Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Proline Promass 40E

Coriolis Mass Flow Measuring System
The mass flow measuring system with low cost and basic functionality. The economical alternative to conventional volume flowmeters.

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

- Extremely accurate measurement of liquids and gases, e.g. additives, oils, greases, acids, alkalis, lacquers, paints and natural gas
- Fluid temperatures up to +125 °C
- Process pressures up to 100 bar
- Mass flow measurement up to 70 t/h

Approvals in the food industry/hygiene sector:
- 3A authorization

Approvals for hazardous area:
- ATEX, FM, CSA, TIIS, IECEx, NEPSI

Connection to process control systems:
- HART

Relevant safety aspects:
- Pressure Equipment Directive (PED)

Your benefits
The Promass measuring devices make it possible to simultaneously record several process variables (mass/volume/corrected volume) for various process conditions during measuring operation.

The **Proline transmitter concept** comprises:
- Modular device and operating concept resulting in a higher degree of efficiency

The **Promass sensors,** tried and tested in over 100000 applications, offer:
- 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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Endress+Hauser
People for Process Automation

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Function and system design

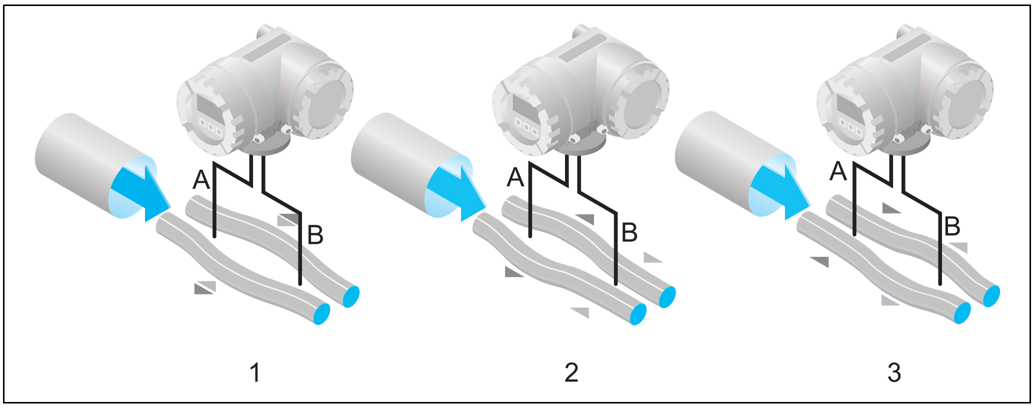
Measuring principle

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 sensor, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):
- At zero flow, 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).



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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.

Volume 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 density value obtained in this way can be used in conjunction with the measured mass flow to calculate the volume flow.
The temperature of the measuring tubes is also determined in order to calculate the compensation factor due to temperature effects.

Measuring system

The measuring system consists of a transmitter and a sensor (compact version):
- Promass 40 transmitter
- Promass E sensor (DN 8 to 50)

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)
- Volume flow (calculated from mass flow and fluid density. The density is proportional to the resonance frequency of the measuring tubes).
- Measuring tube temperature (by temperature sensors) for calculatory compensation of temperature effects.

Measuring range

Measuring ranges for liquids

DN	Range for full scale values (liquids) $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$
8	0 to 2000 kg/h
15	0 to 6500 kg/h
25	0 to 18000 kg/h
40	0 to 45000 kg/h
50	0 to 70000 kg/h

Measuring ranges for gases

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

$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div 320$ [kg/m³]

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

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

Calculation example for gas:

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

Max. possible full scale value:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div 320$ [kg/m³] = 70000 kg/h · 60.3 kg/m³ ÷ 320 kg/m³ = 13190 kg/h

Recommended full scale values

See information in the "Limiting flow" section → Page 12 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).

Output

Output signal

Current output:

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% o.f.s./°C, resolution: 0.5 µA
- Active: 0/4 to 20 mA, R_L < 700 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: full scale frequency 2 to 1000 Hz (f_{max} = 1250 Hz), on/off ratio 1:1, pulse width max. 10 s
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.5 to 2000 ms)

Signal on alarm

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

Pulse/frequency output:
Failsafe mode selectable

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

Load

see "Output signal"

Low flow cutoff

Switch points for low flow are selectable.

Galvanic isolation

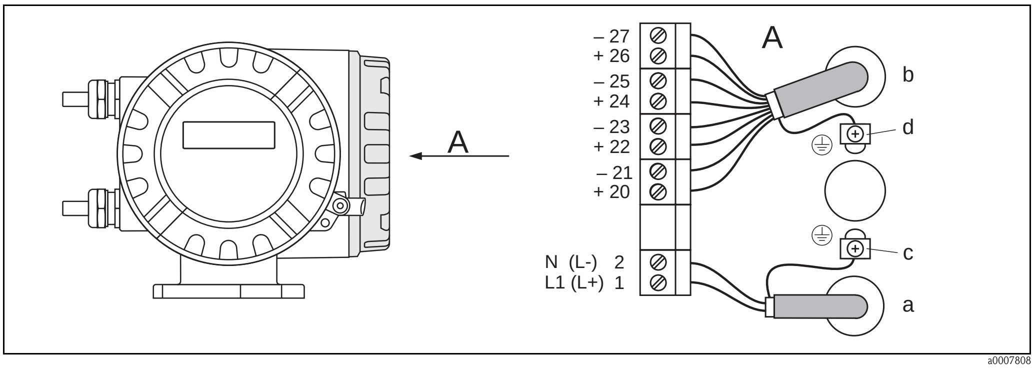
All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

Switching output

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

Power supply

Electrical connection Measuring unit



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

a 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
b Signal cable: see Terminal assignment → *Page 6*
c Ground terminal for protective conductor
d Ground terminal for signal cable shield

Electrical connection, terminal assignment

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

Supply voltage

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

Cable entries

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

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

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.)

Potential equalization

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

Performance characteristics

Reference operating conditions

Error limits following ISO/DIS 11631:
- 20 to 30 °C
- 2 to 4 bar
- Calibration systems as per national norms
- Zero point calibrated under operating conditions
- Field density calibrated

Maximum measured error

The following values refer to the pulse/frequency output. Measured error at the current output is typically ±5 µA.
o.r. = of reading

Mass flow (liquid):

±0.5% ± [(zero point stability ÷ measured value) · 100]% o.r.

Mass flow (gas)

±1.0% ± [(zero point stability ÷ measured value) · 100]% o.r.

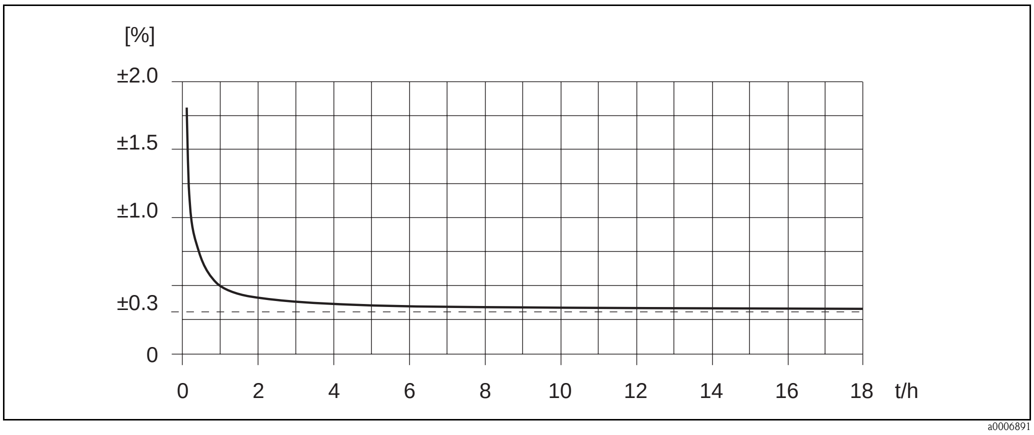
Volume flow (liquid)

±0.7% ± [(zero point stability ÷ measured value) · 100]% o.r.

Zero point stability:

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

Sample calculation



Max. measured error in % of measured value (example: Promass 40E / DN 25)

Calculation example (mass flow, liquid):
Given: Promass 83P/ DN 25, flow measured value = 8000 kg/h
Max. measured error: ±0.5% ± [(zero point stability ÷ measured value) · 100]% o.r.
Max. measured error: ±0.5% ±1.8 kg/h ÷ 8000 kg/h · 100% = ±0.523%

Repeatability

Mass flow (liquid):

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

Mass flow (gas):

±0.5% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.

Volume flow (liquid):

±0.35% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.

o.r. = of reading
Zero point stability: see "Max. measured error"→ Page 6 ff.

Calculation example (mass flow, liquid):
Given: Promass 40E / DN 25, flow measured value = 8000 kg/h
Repeatability: ±0.25% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.
Repeatability: ±0.25% ±½ · 1.8 kg/h ÷ 8000 kg/h · 100% = ±0.261%

Influence of fluid temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is ±0.0003% of the full scale value / °C.

Influence of fluid pressure

With nominal diameters DN 8 to 40, the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure can be neglected.
With DN 50 the influence is –0.009% o.r. / bar (o.r. = of reading)

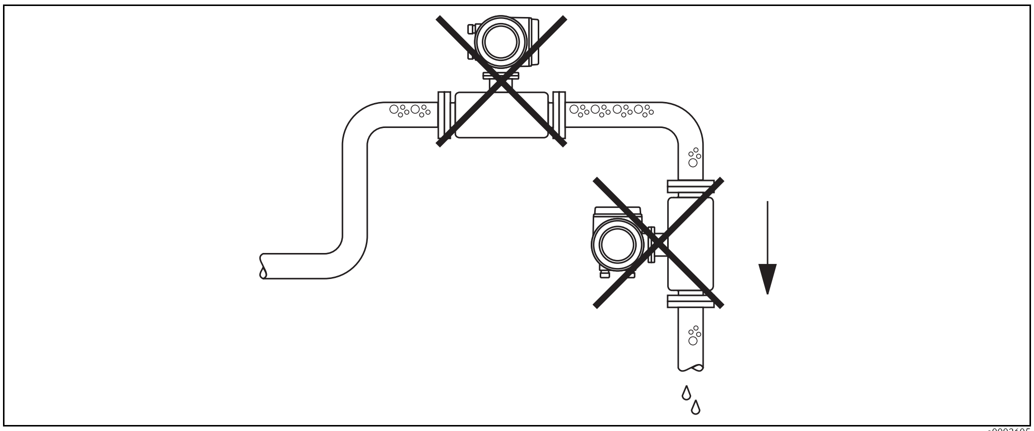
Operating conditions: Installation

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.

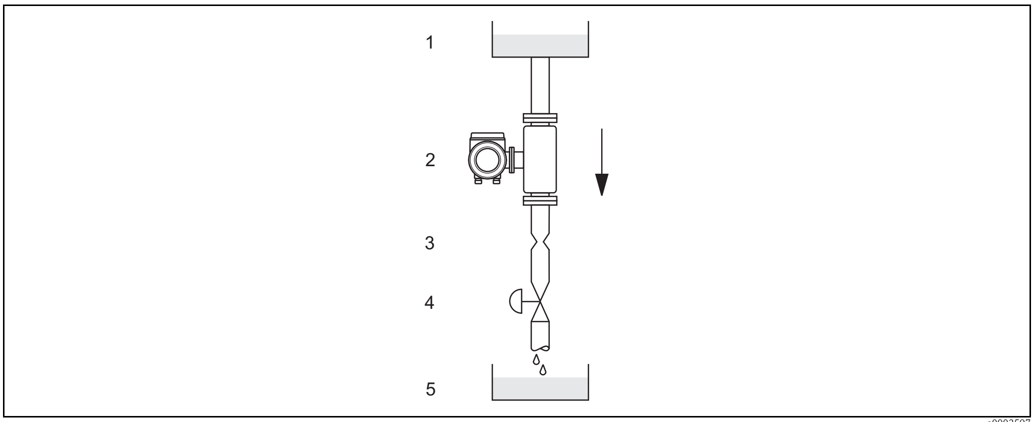
Mounting location

Entrained air or gas bubbles in the measuring tube can result in an increase in measuring errors.
Therefore, avoid the following mounting locations in the pipe installation:
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.



Mounting location

Notwithstanding the above, the installation proposal below permits installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



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

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

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

Orientation

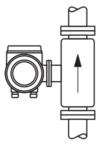
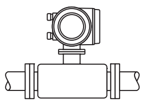
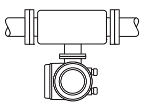
Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction of fluid flow through the pipe).

Vertical (view V)

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

Horizontal (view H1 to H3)

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

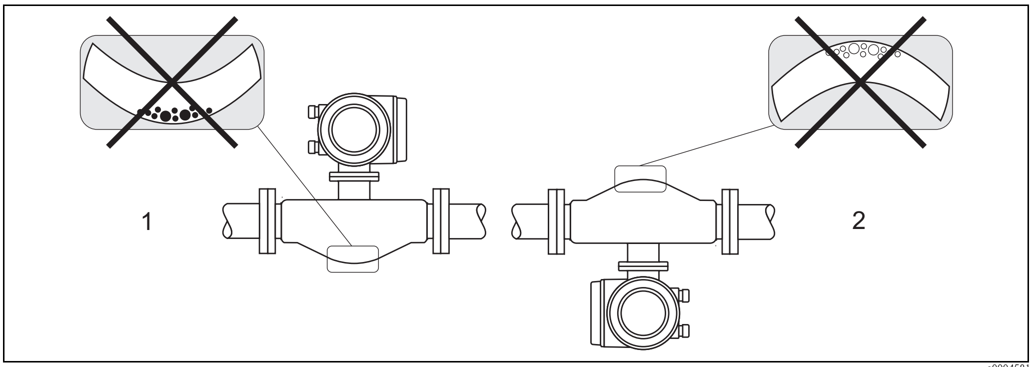
	Standard, compact	**Standard, remote**
Fig. V: Vertical orientation  a0004572	✔✔	✔✔
Fig. H1: Horizontal orientation Transmitter head up  a0004576	✔✔	✔✔
Fig. H2: Horizontal orientation Transmitter head down  a0004580	✔✔ ①	✔✔ ①

✔✔ = Recommended orientation
✔ = Orientation recommended in certain situations
✘ = Impermissible orientation

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

Special installation instructions

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



Horizontal installation for sensors with a bent measuring tube

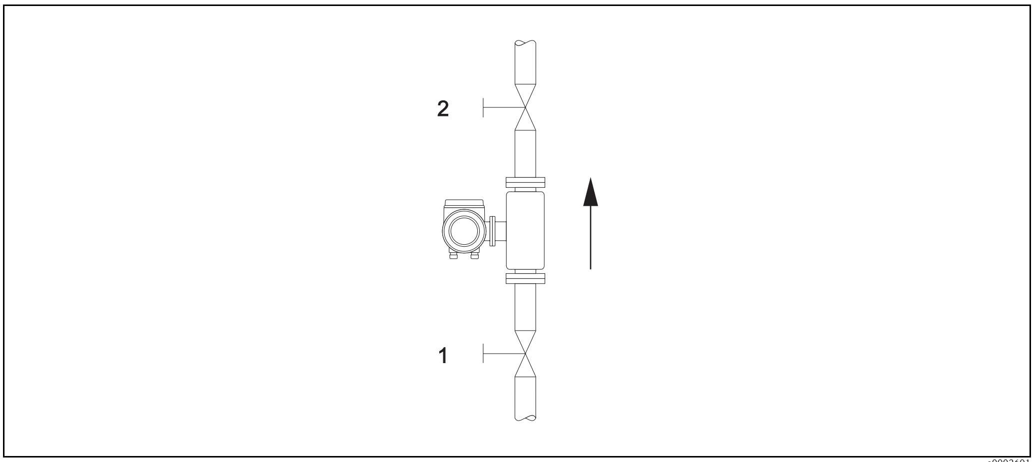
1 Not suitable for fluids with entrained solids. Risk of solids accumulating.
2 Not suitable for outgassing fluids. Risk of air accumulating.

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 6 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

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!
- If using an electric trace heating system whose heating is regulated via phase angle control or pulse packages, influence on the measured values cannot be ruled out due to magnetic fields (i.e. for values that are greater than the values approved by the EN standard (sine 30 A/m)). In such cases, the sensor must be magnetically shielded.
  The secondary containment can be shielded with tin plates or electric sheets without preferential direction (e.g. V330-35A) with the following properties:
  - Relative magnetic permeability $\mu_r \geq 300$
  - Plate thickness $d \geq 0.35$ mm
- Information on permitted temperature ranges → Page 12

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

Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs.

Length of connecting cable

Max. 20 meters (remote version)

System pressure

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

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

Operating conditions: Environment

Ambient temperature range

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

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

Storage temperature

–40 to +80 °C, preferably +20 °C

Degree of protection

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

Shock resistance

According to IEC 68-2-31

Vibration resistance

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

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR recommendation NE 21

Operating conditions: Process

Fluid temperature range

Sensor

–40 to +125 °C

Fluid pressure range (nominal pressure)

Flanges:

DIN PN 40 to 100 / ASME B16.5 Cl 150, Cl 300, Cl 600 / JIS 10K, 20K, 40K, 63K

Secondary containment:

The sensor Promass E has no secondary containment.

Rupture disk in the sensor housing (optional)

The sensor housing protects the inner electronics and mechanics and is filled with dry nitrogen. The housing of this sensor does not fulfill any additional secondary containment function. However, 15 bar can be specified as a reference value for the pressure loading capacity.
For increased safety, a version with rupture disk (triggering pressure 10 to 15 bar) can be used, which is available for order as a separate option.

Further informationen → Page 21 ff.

Limiting flow

See information in the "Measuring range" section → Page 4

Select nominal diameter by optimizing between required flow range and permissible pressure loss. See the "Measuring range" section for a list of maximum possible full scale values.
- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal
- Select a lower full scale value for abrasive substances such as fluids with entrained solids (flow velocity <1 m/s).
- 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 4

Pressure loss

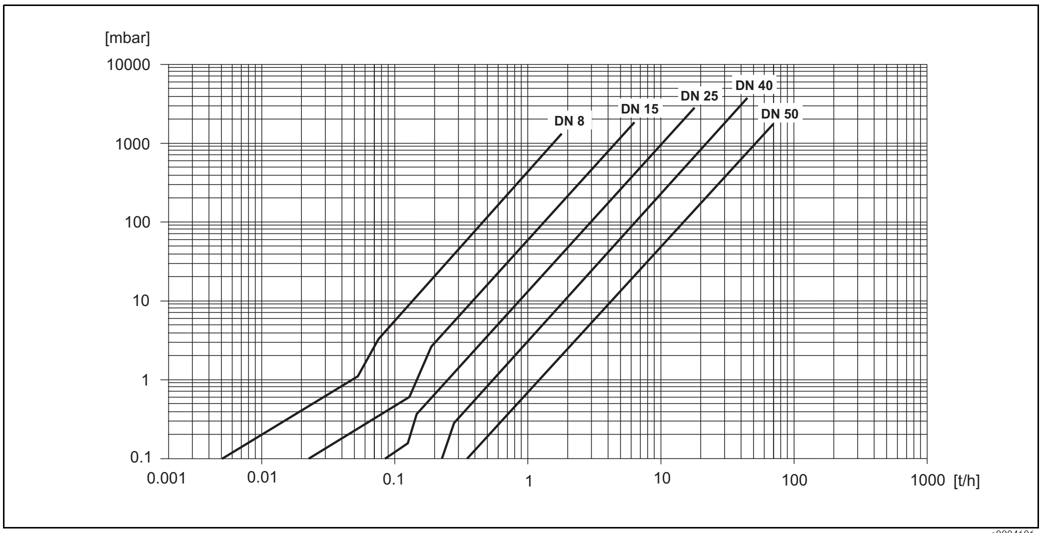
Pressure loss depends on the fluid properties and on the flow rate. The following formulae can be used to approximately calculate the pressure loss:

Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ a0004623
Re ≥ 2300[1]	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$ a0004626
Re < 2300	$\Delta p = K1 \cdot \nu \cdot \dot{m} + \frac{K2 \cdot \nu^{0.25} \cdot \dot{m}^2}{\rho}$ a0004628
Δp = pressure loss [mbar] ν = kinematic viscosity [m2/s] ṁ = mass flow [kg/s]	ρ = fluid density [kg/m3] 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 ≥ 2300.

Pressure loss coefficients for Promass E

DN	d[m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$7.91 \cdot 10^{7}$	$2.10 \cdot 10^{7}$
15	$8.30 \cdot 10^{-3}$	$7.62 \cdot 10^{6}$	$1.73 \cdot 10^{7}$	$2.13 \cdot 10^{6}$
25	$12.00 \cdot 10^{-3}$	$1.89 \cdot 10^{6}$	$4.66 \cdot 10^{6}$	$6.11 \cdot 10^{5}$
40	$17.60 \cdot 10^{-3}$	$4.42 \cdot 10^{5}$	$1.35 \cdot 10^{6}$	$1.38 \cdot 10^{5}$
50	$26.00 \cdot 10^{-3}$	$8.54 \cdot 10^{4}$	$4.02 \cdot 10^{5}$	$2.31 \cdot 10^{4}$



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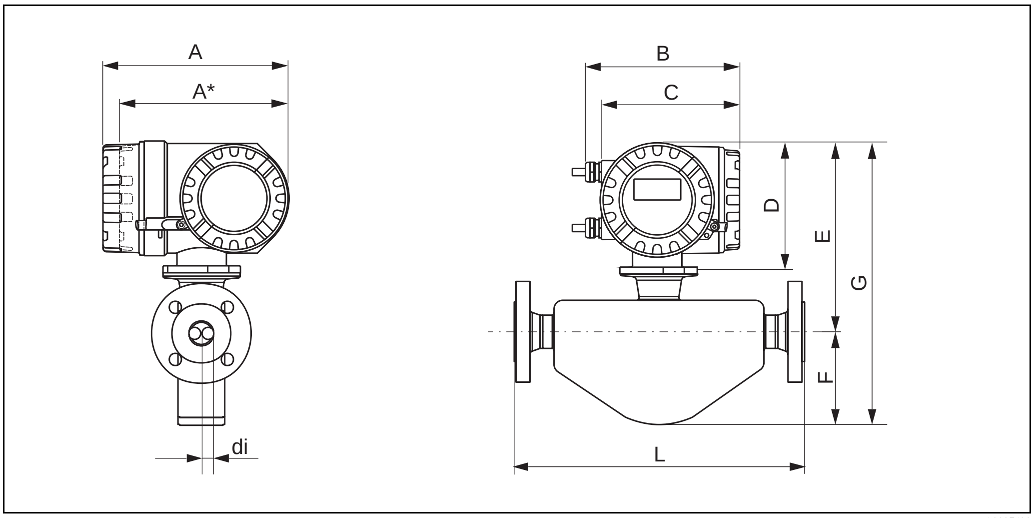
Pressure loss diagram for water

Mechanical construction

Design / dimensions

Dimensions:	
Field housing compact version, powder-coated die-cast aluminum	→ Page 14
Flange connections EN (DIN), ASME B16.5, JIS	→ Page 15
VCO connections	→ Page 17
Tri-Clamp connections	→ Page 18
DIN 11851 (hygienic connection)	→ Page 19
DIN 11864-1 Form A couplings (threaded ferrule)	→ Page 19
DIN 11864-2 Form A (flat flange)	→ Page 20
ISO 2853 connections (couplings)	→ Page 20
SMS 1145 (hygienic connection)	→ Page 21

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



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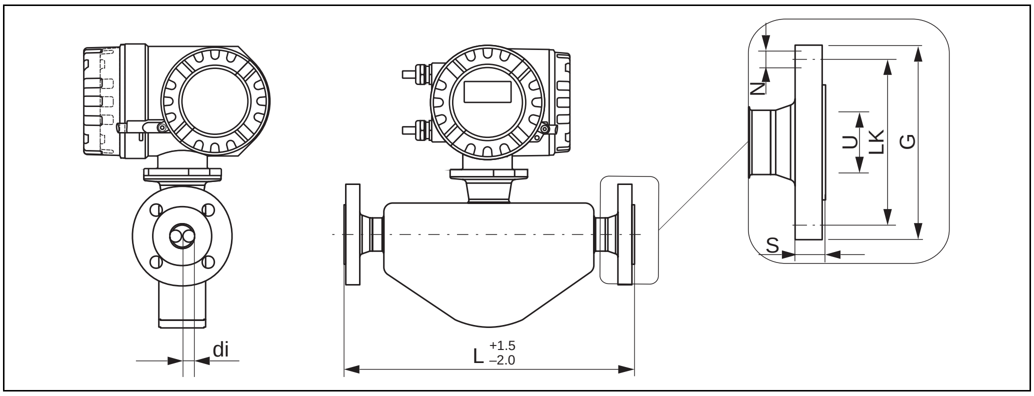
A	A*	B	C	D
227	207	187	168	160

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

DN	E	F	G	L	di
8	224	93	317	*	*
15	226	105	331	*	*
25	231	106	337	*	*
40	237	121	358	*	*
50	253	170	423	*	*

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

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



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Flange EN 1092-1 (DIN 2501 / DIN 2512N [1] / PN 40: 1.4404/316L/316							
DN	G	L	N	S	LK	U	di
8	95	232	4 × Ø14	16	65	17.3	5.35
15	95	279	4 × Ø14	16	65	17.3	8.30
25	115	329	4 × Ø14	18	85	28.5	12.00
40	150	445	4 × Ø18	18	110	43.1	17.60
50	165	556	4 × Ø18	20	125	54.5	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. [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/316							
DN	G	L	N	S	LK	U	di
8	115	329	4 × Ø14	18	85	28.5	5.35
15	115	329	4 × Ø14	18	85	28.5	8.30
All dimensions in [mm]; Further dimensions → Page 14 ff.							

Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 63: 1.4404/316L/316							
DN	G	L	N	S	LK	U	di
50	180	565	4 × Ø22	26	135.0	54.5	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. [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/316							
DN	G	L	N	S	LK	U	di
8	105	261	4 × Ø14	20	75	17.3	5.35
15	105	295	4 × Ø14	20	75	17.3	8.30
25	140	360	4 × Ø18	24	100	28.5	12.00
40	170	486	4 × Ø22	26	125	42.5	17.60
50	195	581	4 × Ø26	28	145	53.9	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. [1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available							

Flange according to ASME B16.5 / Cl 150: 1.4404/316L/316								
DN		G	L	N	S	LK	U	di
8	3/8"	88.9	232	4 × Ø15.7	11.2	60.5	15.7	5.35
15	½"	88.9	279	4 × Ø15.7	11.2	60.5	15.7	8.30
25	1"	108.0	329	4 × Ø15.7	14.2	79.2	26.7	12.00
40	1½"	127.0	445	4 × Ø15.7	17.5	98.6	40.9	17.60
50	2"	152.4	556	4 × Ø19.1	19.1	120.7	52.6	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.								

Flange according to ASME B16.5 / Cl 300: 1.4404/316L/316								
DN		G	L	N	S	LK	U	di
8	3/8"	95.2	232	4 × Ø15.7	14.2	66.5	15.7	5.35
15	½"	95.2	279	4 × Ø15.7	14.2	66.5	15.7	8.30
25	1"	123.9	329	4 × Ø19.0	17.5	88.9	26.7	12.00
40	1½"	155.4	445	4 × Ø22.3	20.6	114.3	40.9	17.60
50	2"	165.1	556	8 × Ø19.0	22.3	127.0	52.6	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.								

Flange according to ASME B16.5 / Cl 600: 1.4404/316L/316								
DN		G	L	N	S	LK	U	di
8	3/8"	95.3	261	4 × Ø15.7	20.6	66.5	13.9	5.35
15	½"	95.3	295	4 × Ø15.7	20.6	66.5	13.9	8.30
25	1"	124.0	380	4 × Ø19.1	23.9	88.9	24.3	12.00
40	1½"	155.4	496	4 × Ø22.4	28.7	114.3	38.1	17.60
50	2"	165.1	583	8 × Ø19.1	31.8	127.0	49.2	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.								

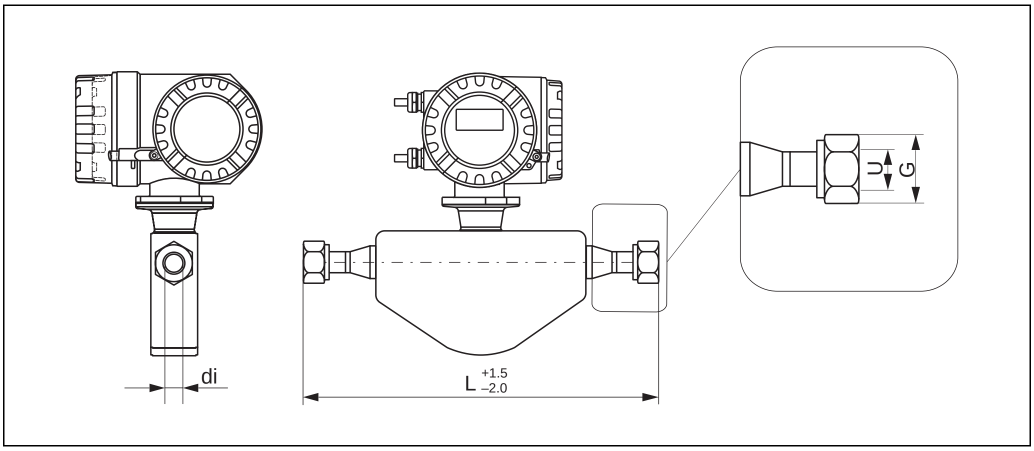
Flange JIS B2220 / 10K: 1.4404/316L/316							
DN	G	L	N	S	LK	U	di
50	155	556	4 × Ø19	16	120	50	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.							

Flange JIS B2220 / 20K: 1.4404/316L/316							
DN	G	L	N	S	LK	U	di
8	95	232	4 × Ø15	14	70	15	5.35
15	95	279	4 × Ø15	14	70	15	8.30
25	125	329	4 × Ø19	16	90	25	12.00
40	140	445	4 × Ø19	18	105	40	17.60
50	155	556	8 × Ø19	18	120	50	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.							

Flange JIS B2220 / 40K: 1.4404/316L/316							
DN	G	L	N	S	LK	U	di
8	115	261	4 × Ø19	20	80	15	5.35
15	115	300	4 × Ø19	20	80	15	8.30
25	130	375	4 × Ø19	22	95	25	12.00
40	160	496	4 × Ø23	24	120	38	17.60
50	165	601	8 × Ø19	26	130	50	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.							

Flange JIS B2220 / 63K: 1.4404/316L/316							
DN	G	L	N	S	LK	U	di
8	120	282	4 × Ø19	23	85	12	5.35
15	120	315	4 × Ø19	23	85	12	8.30
25	140	383	4 × Ø23	27	100	22	12.00
40	175	515	4 × Ø25	32	130	35	17.60
50	185	616	8 × Ø23	34	145	48	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff.							

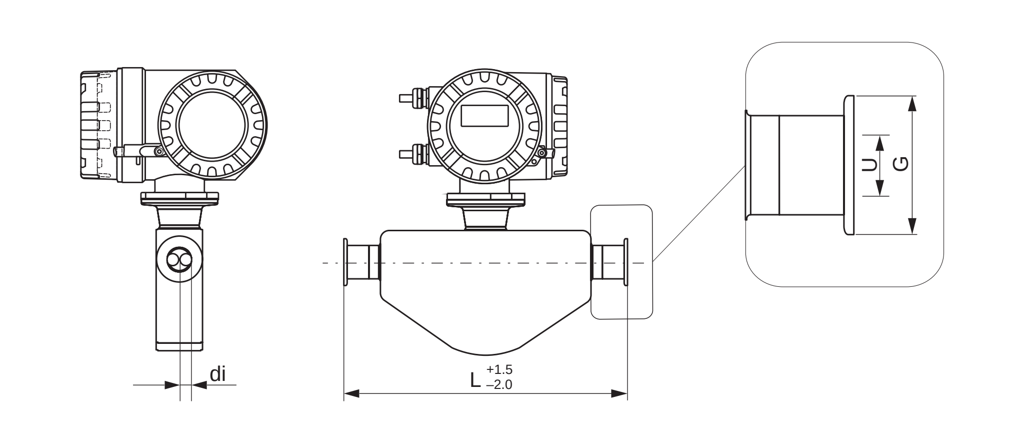
VCO connections



a0007641-en

VCO connections: 1.4404/316L				
DN	G	L	U	di
8	1" AF	252	10.2	5.35
15	1½" AF	305	15.7	8.30
All dimensions in [mm]; Further dimensions → Page 14 ff.				

Tri-Clamp connections

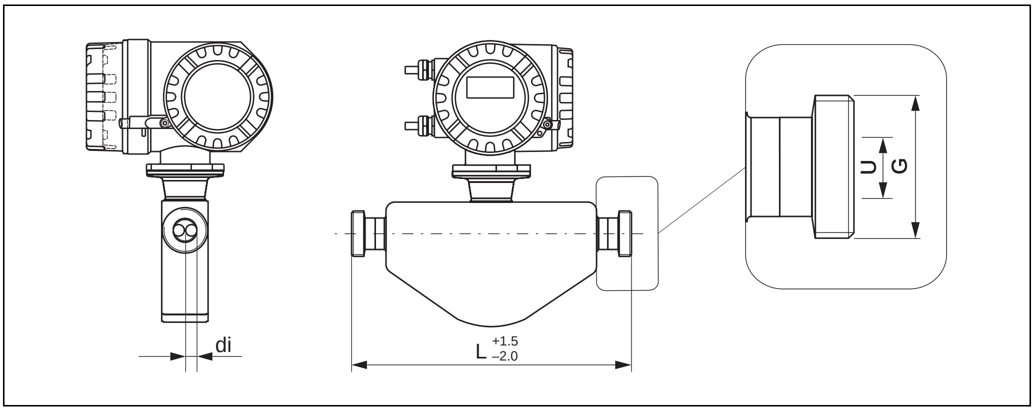


a0007643-en

1", 1½", 2" Tri-Clamp: 1.4435/316L					
DN	Clamp	G	L	U	di
8	1"	50.4	229	22.1	5.35
15	1"	50.4	273	22.1	8.30
25	1"	50.4	324	22.1	12.00
40	1½"	50.4	456	34.8	17.60
50	2"	63.9	562	47.5	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. 3A version also available (Ra ≤ 0.8 µm/150 grit.)					

½" Tri-Clamp: 1.4435/316L					
DN	Clamp	G	L	U	di
8	½"	25.0	229	9.5	5.35
15	½"	25.0	273	9.5	8.30
All dimensions in [mm]; Further dimensions → Page 14 ff. 3A version also available (Ra ≤ 0.8 µm/150 grit.)					

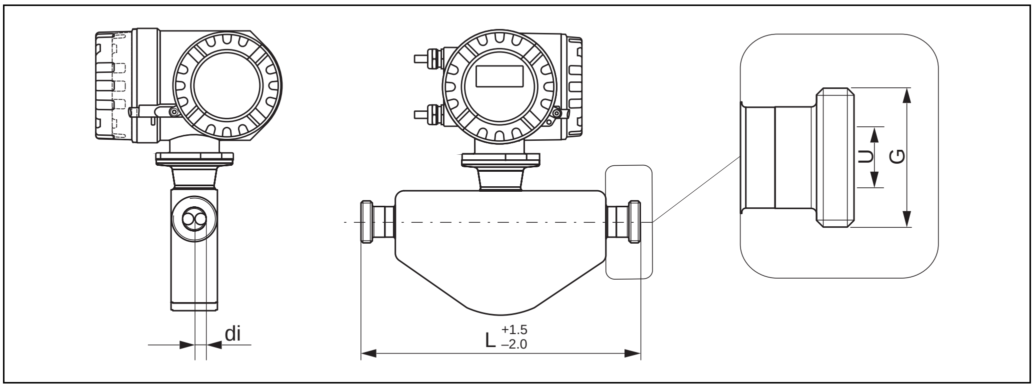
DIN 11851 (hygienic connection)



a0007644-en

Hygienic connection DIN 11851: 1.4435/316L				
DN	G	L	U	di
8	Rd 34 × 1/8"	229	16	5.35
15	Rd 34 × 1/8"	273	16	8.30
25	Rd 52 × 1/6"	324	26	12.00
40	Rd 65 × 1/6"	456	38	17.60
50	Rd 78 × 1/6"	562	50	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. 3A version also available (Ra ≤ 0.8 µm/150 grit.)				

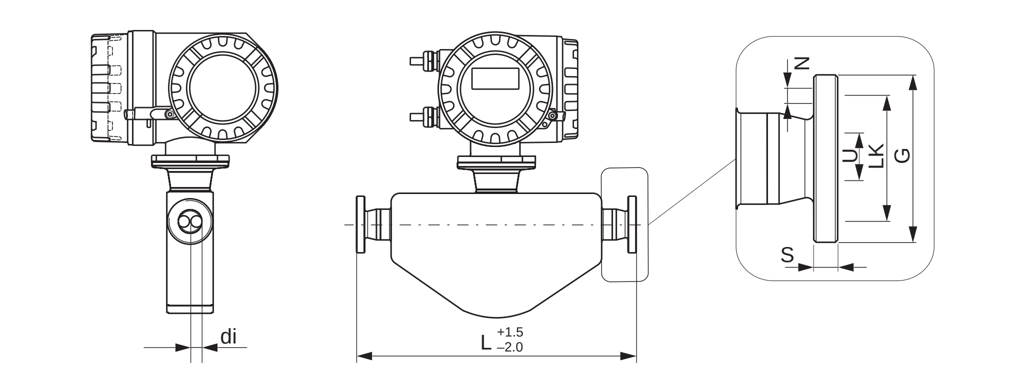
DIN 11864-1 Form A couplings (threaded ferrule)



a0007649-en

Coupling DIN 11864-1 Form A (threaded ferrule): 1.4435/316L				
DN	G	L	U	di
8	Rd 28 × 1/8"	229	10	5.35
15	Rd 34 × 1/8"	273	16	8.30
25	Rd 52 × 1/6"	324	26	12.00
40	Rd 65 × 1/6"	456	38	17.60
50	Rd 78 × 1/6"	562	50	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. 3A version also available (Ra ≤ 0.8 µm/150 grit.)				

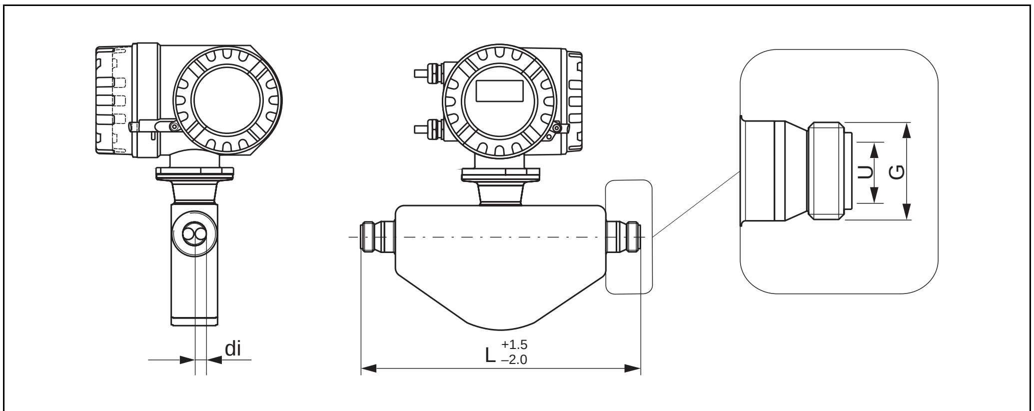
DIN 11864-2 Form A (flat flange)



a0007649-en

Flange DIN 11864-2 Form A (flat flange): 1.4435/316L							
DN	G	L	N	S	LK	U	di
8	54	249	4 × Ø9	10	37	10	5.35
15	59	293	4 × Ø9	10	42	16	8.30
25	70	344	4 × Ø9	10	53	26	12.00
40	82	456	4 × Ø9	10	65	38	17.60
50	94	562	4 × Ø9	10	77	50	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. 3A version also available (Ra ≤ 0.8 µm/150 grit.)							

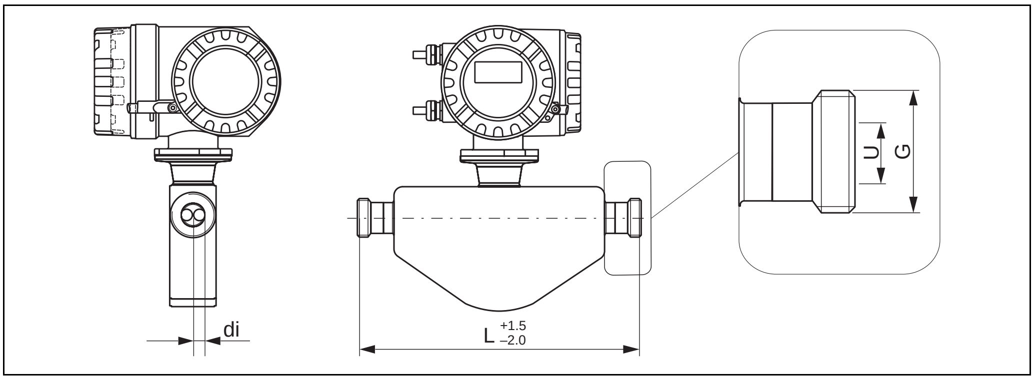
ISO 2853 connections (couplings)



a0007651-en

Coupling ISO 2853: 1.4435/316L				
DN	G[1]	L	U	di
8	37.13	229	22.6	5.35
15	37.13	273	22.6	8.30
25	37.13	324	22.6	12.00
40	50.68	456	35.6	17.60
50	64.16	562	48.6	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. [1] Max. thread diameter to ISO 2853 Annex A,; 3A version also available (Ra ≤ 0.8 µm/150 grit.)				

SMS 1145 (hygienic connection)



a0007653-en

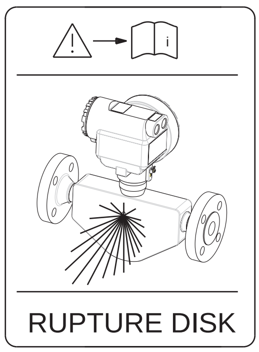
Hygienic connection SMS 1145: 1.4435/316L				
DN	G	L	U	di
8	Rd 40 × 1/6"	229	22.5	5.35
15	Rd 40 × 1/6"	273	22.5	8.30
25	Rd 40 × 1/6"	324	22.5	12.00
40	Rd 60 × 1/6"	456	35.5	17.60
50	Rd 70 × 1/6"	562	48.5	26.00
All dimensions in [mm]; Further dimensions → Page 14 ff. 3A version also available (Ra ≤ 0.8 µm/150 grit.)				

Rupture disk in the sensor housing (optional)

Burst pressure 10 to 15 bar.

Warning!
Sensor housings with integrated rupture disks are optionally available. Make sure that the function and operation of the rupture disk is not impeded through the installation. Take adequate precautions to ensure that no damage occurs, and risk to human life is ruled out, if the rupture disk is triggered.

The position of the rupture disk is indicated by an adhesive label on top of the disk. If the rupture disk is triggered, the adhesive label is damaged and can thus be visually monitored.



a0007823

Additional sign regarding the position of the rupture disk

Weight

DN	8	15	25	40	50
Compact version	8	8	10	15	22

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

Materials

Transmitter housing:

- Compact housing: powder coated die-cast aluminum

Sensor housing / containment:

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

Process connections

Hygienic process connection
- 3A approved

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

Stainless Steel 1.4404/316L
- DIN 11864-2 Form A (flat flange)
- VCO conection
- Tri-Clamp
- Hygienic connection:
  - DIN 11864-1, Form A
  - DIN 11851
  - SMS 1145
  - ISO 2853

Measuring tubes:

- Stainless Steel 1.4539/904L
- Finish quality: Ra_{max} = 0.8 µm

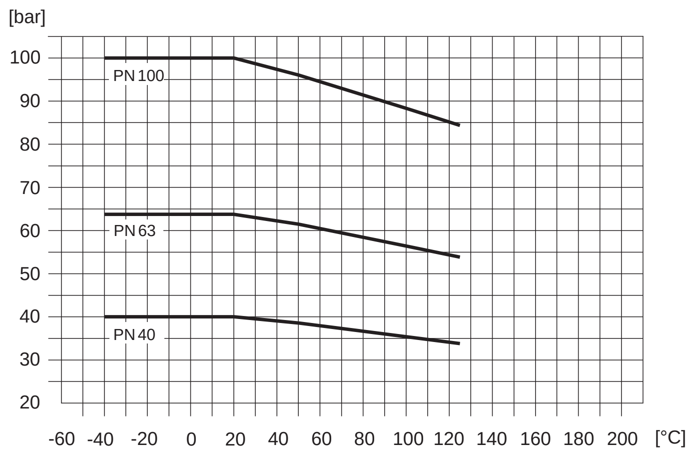
Seals:

- Welded process connections without internal seals

Material load curves

Flange connection to EN 1092-1 (DIN 2501)

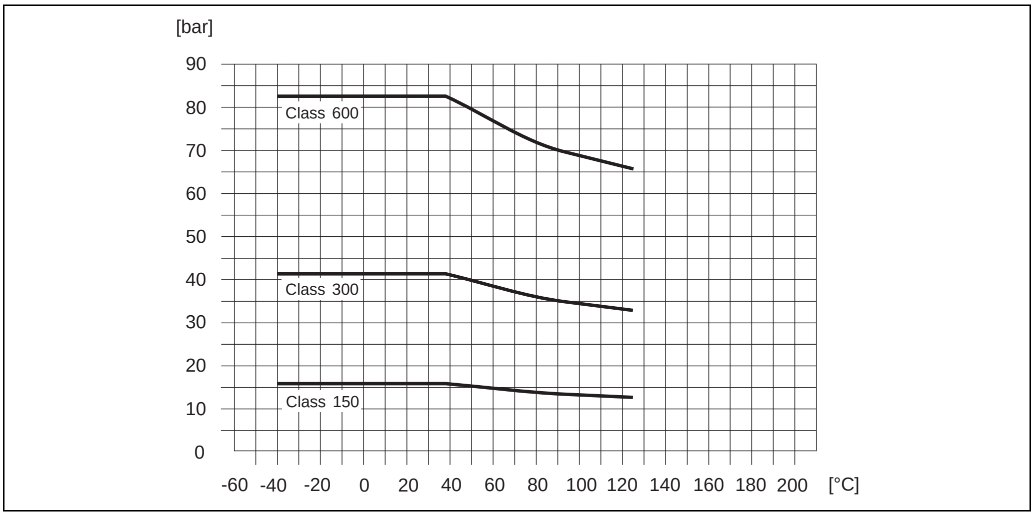
Flange material: 1.4404/316L



a0006904-en

Flange connection according to ASME B16.5

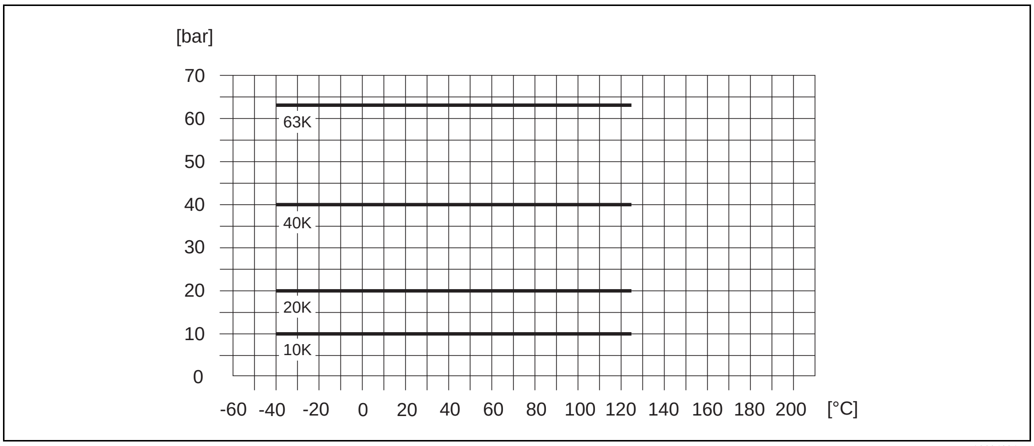
Flange material: 1.4404/316L



a0006905-en

Flange connection to JIS B2220

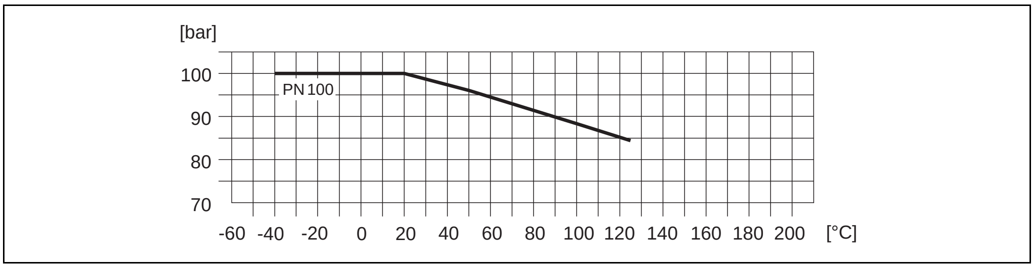
Flange material: 1.4404/316L



A0006906-en

VCO process connection

Flange material: 1.4404/316L



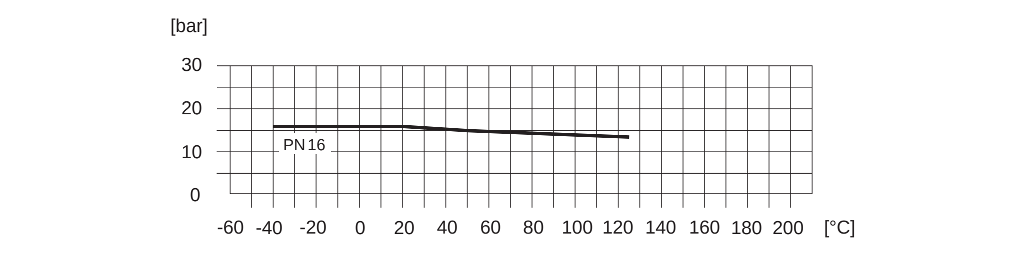
a0006908-en

Tri-Clamp process connection

The Clamp connections (e.g. Tri-Clamp ISO2852, DIN32676) are suited up to a maximum pressure of 16 bar. As these operating limits also depend on the clamp and the seal used, their specifications have to be observed. The clamp and the seal are not included in the scope of supply.

Hygienic Coupling to DIN 11851 and SMS 1145

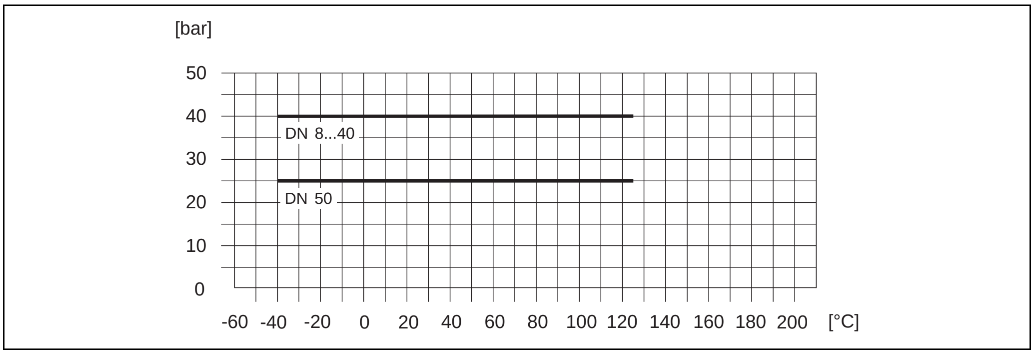
Coupling material: 1.4404/316L



A0006909-en

Hygienic Coupling to DIN 11864-1 Form A

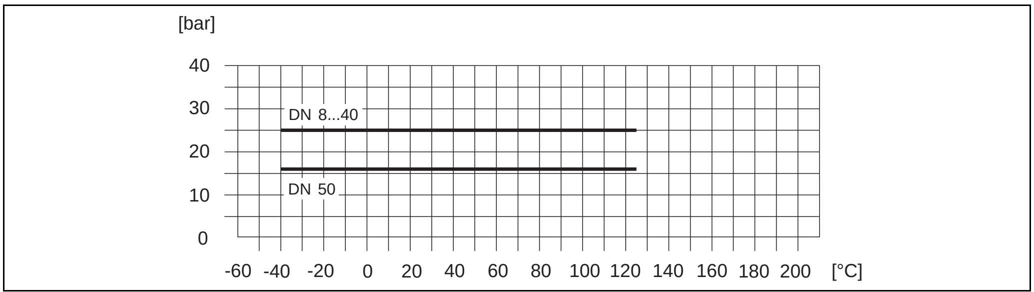
Coupling material: 1.4404/316L



A0006910-en

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

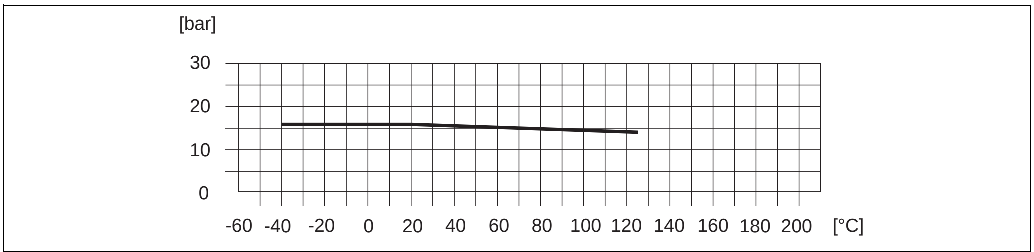
Flange material: 1.4404/316L



A0006911-en

Coupling to ISO 2853

Coupling material: 1.4404/316L



A0006912-en

Process connections

See Page 22 → Materials → Process connections

Human interface

Display elements

- Liquid-crystal display (optional): backlit, two lines 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.
- Display languages: French, Spanish, Italian, Dutch, Portuguese, German, English

Remote operation

- HART protocol (handheld communicator)
- Configuration and service software or "FieldCare" from Endress+Hauser
- AMS configuration programs (Fisher Rosemount), SIMATIC PDM (Siemens)

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives.
Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-Tick symbol

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

Ex approval

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

Hygienic compatibility

- 3A approval

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  "Emission in accordance with Class A requirements".
  Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics

Pressure Equipment Directive

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

Ordering information

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

Accessories

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

Documentation

- Flow measurement (FA005D/06/en)
- Description of Device Functions Promass 40 (BA062D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA

Registered trademarks

TRI-CLAMP ®
Registered trademark of Ladish & Co., Inc., Kenosha, WI, USA

HART®
Registered trademark of HART Communication Foundation, Austin, TX, USA

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, ToF Tool - Fieldtool® Package, Fieldcheck®, Applicator®
FieldCare®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

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