35
15	341	266	75	37.13	398	22.6	8.30
25	341	266	75	37.13	434	22.6	12.00
40	376	271	105	52.68	560	35.6	17.60
50	424	283	141	64.16	720	48.6	26.00
80	505	305	200	91.19	900	72.9	40.50
100	571	324	247	118.21	1128	97.6	51.20

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

Dimensions, Promass F: VCO connections

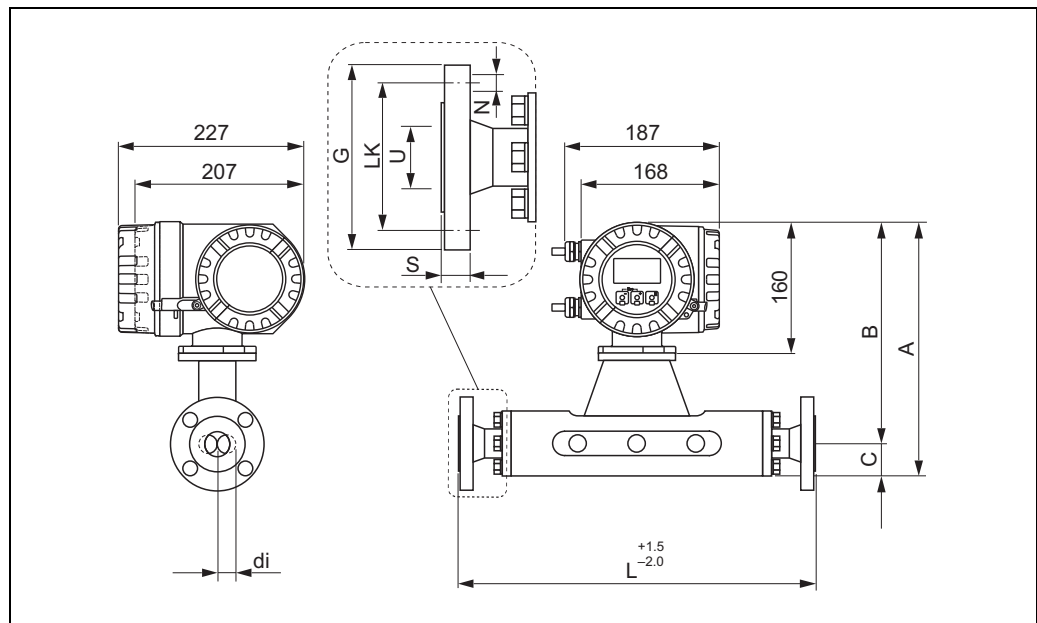


a0004552

8-VCO-4 (1/2"): 1.4404/316L							
DN	A	B	C	G	L	U	di
8	341	266	75	SW 1"	390	10.2	5.35

12-VCO-4 (3/4"): 1.4404/316L							
DN	A	B	C	G	L	U	di
15	341	266	75	SW 1 1/2"	430	15.7	8.30

Dimensions, Promass M: Flange connections EN (DIN), ANSI, JIS



a0002525

Flange EN 1092-1 (DIN 2501) / PN 16: PVDF										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø14	16	65	16.1	5.53
15	305	268	37	95	404	4 x Ø14	16	65	16.1	8.55
25	312	272	40	115	440	4 x Ø14	18	85	28.5	11.38
40	332	283	49	150	550	4 x Ø18	18	110	43.1	17.07
50	351	293	58	165	715	4 x Ø18	20	125	54.5	25.60

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 40: 1.4404/316L, titanium										
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø14	16	65	17.3	5.53
15	305	268	37	95	404	4 x Ø14	16	65	17.3	8.55
25	312	272	40	115	440	4 x Ø14	18	85	28.5	11.38
40	332	283	49	150	550	4 x Ø18	18	110	43.1	17.07
50	351	293	58	165	715	4 x Ø18	20	125	54.5	25.60
80	385	309	76	200	840	8 x Ø18	24	160	82.5	38.46

¹⁾ Flange with groove to EN 1092-1 Form D (DIN 2512N) available

Flange EN 1092-1 (DIN 2501) / PN 40 (with DN 25 flanges): 1.4404/316L										
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	115	440	4 x Ø14	18	85	28.5	5.53
15	305	268	37	115	440	4 x Ø14	18	85	28.5	8.55

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 63: 1.4404/316L, titanium										
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
50	351	293	58	180	724	4 x Ø22	26	135	54.5	25.60
80	385	309	76	215	875	8 x Ø22	28	170	81.7	38.46

¹⁾ Flange with groove to EN 1092-1 Form D (DIN 2512N) available

Flange EN 1092-1 (DIN 2501 / DIN 2512N ¹⁾) / PN 100: 1.4404/316L, titanium										
Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 1.6 to 3.2 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	400	4 x Ø14	20	65	17.3	5.53
15	305	268	37	95	420	4 x Ø14	20	65	17.3	8.55
25	312	272	40	115	470	4 x Ø14	24	85	28.5	11.38
40	332	283	49	150	590	4 x Ø18	26	110	43.1	17.07
50	351	293	58	165	740	4 x Ø18	28	125	54.5	25.60
80	385	309	76	230	885	8 x Ø26	32	180	80.9	38.46

¹⁾ Flange with groove in accordance with EN 1092-1 Form D (DIN 2512N) available

Flange ANSI B16.5 / CI 150: 1.4404/316L, titanium											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN	A	B	C	G	L	N	S	LK	U	di	
8	3/8"	301	266	35	88.9	370	4 x Ø15.7	11.2	60.5	15.7	5.53
15	1/2"	305	268	37	88.9	404	4 x Ø15.7	11.2	60.5	15.7	8.55
25	1"	312	272	40	108.0	440	4 x Ø15.7	14.2	79.2	26.7	11.38
40	1 1/2"	332	283	49	127.0	550	4 x Ø15.7	17.5	98.6	40.9	17.07
50	2"	351	293	58	152.4	715	4 x Ø19.1	19.1	120.7	52.6	25.60
80	3"	385	309	76	190.5	840	4 x Ø19.1	23.9	152.4	78.0	38.46

Flange ANSI B16.5 / CI 150: PVDF											
DN	A	B	C	G	L	N	S	LK	U	di	
8	3/8"	301	266	35	88.9	370	4 x Ø15.7	16	60.5	15.7	5.53
15	1/2"	305	268	37	88.9	404	4 x Ø15.7	16	60.5	15.7	8.55
25	1"	312	272	40	108.0	440	4 x Ø15.7	18	79.2	26.7	11.38
40	1 1/2"	332	283	49	127.0	550	4 x Ø15.7	21	98.6	40.9	17.07
50	2"	351	293	58	152.4	715	4 x Ø19.1	28	120.7	52.6	25.60

Flange ANSI B16.5 / CI 300: 1.4404/316L, titanium											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	301	266	35	95.2	370	4 x Ø15.7	14.2	66.5	15.7	5.53
15	1/2"	305	268	37	95.2	404	4 x Ø15.7	14.2	66.5	15.7	8.55
25	1"	312	272	40	123.9	440	4 x Ø19.0	17.5	88.9	26.7	11.38
40	1 1/2"	332	283	49	155.4	550	4 x Ø22.3	20.6	114.3	40.9	17.07
50	2"	351	293	58	165.1	715	8 x Ø19.0	22.3	127.0	52.6	25.60
80	3"	385	309	76	209.5	840	8 x Ø22.3	28.4	168.1	78.0	38.46

Flange ANSI B16.5 / CI 600: 1.4404/316L, titanium											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	301	266	35	95.3	400	4 x Ø15.7	20.6	66.5	13.8	5.53
15	1/2"	305	268	37	95.3	420	4 x Ø15.7	20.6	66.5	13.8	8.55
25	1"	312	272	40	124.0	490	4 x Ø19.1	23.6	88.9	24.4	11.38
40	1 1/2"	332	283	49	155.4	600	4 x Ø22.4	28.7	114.3	38.1	17.07
50	2"	351	293	58	165.1	742	8 x Ø19.1	31.8	127.0	49.3	25.60
80	3"	385	309	76	209.6	900	8 x Ø22.4	38.2	168.1	73.7	38.46

Flange JIS B2238 / 10K: 1.4404/316L, titanium											
Surface roughness (flange): Ra 3.2 to 6.3 µm											
DN	A	B	C	G	L	N	S	LK	U	di	
50	351	293	49.25	155	715	4 x Ø19	16	120	50	25.60	
80	385	309	58	185	832	8 x Ø19	18	150	80	38.46	

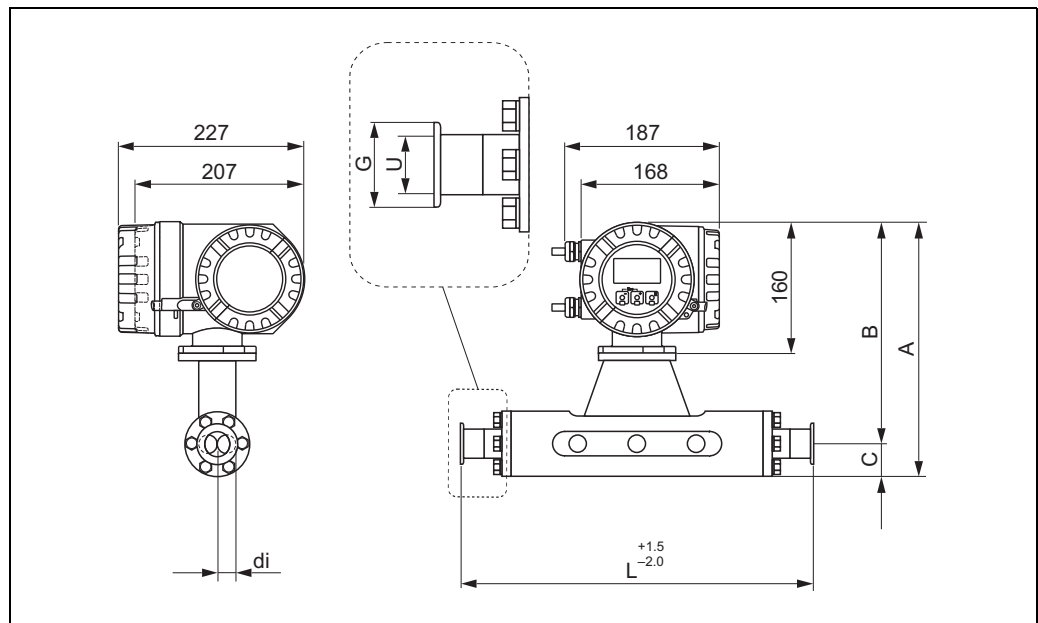
Flange JIS B2238 / 10K: 1.4404/316L, PVDF											
DN	A	B	C	G	L	N	S	LK	U	di	
8	301	266	35	95	370	4 x Ø15	16	70	15	5.53	
15	305	268	37	95	404	4 x Ø15	16	70	15	8.55	
25	312	272	40	125	440	4 x Ø19	18	90	25	11.38	
40	332	283	49	140	550	4 x Ø19	21	105	40	17.07	
50	351	293	58	155	715	4 x Ø19	22	120	50	25.60	

Flange JIS B2238 / 20K: 1.4404/316L, titanium										
Surface roughness (flange): Ra 3.2 to 6.3 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	95	370	4 x Ø15	16	70	15	5.53
15	305	268	37	95	404	4 x Ø15	16	70	15	8.55
25	312	272	40	125	440	4 x Ø19	18	90	25	11.38
40	332	283	49	140	550	4 x Ø19	21	105	40	17.07
50	351	293	58	155	715	4 x Ø19	22	120	50	25.60
80	385	309	76	200	832	8 x Ø23	22	160	80	38.46

Flange JIS B2238 / 40K: 1.4404/316L, titanium										
Surface roughness (flange): Ra 3.2 to 6.3 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	115	400	4 x Ø19	20	80	15	5.53
15	305	268	37	115	425	4 x Ø19	20	80	15	8.55
25	312	272	40	130	485	4 x Ø19	22	95	25	11.38
40	332	283	49	160	600	4 x Ø23	24	120	38	17.07
50	351	293	58	165	760	8 x Ø19	26	130	50	25.60
80	385	309	76	210	890	8 x Ø23	32	170	75	38.46

Flange JIS B2238 / 63K: 1.4404/316L, titanium										
Surface roughness (flange): Ra 3.2 to 6.3 µm										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	120	420	4 x Ø19	23	85	12	5.53
15	305	268	37	120	440	4 x Ø19	23	85	12	8.55
25	312	272	40	140	494	4 x Ø23	27	100	22	11.38
40	332	283	49	175	620	4 x Ø25	32	130	35	17.07
50	351	293	58	185	775	8 x Ø23	34	145	48	25.60
80	385	309	76	230	915	8 x Ø25	40	185	73	38.46

Dimensions, Promass M: Tri-Clamp connections

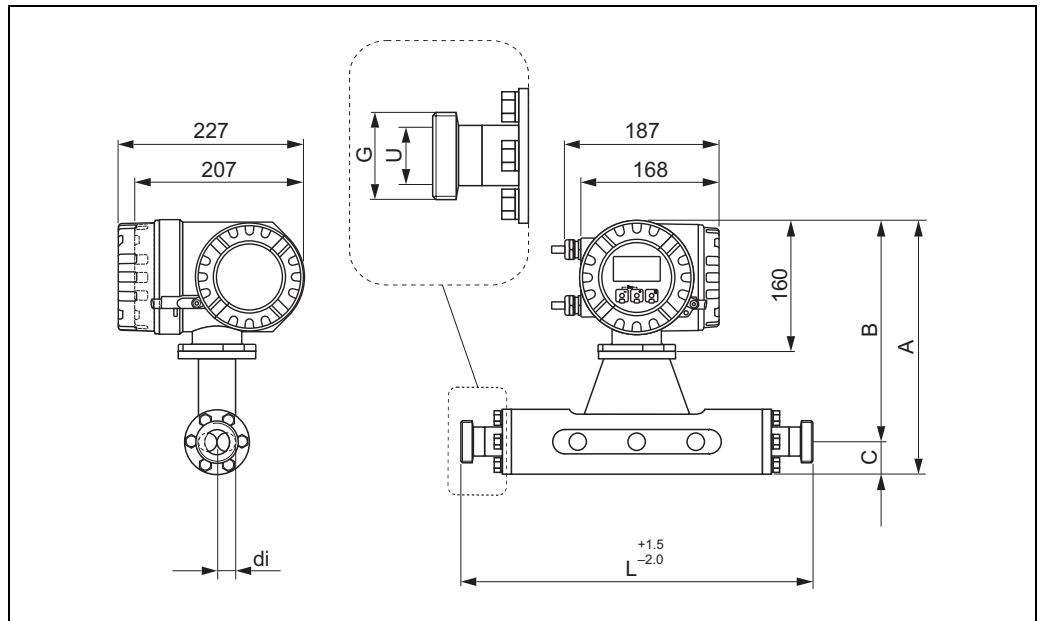


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Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	301	266	35	50.4	367	22.1	5.53
15	1"	305	268	37	50.4	398	22.1	8.55
25	1"	312	272	40	50.4	434	22.1	11.38
40	1 1/2"	332	283	49	50.4	560	34.8	17.07
50	2"	351	293	58	63.9	720	47.5	25.60
80	3"	385	309	76	90.9	801	72.9	38.46
3A version also available (Ra ≤ 0.8 μm/150 grit)								

1/2" Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1/2"	301	266	35	25.0	367	9.5	5.53
15	1/2"	305	268	37	25.0	398	9.5	8.55
3A version also available (Ra ≤ 0.8 μm/150 grit)								

Dimensions, Promass M: DIN 11851 connections (dairy fitting)



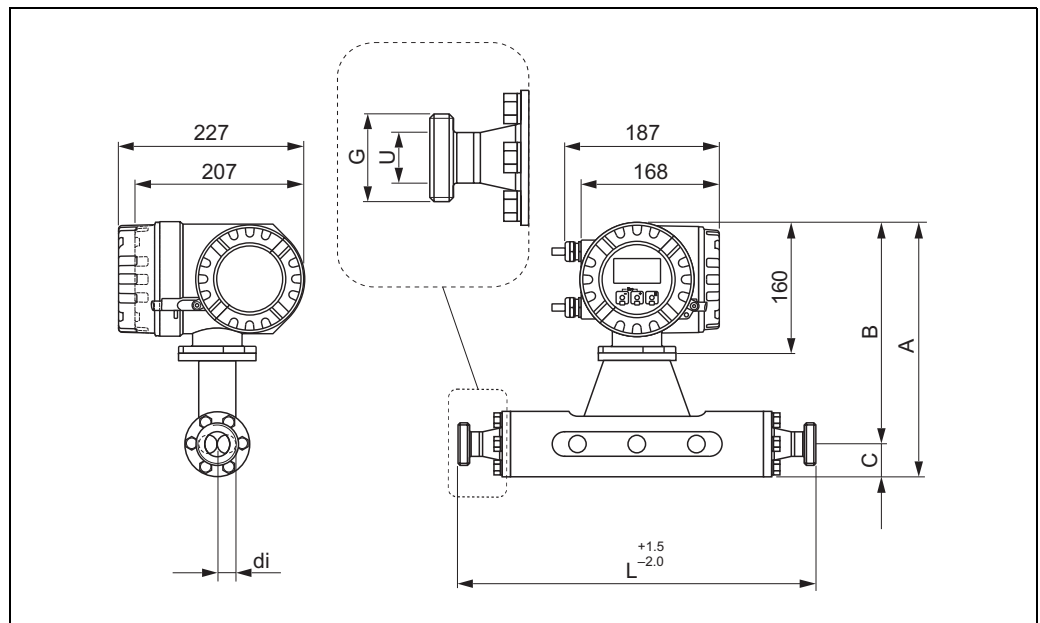
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Dairy fitting DIN 11851: 1.4404/316L

DN	A	B	C	G	L	U	di
8	301	266	35	Rd 34 x 1/8"	367	16	5.53
15	305	268	37	Rd 34 x 1/8"	398	16	8.55
25	312	272	40	Rd 52 x 1/6"	434	26	11.38
40	332	283	49	Rd 65 x 1/6"	560	38	17.07
50	351	293	58	Rd 78 x 1/6"	720	50	25.60
80	385	309	76	Rd 110 x 1/4"	815	81	38.46

3A version also available (Ra ≤ 0.8 μm/150 grit.)

Dimensions, Promass M: DIN 11864-1 Form A connections (couplings)

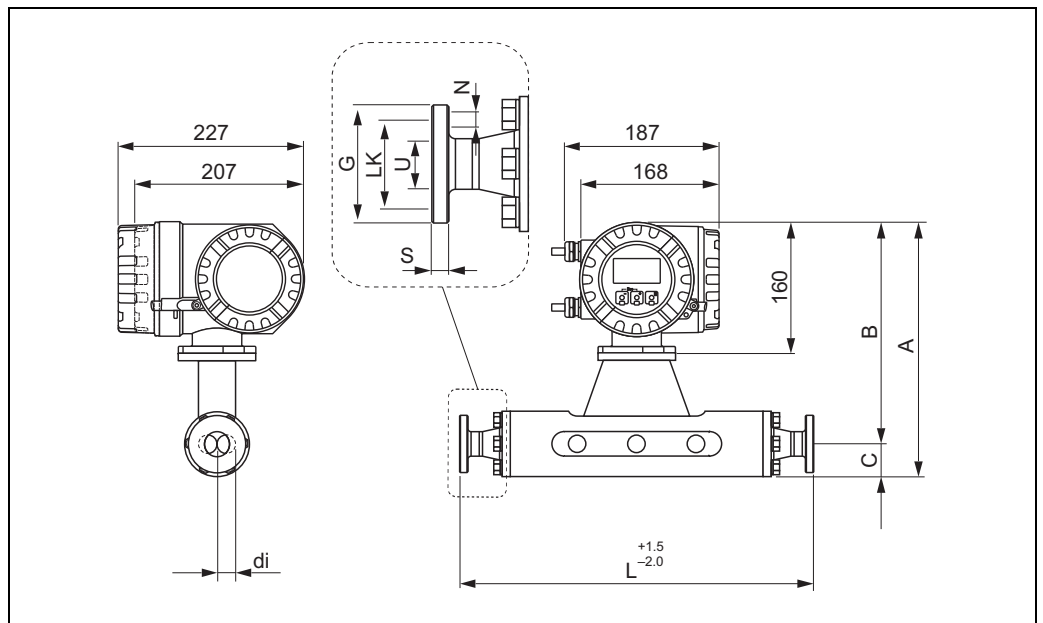


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Coupling DIN 11864-1 Form A: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	301	266	35	Rd 28 x 1/8"	367	10	5.53
15	305	268	37	Rd 34 x 1/8"	398	16	8.55
25	312	272	40	Rd 52 x 1/6"	434	26	11.38
40	332	283	49	Rd 65 x 1/6"	560	38	17.07
50	351	293	58	Rd 78 x 1/6"	720	50	25.60
80	385	309	76	Rd 110 x 1/4"	815	81	38.46

3A version also available ($Ra \leq 0.8 \mu\text{m}/150 \text{ grit.}$)

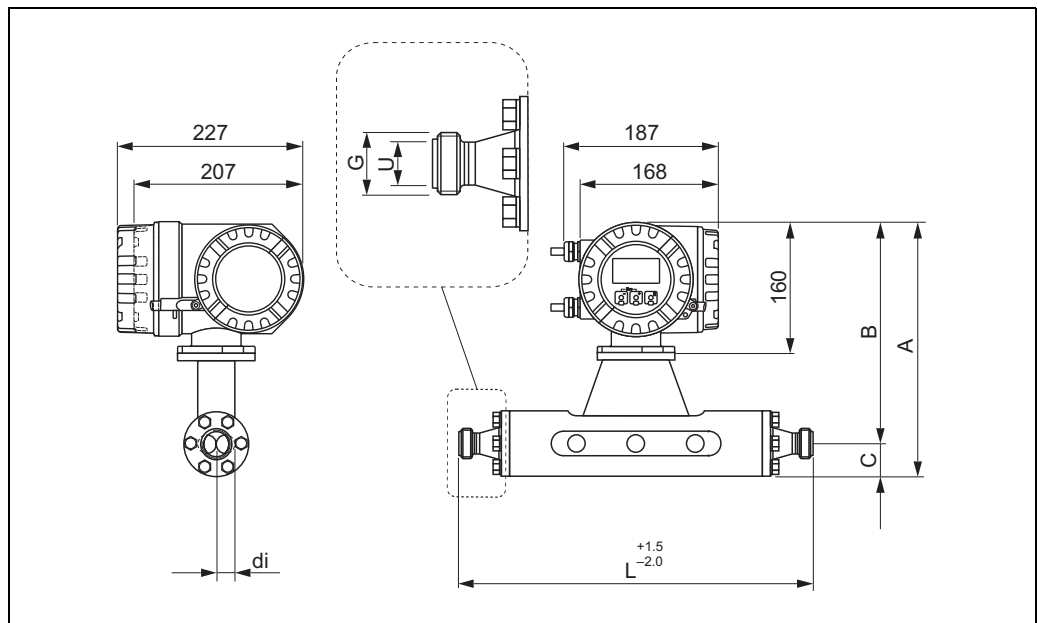
Dimensions, Promass M: Flange connections DIN 11864-2 Form A (flat flange)



a0002529

Flange DIN 11864-2 Form A (flat flange): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	301	266	35	54	367	4 x Ø9	10	37	10	5.53
15	305	268	37	59	398	4 x Ø9	10	42	16	8.55
25	312	272	40	70	434	4 x Ø9	10	53	26	11.38
40	332	283	49	82	560	4 x Ø9	10	65	38	17.07
50	351	293	58	94	720	4 x Ø9	10	77	50	25.60
80	385	309	76	133	815	8 x Ø11	12	112	81	38.46
3A version also available (Ra ≤ 0.8 µm/150 grit)										

Dimensions, Promass M: ISO 2853 connections (couplings)

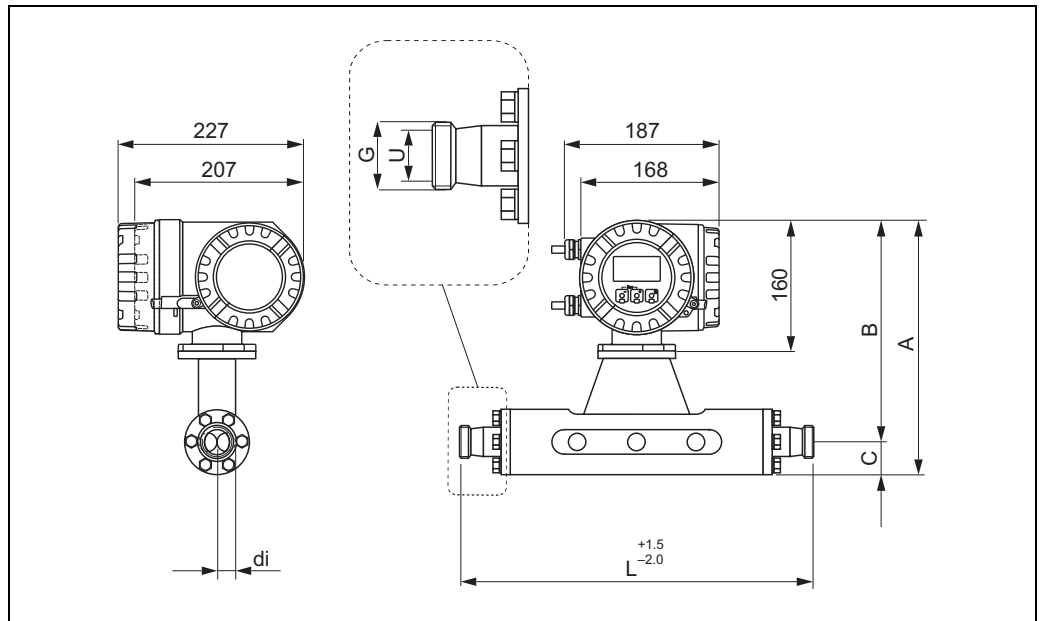


a0002530

Coupling ISO 2853: 1.4404/316L							
DN	A	B	C	G ¹⁾	L	N	di
8	301	266	35	37.13	367	22.6	5.53
15	305	268	37	37.13	398	22.6	8.55
25	312	272	40	37.13	434	22.6	11.38
40	332	283	49	52.68	560	35.6	17.07
50	351	293	58	64.16	720	48.6	25.60
80	385	309	76	91.19	815	72.9	38.46

¹⁾ Max. thread diameter to ISO 2853 Annex A
3A version also available (Ra ≤ 0.8 μm/150 grit)

Dimensions, Promass M: SMS 1145 connections (dairy fitting)

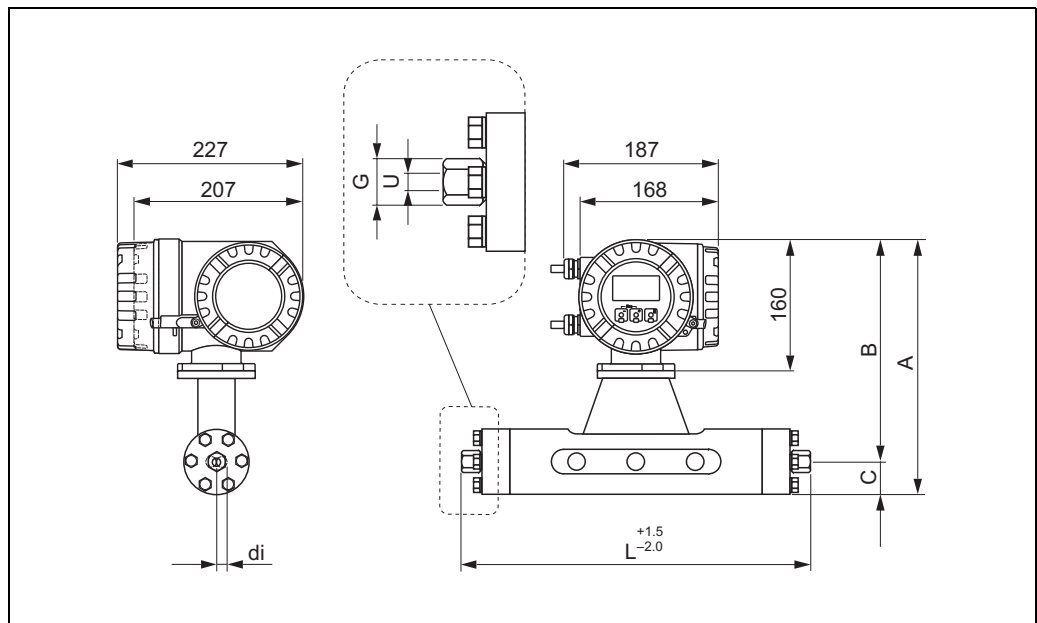


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Dairy fitting SMS 1145: 1.4404/316L

DN	A	B	C	G	L	U	di
8	301	266	35	Rd 40 x 1/6"	367	22.5	5.53
15	305	268	37	Rd 40 x 1/6"	398	22.5	8.55
25	312	272	40	Rd 40 x 1/6"	434	22.5	11.38
40	332	283	49	Rd 40 x 1/6"	560	35.5	17.07
50	351	293	58	Rd 70 x 1/6"	720	48.5	25.60
80	385	309	76	Rd 98 x 1/6"	792	72.0	38.46

3A version also available (Ra ≤ 0.8 μm/150 grit)

Dimensions, Promass M (high pressure): NPT 1/2", NPT 3/8" and G 3/8" connections


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NPT 1/2": 1.4404/316L

DN	A	B	C	G	L	U	di
8	301	266	35	SW 1 1/16"	370	10.2	4.93
15	305	268	37	SW 1 1/16"	400	10.2	7.75
25	312	272	40	SW 1 1/16"	444	10.2	10.20

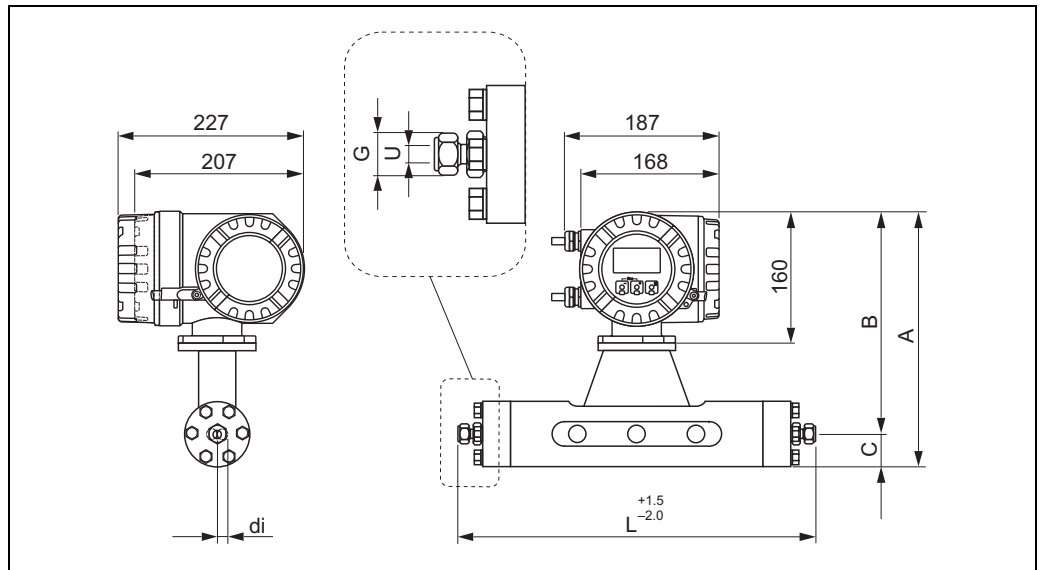
NPT 3/8": 1.4404/316L

DN	A	B	C	G	L	U	di
8	301	266	35	SW 1 5/16"	355.8	10.2	4.93
15	305	268	37	SW 1 5/16"	385.8	10.2	7.75
25	312	272	40	SW 1 5/16"	429.8	10.2	10.20

G 3/8": 1.4404/316L

DN	A	B	C	G	L	U	di
8	301	266	35	SW 24	355.8	10.2	4.93
15	305	268	37	SW 24	385.8	10.2	7.75
25	312	272	40	SW 24	429.8	10.2	10.20

Dimensions, Promass M (high pressure): 1/2" SWAGELOK connection

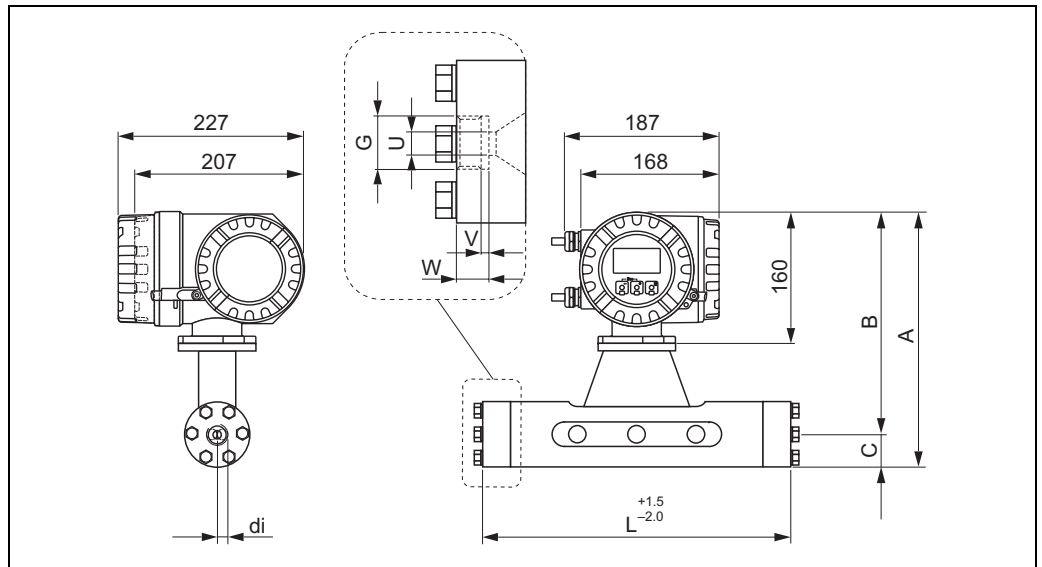


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1/2" SWAGELOK: 1.4404/316L

DN	A	B	C	G	L	U	di
8	301	266	35	7/8"	366.4	10.2	4.93
15	305	268	37	7/8"	396.4	10.2	7.75
25	312	272	40	7/8"	440.4	10.2	10.20

Dimensions, Promass M (high pressure): Connector with internal thread 7/8-14 UNF

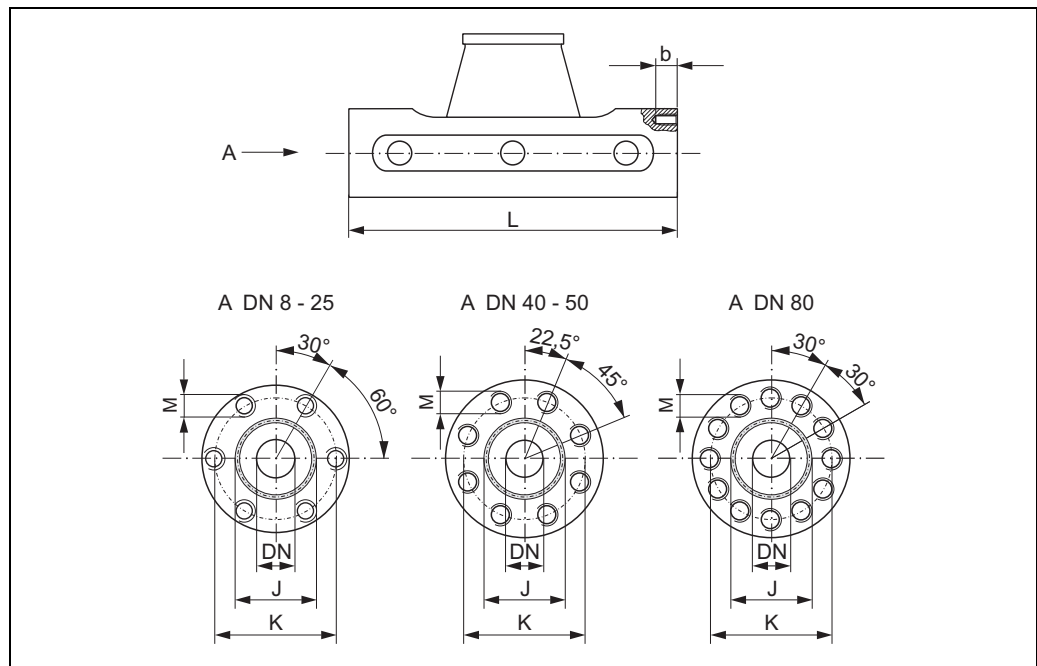


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Internal thread 7/8-14-UNF: 1.4404/316L

DN	A	B	C	G	L	U	V	W	di
8	301	266	35	7/8-14UNF	304	10.2	3	14	4.93
15	305	268	37	7/8-14UNF	334	10.2	3	14	7.75
25	312	272	40	7/8-14UNF	378	10.2	3	14	10.20

Dimensions, Promass M: Without process connections



40002535

DN	L	J	K	M	b _{max.}	b _{min.}
8	256	27	54	6 x M 8	12	10
8 ¹⁾	256	27	54	6 x M 8	12	10
15	286	35	56	6 x M 8	12	10
15 ¹⁾	286	35	56	6 x M 8	12	10
25	310	40	62	6 x M 8	12	10
25 ¹⁾	310	40	62	6 x M 8	12	10
40	410	53	80	8 x M 10	15	13
50	544	73	94	8 x M 10	15	13
80	644	102	128	12 x M 12	18	15

¹⁾ High-pressure version; permitted screws: A4 - 80; lubricant: Molykote P37

DN	Tightening torque Nm	Lubricated thread yes/no	O-ring	
			Thickness	Inside Ø
8	30.0	no	2.62	21.89
8 ¹⁾	19.3	yes	2.62	21.89
15	30.0	no	2.62	29.82
15 ¹⁾	19.3	yes	2.62	29.82
25	30.0	no	2.62	34.60
25 ¹⁾	19.3	yes	2.62	34.60
40	60.0	no	2.62	47.30
50	60.0	yes	2.62	67.95
80	100.0	yes	3.53	94.84

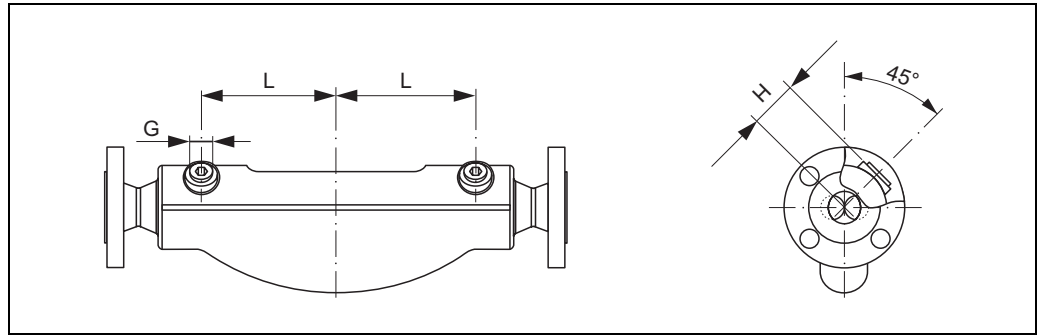
¹⁾ High-pressure version; permitted screws: A4 - 80; lubricant: Molykote P37

Purge connections / pressure vessel monitoring

Caution!

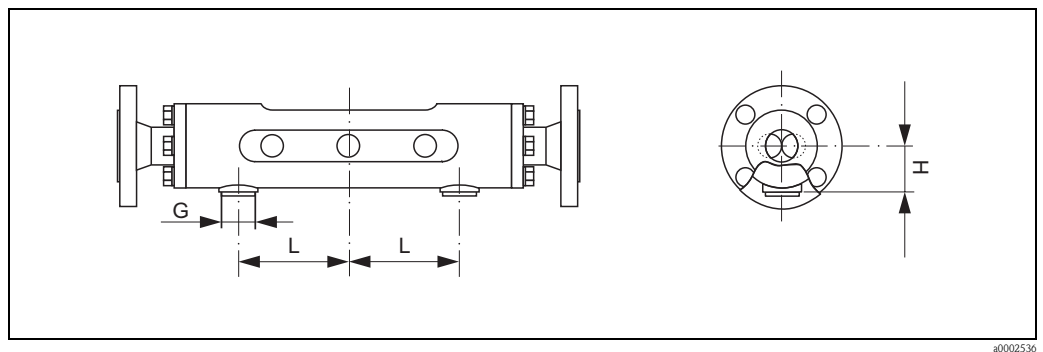
The secondary containment is filled with dry nitrogen (N₂). Do not open the purge connections unless the containment can be filled immediately with a dry inert gas. Use only low gauge pressure to purge. Maximum pressure: 5 bar.

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



DN	L	H	G
8	108	62	1/2" NPT
15	110	62	1/2" NPT
25	130	62	1/2" NPT
40	155	67	1/2" NPT
50	226	79	1/2" NPT
80	280	101	1/2" NPT
100	342	115	1/2" NPT
150	440	121	1/2" NPT

Dimensions, Promass M:



DN	L	H	G
8	85	44.0	1/2" NPT
15	100	46.5	1/2" NPT
25	110	50.0	1/2" NPT
40	155	59.0	1/2" NPT
50	210	67.5	1/2" NPT
80	210	81.5	1/2" NPT

Weight

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

Promass F / DN	8	15	25	40	50	80	100	150	250 ¹⁾
Compact version	11	12	14	19	30	55	96	154	400
High-temperature compact version	–	–	14.7	–	30.7	55.7	–	–	–
Remote version	9	10	12	17	28	53	94	152	398
High-temperature remote version	–	–	13.5	–	29.5	54.5	–	–	–
¹⁾ With 10" ANSI Cl 300 flanges									

Promass M / DN	8	15	25	40	50	80
Compact version	11	12	15	24	41	67
Remote version	9	10	13	22	39	65

Weight information in [kg].

All values (weight) refer to devices with EN/DIN PN 40 flanges.

Material**Transmitter housing:**

- Compact housing: stainless steel 1.4301/304
- Compact housing: powder coated die-cast aluminum
- Wall-mount housing: powder coated die-cast aluminum
- Remote field housing: powder-coated die-cast aluminum

Sensor housing / containment:

Promass F:

Acid and alkali-resistant outer surface

DN 8 to 50: stainless steel 1.4301/304

DN 80 to 250: stainless steel 1.4301/304 and 1.4308/304L

Promass M:

Acid and alkali-resistant outer surface

DN 8 to 50: steel, chemically nickel-plated

DN 80: stainless steel

Connection housing, sensor (remote version):

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

Process connections

Promass F:

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Stainless steel 1.4404/316L
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602/N 06022
- Flange DIN 11864-2 Form A (flat flange) → Stainless steel 1.4404/316L
- Dairy fitting DIN 11851 / SMS 1145 → Stainless steel 1.4404/316L
- Coupling ISO 2853 / DIN 11864-1 → Stainless steel 1.4404/316L
- Tri-Clamp (OD-Tubes) → Stainless steel 1.4404/316L
- VCO connection → Stainless steel 1.4404/316L

Promass F (high-temperature version):

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Stainless steel 1.4404/316L
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602 (N 06022)

Promass M:

- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Stainless steel 1.4404/316L, titanium Grade 2
- Flange DIN 11864-2 Form A (flat flange) → Stainless steel 1.4404/316L
- PVDF coupling to DIN / ANSI / JIS
- Dairy fitting DIN 11851 / SMS 1145 → Stainless steel 1.4404/316L
- Coupling ISO 2853 / DIN 11864-1 → Stainless steel 1.4404/316L
- Tri-Clamp (OD-Tubes) → Stainless steel 1.4404/316L

Promass M (high-pressure version):

- Connector → Stainless steel 1.4404/316L
- Coupling → Stainless steel 1.4401/316

Measuring tube(s):

Promass F:

- DN 8 to 100: stainless steel 1.4539 (904L)
- DN 150: stainless steel 1.4404/316L
- DN 250: stainless steel 1.4404/316L; manifold: CF3M
- DN 8 to 150: Alloy C-22 2.4602/N 06022

Promass F (high-temperature version):

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

Promass M:

- DN 8 to 50: Titanium grade 9
- DN 80: Titanium grade 2

Promass M (high-pressure version):

- Titanium Grade 9

Seals:

Promass F:

Welded process connections without internal seals

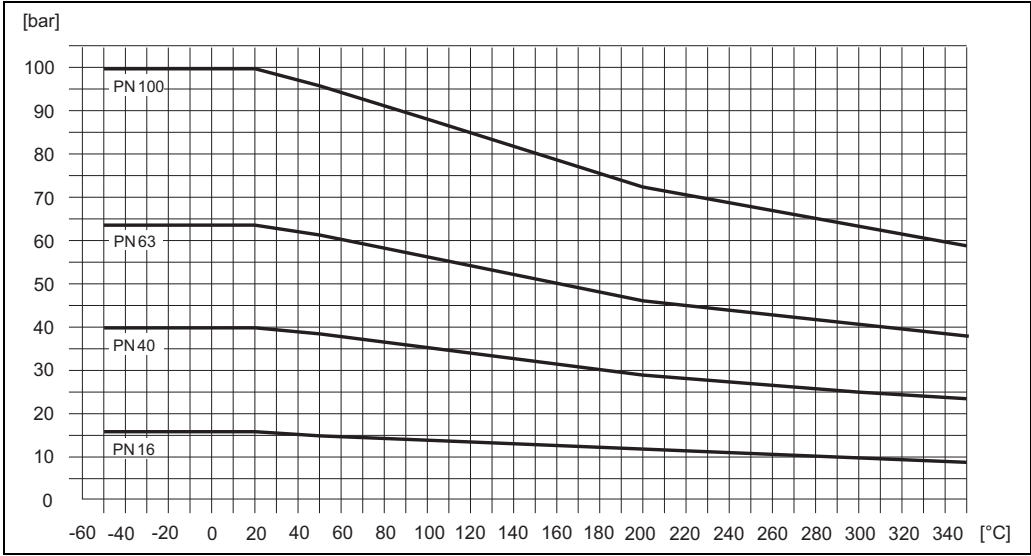
Promass M:

Viton, EPDM, silicone, Kalrez, FEP sheathing (not for gas applications)

Material load diagram

Promass F: Flange connection to EN 1092-1 (DIN 2501)

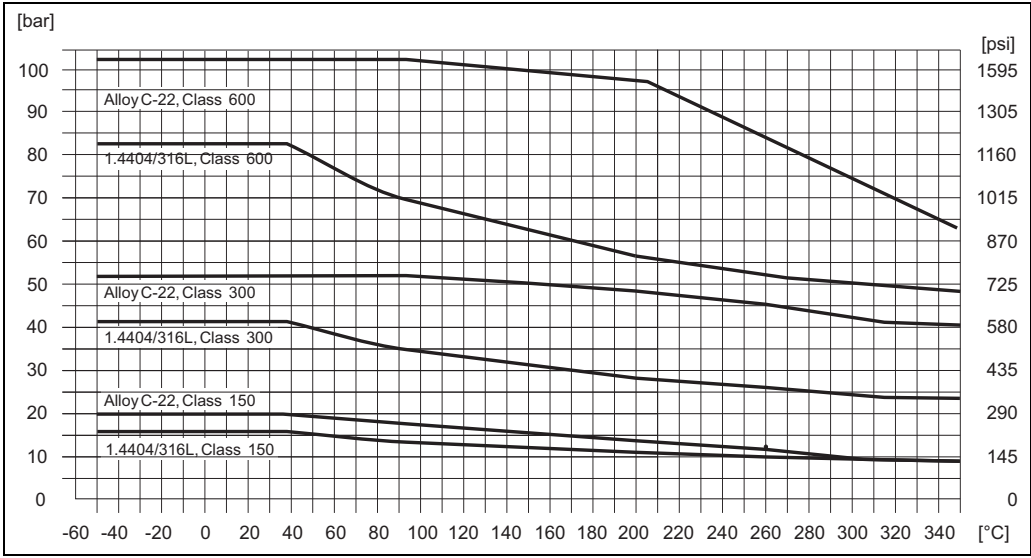
Flange material: 1.4404/316L, Alloy C-22



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

Promass F: Flange connection to ANSI B16.5

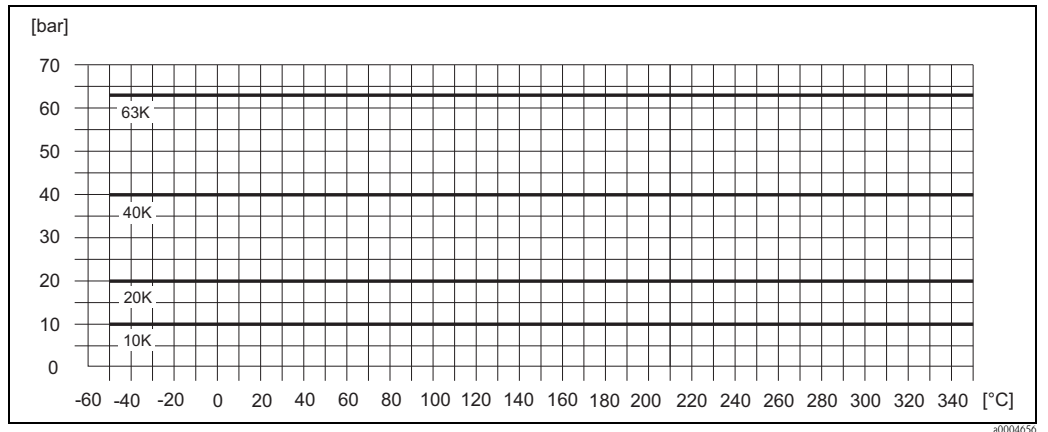
Flange material: 1.4404/316L, Alloy C-22



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

Promass F: Flange connection to JIS B2238

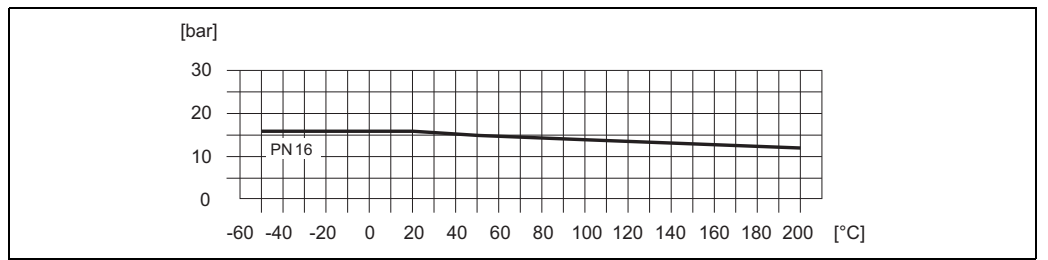
Flange material: 1.4404/316L, Alloy C-22



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

Promass F: Dairy fitting to DIN 11851 / SMS 1145

Connection material: 1.4404/316L

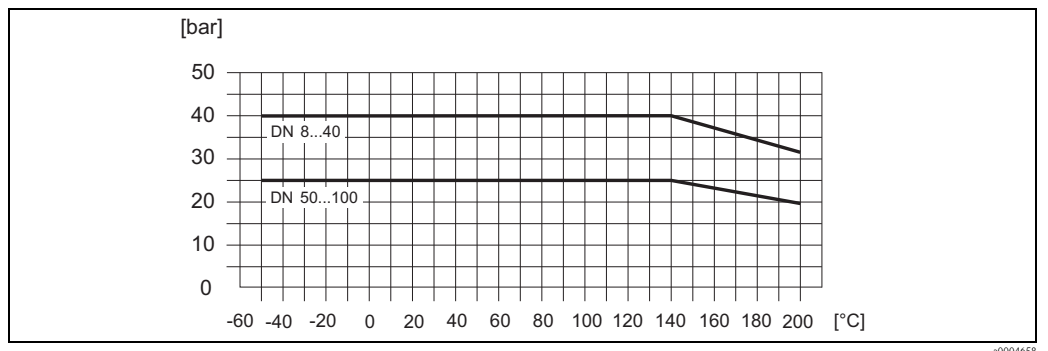


Promass F: Tri-Clamp process connection

The load limit is defined exclusively by the material properties of the outer clamp used. This clamp is not included in the scope of delivery.

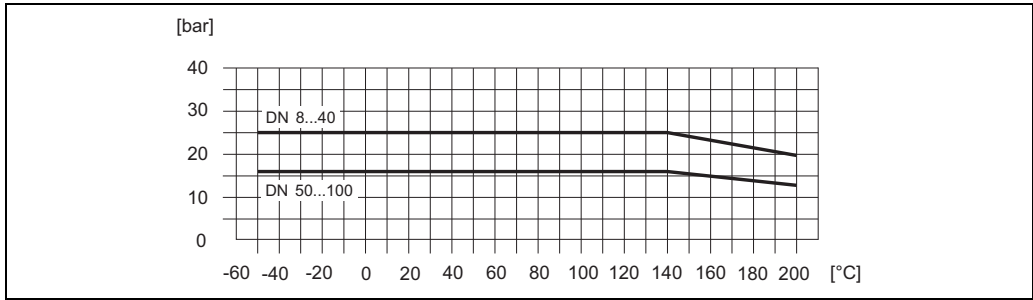
Promass F: Coupling to DIN 11864-1

Connection material: 1.4404/316L



Promass F: Flange connection to DIN 11864-2 Form A (flat flange)

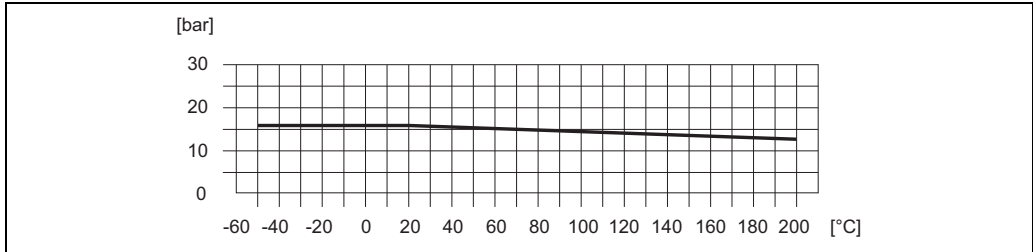
Flange material: 1.4404/316L



a0004659

Promass F: Coupling to ISO 2853

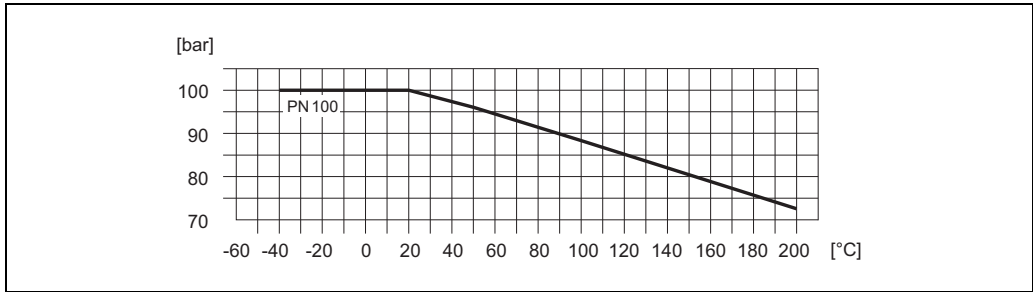
Connection material: 1.4404/316L



a0004660

Promass F: VCO process connection

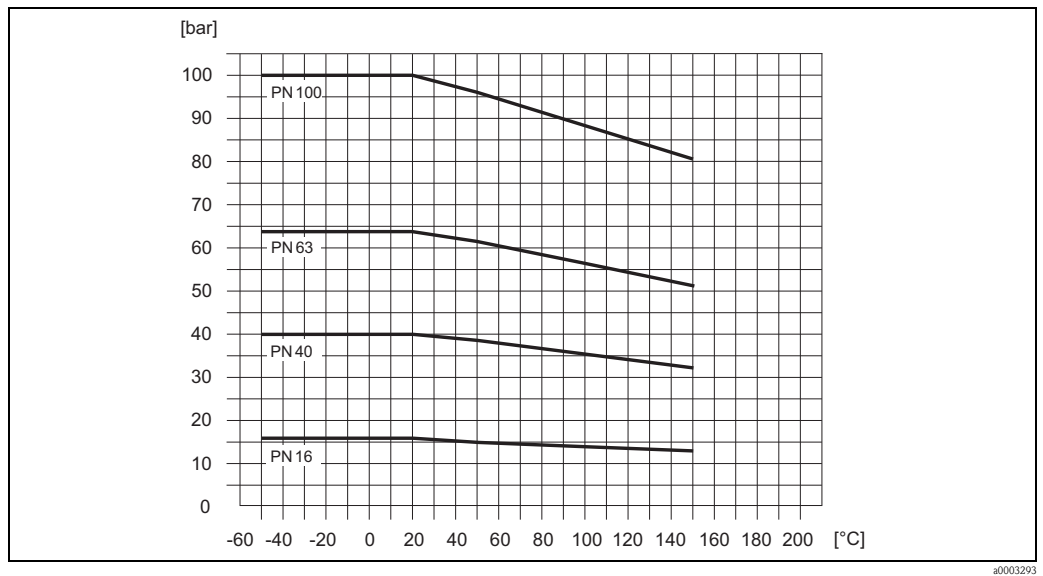
Connection material: 1.4404/316L



a0004553

Promass M: Flange connection to EN 1092-1 (DIN 2501)

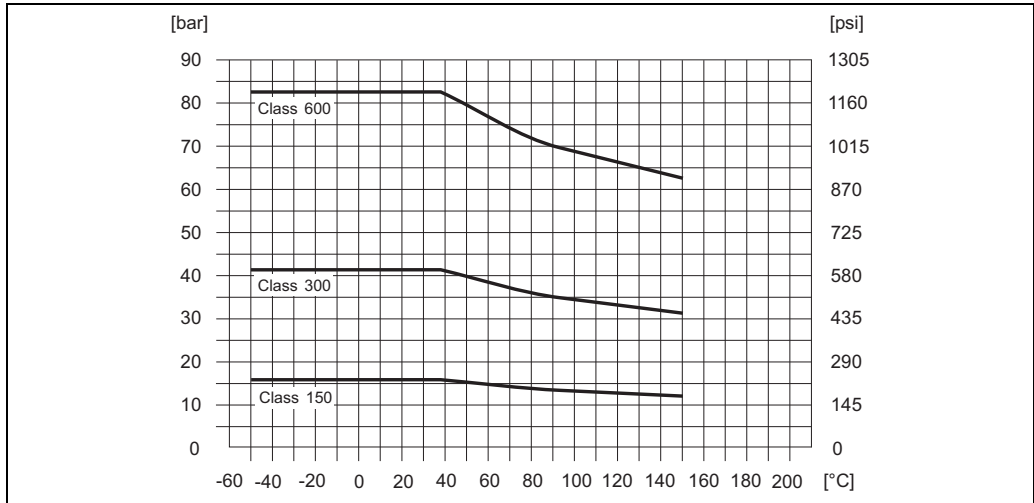
Flange material: 1.4404/316L, titanium grade 2



a0003293

Promass M: Flange connection to ANSI B16.5

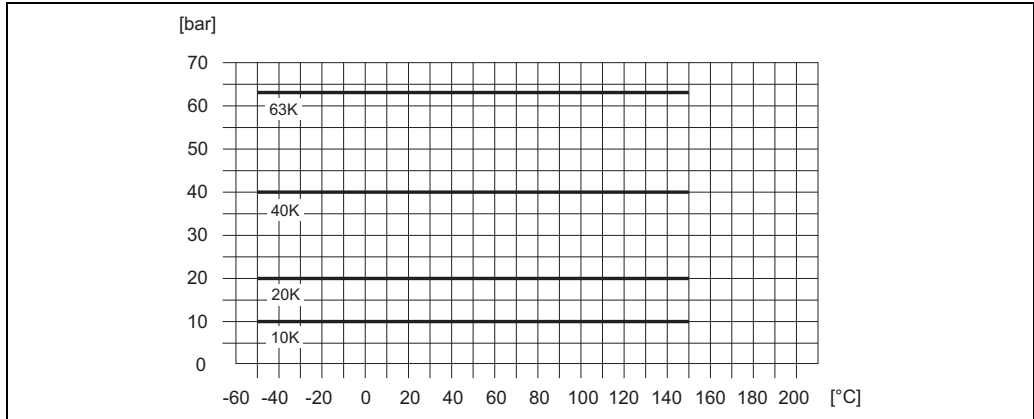
Flange material: 1.4404/316L, titanium grade 2



a0003297

Promass M: Flange connection to JIS B2238

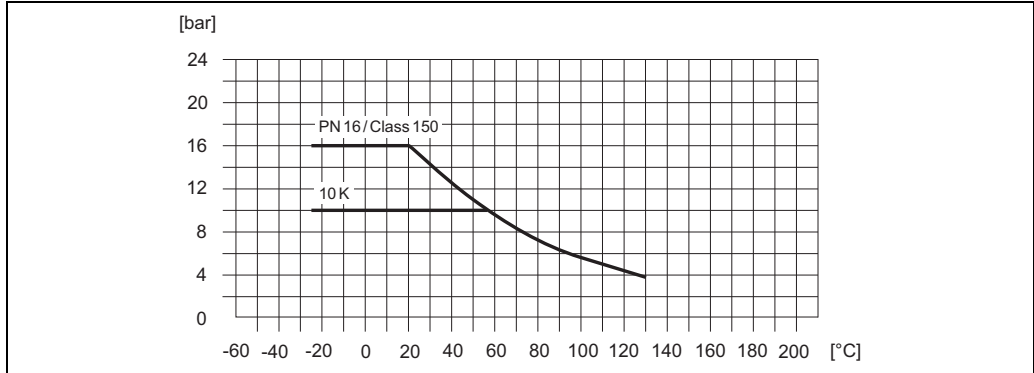
Flange material: 1.4404/316L, titanium grade 2



a0003304

Promass M: PVDF flange connection (to DIN 2501, ANSI B16.5, JIS B2238)

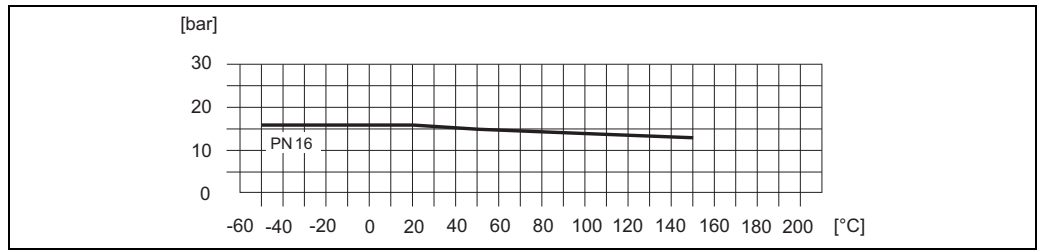
Flange material: PVDF



a0004661

Promass M: Dairy fitting to DIN 11851 / SMS 1145

Connection material: 1.4404/316L

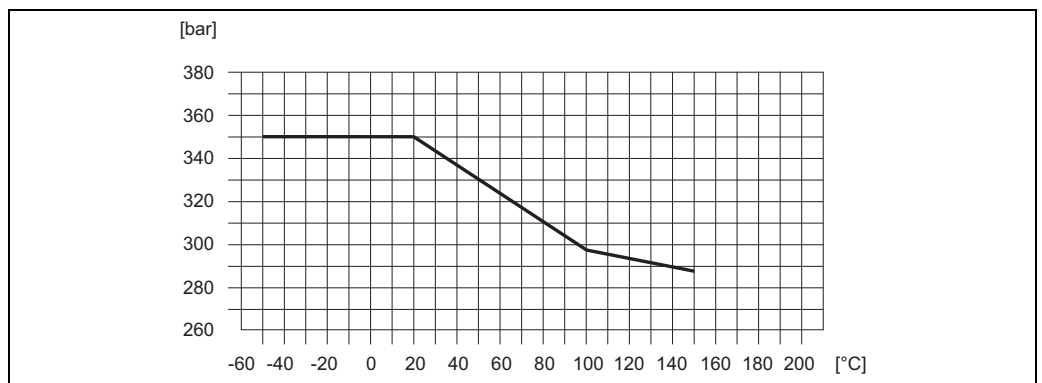


a0003305

Promass M: Process connections for high-pressure version

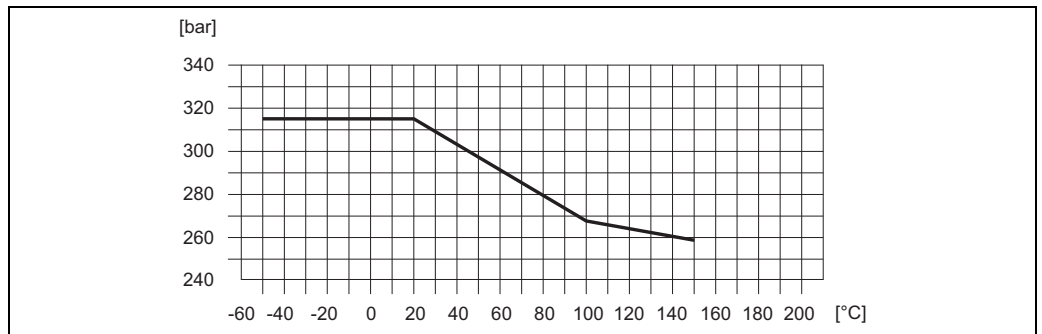
Connector material: 1.4404/316L

Material of thread connections (G 3/8", VCO with 1/2" SWAGELOK, NPT 3/8"): 14401/316



a0004662

Material of thread connections (NPT 1/2"): 1.4401/316



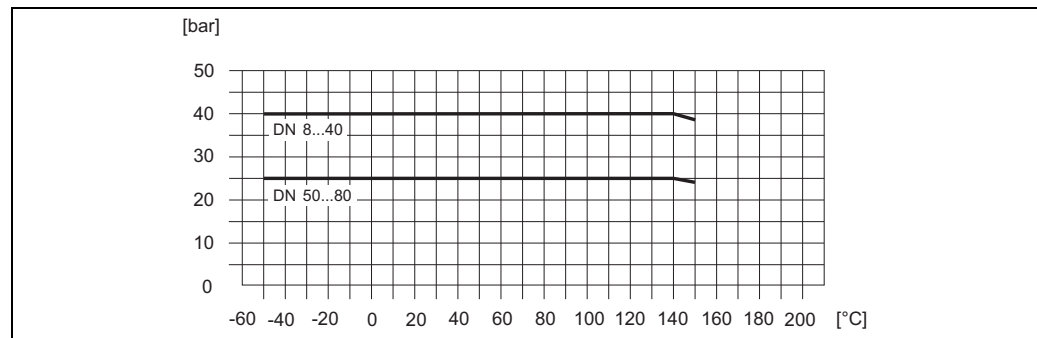
a0004663

Promass M: Tri-Clamp process connection

The load limit is defined exclusively by the material properties of the outer clamp used. This clamp is not included in the scope of delivery.

Promass M: Coupling to DIN 11864-1

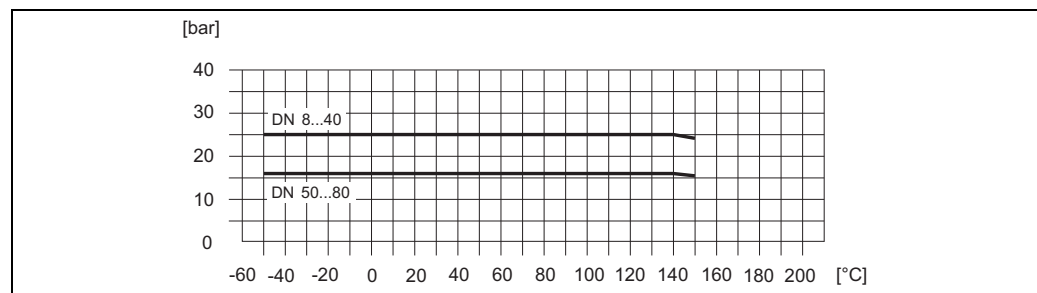
Connection material: 1.4404/316L



a0004604

Promass M: Flange connection to DIN 11864-2 Form A (flat flange)

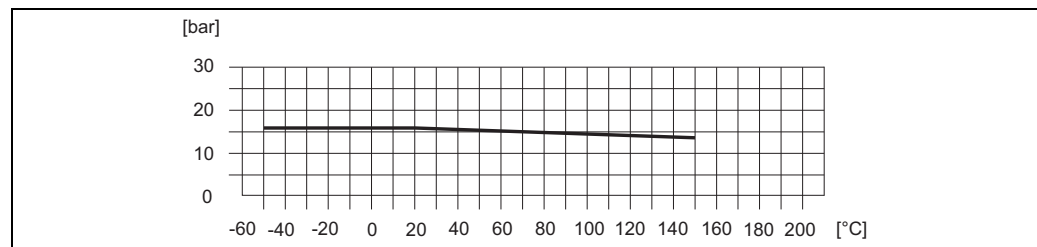
Flange material: 1.4404/316L



a0004605

Promass M: Coupling to ISO 2853

Connection material: 1.4404/316L



a0003308

Process connections

Promass F (welded process connections):

- Flanges EN 1092-1 (DIN 2501), ANSI B16.5, JIS B2238, VCO connections
- Sanitary connections: Tri-Clamp, couplings (DIN 11851, SMS 1145, ISO 2853, DIN 11864-1), flange to DIN 11864-2 Form A (flat flange)

Promass M (threaded process connections):

- Flanges EN 1092-1 (DIN 2501), ANSI B16.5, JIS B2238
- Sanitary connections: Tri-Clamp, couplings (DIN 11851, SMS 1145, ISO 2853, DIN 11864-1), flange to DIN 11864-2 Form A (flat flange)

Promass M (high-pressure version):

- Thread connections: 3/8", 1/2" NPT, 3/8" NPT and 1/2" SWAGELOK couplings; connector with 7/8-14UNF internal thread

Human interface

Display elements	<ul style="list-style-type: none"> ■ 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:	<p>Promass 80:</p> <ul style="list-style-type: none"> ■ Local operation with three keys (-, +, E) ■ Quick Setup menus for straightforward commissioning <p>Promass 83:</p> <ul style="list-style-type: none"> ■ Local operation with three optical keys (□/□/□) ■ Application-specific Quick Setup menus for straightforward commissioning
Language group	<p>Note! The language group is changed using the “ToF Tool – Fieldtool Package” operating program.</p> <p>Language groups available for operation in different countries:</p> <ul style="list-style-type: none"> ■ 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 <p>Only Promass 83:</p> <ul style="list-style-type: none"> ■ China (CN): English, Chinese
Remote operation	<p>Promass 80:</p> <p>Remote operation via HART, PROFIBUS PA</p> <p>Promass 83:</p> <p>Remote operation via HART, PROFIBUS PA/DP, FOUNDATION Fieldbus</p>

Certificates and approvals

CE mark	<p>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.</p>
Ex approval	<p>Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are contained in separate explosion protection documentation which you can order if required.</p>
Sanitary compatibility	<ul style="list-style-type: none"> ■ 3A approval
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 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	<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 to PROFIBUS Profile Version 3.0 (device certification number: on request) ■ The device can also be operated with certified devices of other manufacturers (interoperability) 																		
MODBUS certification	<p>The measuring device meets all the requirements of the MODBUS/TCP conformity and integration test and has the “MODBUS/TCP Conformance Test Policy, Version 2.0”. The measuring device has successfully passed all the test procedures carried out and is certified by the “MODBUS/TCP Conformance Test Laboratory” of the University of Michigan.</p>																		
Other standards and guidelines	<ul style="list-style-type: none"> ■ EN 60529 Degrees of protection by housing (IP code) ■ EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ■ EN 61326/A1 (IEC 1326) “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 measuring device approval	<p>Flowmeters with a nominal diameter smaller or equal DN 25 are covered by Art. 3(3) of the European directive 97/23/EC (Pressure Equipment Directive) and are designed according to sound engineering practice. For larger nominal diameters, optional approvals according to Cat. II/III are available if required (depends on fluid and process pressure).</p>																		
Functional safety	<p>SIL -2: accordance IEC 61508/IEC 61511-1 (FDIS) “4–20 mA” - output according to the following order code:</p> <p>Promass 80</p> <p>Promass80***_*****A Promass80***_*****D Promass80***_*****S Promass80***_*****T Promass80***_*****8</p> <p>Promass 83</p> <table border="0"> <tr> <td>Promass83***_*****A</td> <td>Promass83***_*****M</td> <td>Promass83***_*****Ø</td> </tr> <tr> <td>Promass83***_*****B</td> <td>Promass83***_*****R</td> <td>Promass83***_*****2</td> </tr> <tr> <td>Promass83***_*****C</td> <td>Promass83***_*****S</td> <td>Promass83***_*****3</td> </tr> <tr> <td>Promass83***_*****D</td> <td>Promass83***_*****T</td> <td>Promass83***_*****4</td> </tr> <tr> <td>Promass83***_*****E</td> <td>Promass83***_*****U</td> <td>Promass83***_*****5</td> </tr> <tr> <td>Promass83***_*****L</td> <td>Promass83***_*****W</td> <td>Promass83***_*****6</td> </tr> </table>	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
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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 on request.

Accessories

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

Note!

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

Documentation

- Flow measuring technology (FA005D/06/en)
- Technical Information Promass 80E, 83E (TI061D/06/en)
- Technical Information Promass 80/83 A (TI 054D/06/en)
- Technical Information Promass 80H, 80I, 83H, 83I (TI052D/06/en)
- Operating Instructions Promass 80 (BA 057D/06/en)
- Operating Instructions Promass 80 PROFIBUS PA (BA072D/06/en)
- Operating Instructions Promass 83 (BA 059D/06/en)
- Operating Instructions Promass 83 FOUNDATION Fieldbus (BA065D/06/en)
- Operating Instructions Promass 83 PROFIBUS DP/PA (BA063D/06/en)
- Operating Instructions Promass 83 MODBUS (BA107D/06/en)
- Description of Device Functions Promass 80 (BA 058D/06/en)
- Description of Device Functions Promass 80 PROFIBUS PA (BA073D/06/en)
- Description of Device Functions Promass 83 (BA 060D/06/en)
- Description of Device Functions Promass 83 FOUNDATION Fieldbus (BA066D/06/en)
- Description of Device Functions Promass 83 PROFIBUS DP/PA (BA064D/06/en)
- Description of Device Functions Promass 83 MODBUS (BA108D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA
- Functional Safety Manual for Promass 80, 83 (SD077D/06/en)

Registered trademarks

KALREZ® and VITON®

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

TRI-CLAMP®

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

SWAGELOK®

Registered trademark of Swagelok & Co., Solon, USA

HART®

Registered trademark of HART Communication Foundation, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™ Fieldbus

Registered trademark of the Fieldbus FOUNDATION, Austin, USA

MODBUS®

Registered trademark of the MODBUS Organization

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, ToF Tool - Fieldtool® Package, Fieldcheck®,
Applicator®

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

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