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 the fluid's physical 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 40 bar
- Mass flow measurement up to 70 t/h

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

Approval in the food industry/hygiene sector:
- 3A

Connection to process control systems:
- HART

Relevant safety aspects:
- PED (Pressure Equipment Directive)

Features and benefits
The Promass measuring devices make it possible to record different 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

TI055D/06/en
50098284

Endress+Hauser
People for Process Automation

Table of Contents

Function and system design

Measuring principle

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

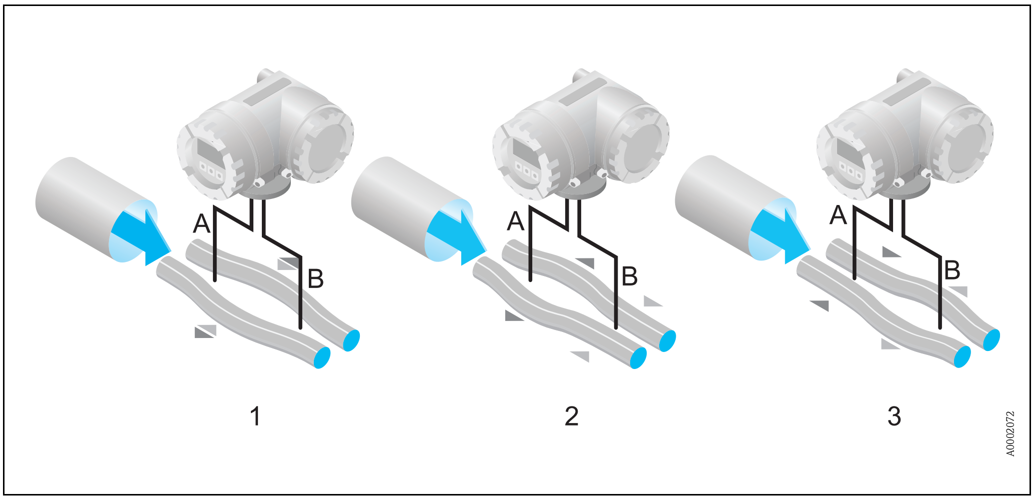
$F_C = 2 \cdot \Delta m \, (v \cdot \omega)$

F_C = Coriolis force
Δm = moved mass
ω = angular velocity
v = radial velocity in the 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).

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.



The Coriolis flow measuring principle

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...50)

Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tubes 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 of full scale values (liquids) $\dot{m}_{min\,(F)} \ldots \dot{m}_{max\,(F)}$
8	0...2000 kg/h
15	0...6500 kg/h
25	0...18000 kg/h
40	0...45000 kg/h
50	0...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:

$$\dot{m}_{max\,(G)} = \dot{m}_{max\,(F)} \cdot \frac{\rho_{(G)}}{320\ kg/m^3}$$

$\dot{m}_{max\,(G)}$ = 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/m^3] under process conditions

Worked example for gas:
- Sensor type: Promass E, DN 50
- Gas: air with a density of 60.3 kg/m^3 (at 20 °C and 50 bar)
- Max. full scale value (liquid): 70000 kg/h

Max. possible full scale value:

$$\dot{m}_{max\,(G)} = \dot{m}_{max\,(F)} \cdot \frac{\rho_{(G)}}{320\ kg/m^3} = \frac{70000\ kg/h \cdot 60.3\ kg/m^3}{320\ kg/m^3} = 13190\ kg/h$$

Recommended measuring ranges:
See Page 11 (“Limiting flow”)

Operable flow range

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...30 V DC, R_i = 5 kΩ, galvanically isolated.
Configurable for: totalizer reset, measured value suppression, error-message reset, start zero point adjustment.

Output

Output signal

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

Pulse/frequency output:
Passive, open collector, 30 V DC, 250 mA, galvanically isolated.
- *Frequency output:* full scale frequency 2...1000 Hz (f_{max} = 1250 Hz), on/off ratio 1:1, pulse width max. 10 s
- *Pulse output:* pulse value and pulse polarity selectable, max. pulse width adjustable (0.5...2000 ms), max. pulse frequency selectable

Signal on alarm

- Current output → failsafe mode selectable
- Pulse/frequency output → failsafe mode selectable
- Relay output → de-energized by fault or power supply failure

Load

see "Output signal"

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.

Low flow cut off

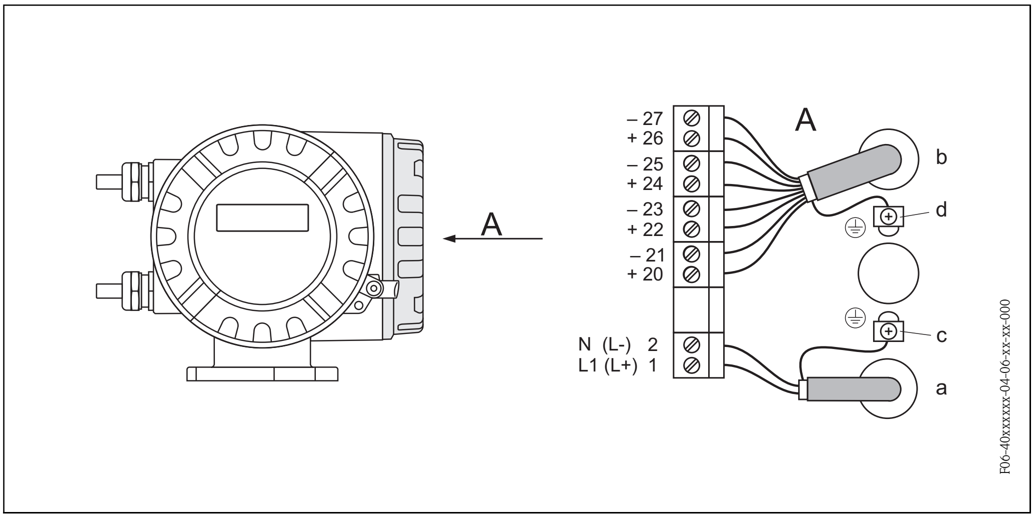
Switch points for low flow cut off are selectable

Galvanic isolation

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

Power supply

Electrical connection (Measuring unit)



a Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L– for DC
b Signal cable: Terminal Nos. 20–27 → see Page 6
c Ground terminal for protective conductor
d Ground terminal for signal cable shield

Terminal assignment, Promass 40

	Terminal Nos. (inputs/outputs)			
Order variant	**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	Current output Ex i active, HART
40***-***********T	–	–	Frequency output Ex i	Current output Ex i passive, HART

Supply voltage

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

Potential equalization

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

Cable entries

Power supply and signal cables (inputs/outputs):
- Cable entry M20 x 1.5 (8...12 mm)
- Threads for cable entries, PG 13.5 (5...15 mm), 1/2" NPT, G 1/2"

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 power supply fails.
- S-DAT is an exchangeable data storage chip with sensor specific data: nominal diameter, serial number, calibration factor, zero point, etc.

Performance characteristics

Reference operating conditions

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

Maximum measured error

The following values refer to the pulse/frequency output.
The additional measured error at the current output is typically ±5 µA.

Mass flow (liquid)
±0.5% ± [(zero point stability / measured value) x 100]% o.r.

Mass flow (gas)
±1.0% ± [(zero point stability / measured value) x 100]% o.r.

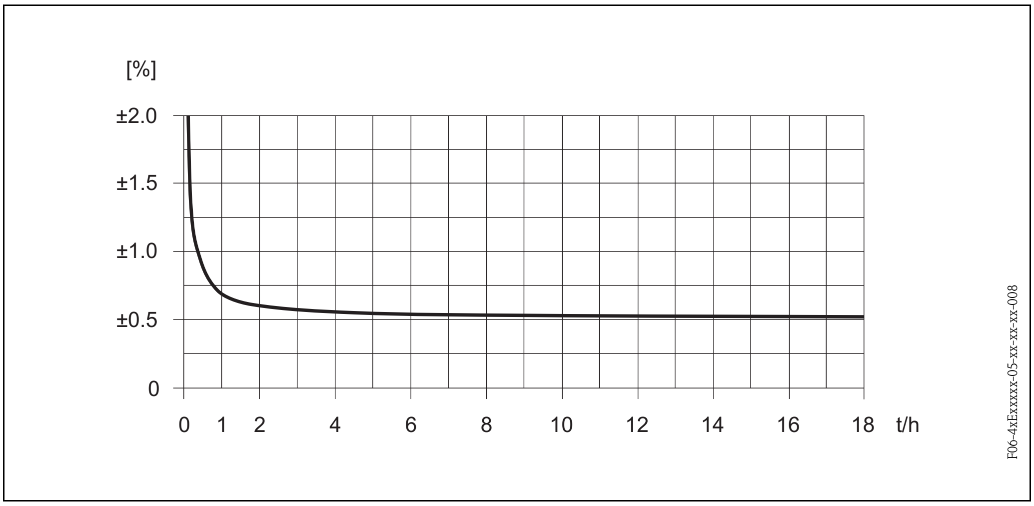
Volume flow (liquid)
±0.7% ± [(zero point stability / measured value) x 100]% o.r.

o.r. = of reading

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

Calculation example (mass flow, liquid):
Given: Promass 40E / DN 25, measured flow = 8000 kg/h
Max. measured error: ±0.5% ± [(zero point stability / measured value) x 100]% o.r.

$$\text{Max. measured error} \rightarrow \pm 0.5\% \pm \frac{1.8 \text{ kg/h}}{8000 \text{ kg/h}} \cdot 100\% = \pm 0.523\%$$



Maximum measured error in % of reading (example: Promass 40E / DN 25)

Repeatability

- Mass flow (liquid): ±0.25% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
- Mass flow (gas): ±0.5% ± [1/2 x (zero point stability / measured value) x 100]% o.r.
- Volume flow (liquid): ±0.35% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

o.r. = of reading
Zero point stability: see "Max. measured error"

Calculation example (mass flow, liquid):
Given: Promass 40E / DN 25, measured flow = 8000 kg/h
Repeatability: ±0.25% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

$$\text{Repeatability} \rightarrow \pm 0.25\% \pm 1/2 \cdot \frac{1.8 \text{ kg/h}}{8000 \text{ kg/h}} \cdot 100\% = \pm 0.261\%$$

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 Promass E is ±0.0003% o.f.s./°C (o.f.s. = of full scale value).

Influence of medium pressure

With nominal diameters DN 8...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)

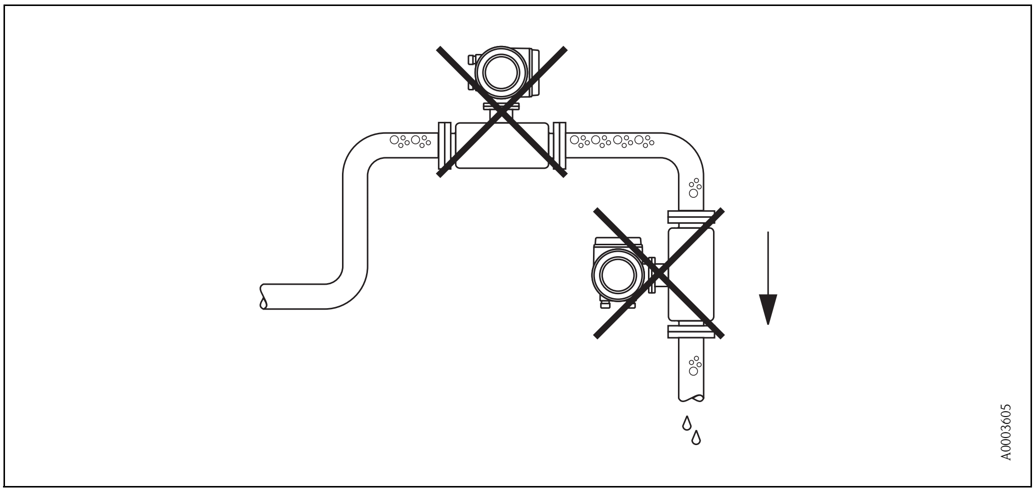
Operating conditions (installation)

Installation instructions

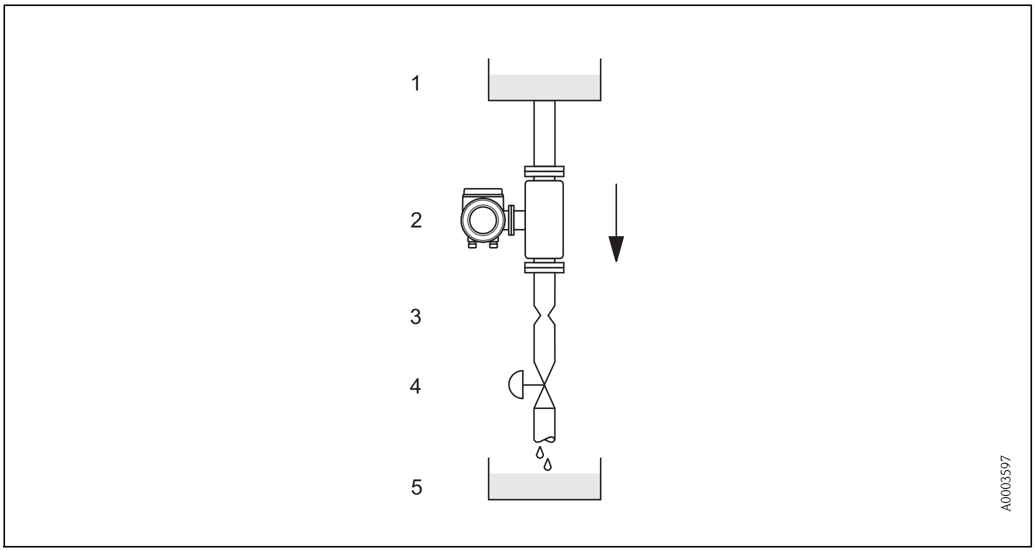
Note the following points:
- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- 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. Avoid the following locations:
- Highest point in a run.
- Directly upstream from an open pipe outlet in a vertical pipeline.



The proposed configuration in the following diagram, however, permits installation in a vertical pipeline. Pipe restrictors 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.



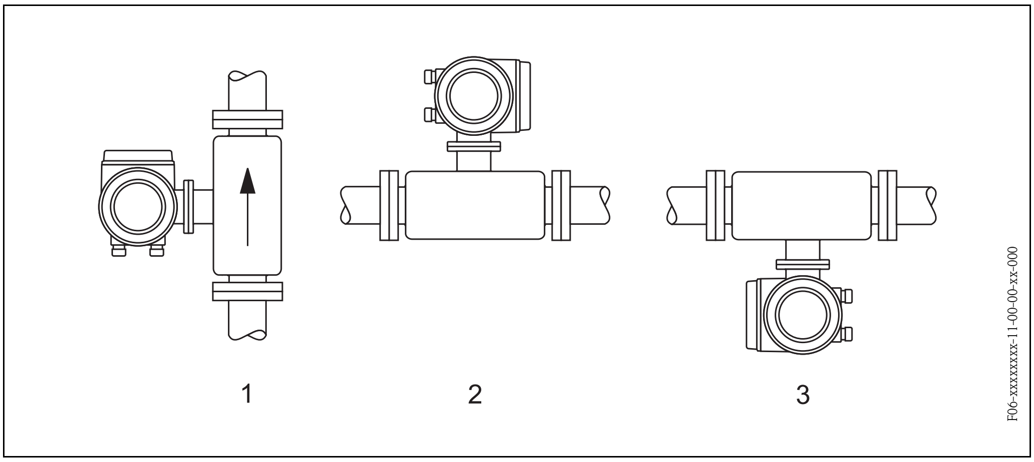
Installation in a down pipe (e.g. for batching applications)
1 = Supply tank, 2 = Sensor, 3 = Orifice, pipe restrictions (see table), 4 = Valve, 5 = Batching tank

Nominal diameter / DN	8	15	25	40	50
Ø orifice / pipe restriction	6 mm	10 mm	14 mm	22 mm	28 mm

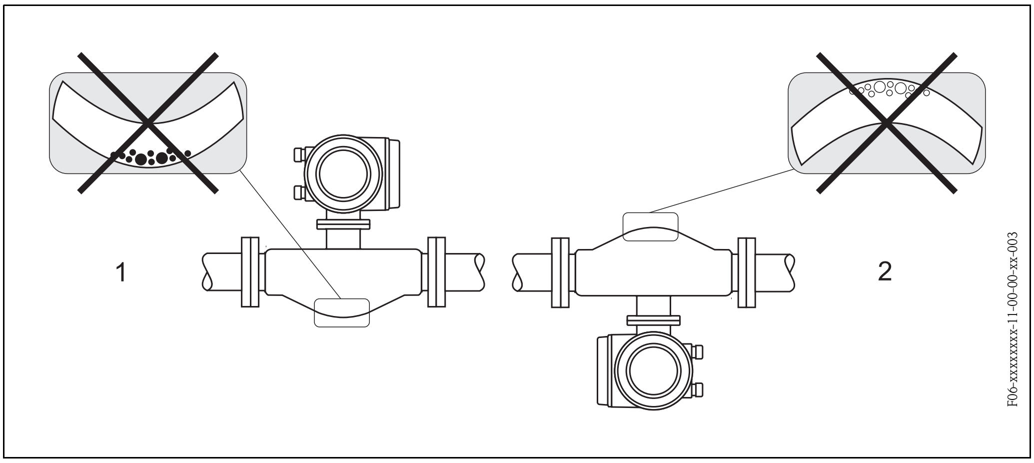
Orientation

Vertical
Recommended orientation with upward direction of flow (View 1). Entrained solids sink down. Gases rise away from the measuring tube when fluid is not flowing. The measuring tubes can be completely drained and protected against solids build-up.

Horizontal
The measuring tubes of Promass E must in the same horizontal plane. When installation is correct the transmitter housing is above or below the pipe (Views 2, 3). Always avoid having the transmitter housing in the same horizontal plane as the pipe.



Caution:
The measuring tubes of Promass E are curved. The position of the sensor, therefore, has to be matched to the fluid properties when the sensor is installed horizontally (see illustration).



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

Fluid temperature / orientation

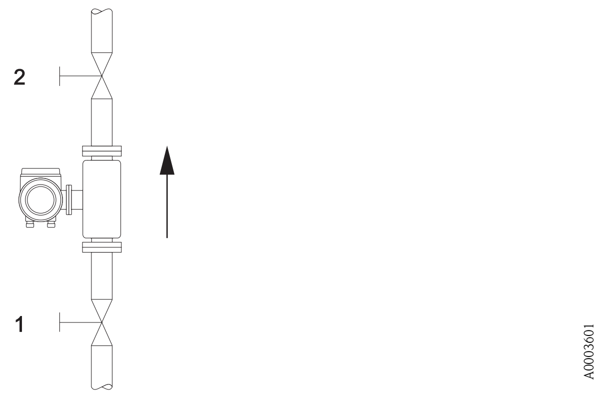
In order to ensure that the maximum permissible ambient temperature for the transmitter (–20...+60 °C) is not exceeded, we recommend the following orientations:

High fluid temperature
Vertical piping: installation in accordance with View 1
Horizontal piping: installation in accordance with View 3

Low fluid temperature
Vertical piping: installation in accordance with View 1
Horizontal piping: installation in accordance with View 2

Zero point adjustment
Zero point adjustment is only required in special cases:
- With very small flow rates
- Under extreme process or operating conditions (e.g. very high process pressure or very high viscosity of the fluid).

Zero point adjustment is performed with the measuring tubes completely filled and "zero flow". This can be achieved, for example, with shut-off 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



Heating, 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. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper.

Note!
- Do not use any heating elements with thyristor controlled voltage sources.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m). In such cases, the sensor must be magnetically screened.
  The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:
  – Relative magnetic permeability $\mu_r \geq 300$
  – Plate thickness $d \geq 0.35$ mm

Caution!
Risk of electronics overheating!
- Make sure that the adapter between sensor and transmitter always remains free of insulating material.
- Bear in mind that a certain orientation might be required, depending on the fluid temperature (see Page 9).
- Information on permissible temperature ranges → Page 11.

System pressure

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tubes. 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.

Consequently, it is generally best to install the sensor:
- downstream from pumps (no risk of partial vacuum),
- at the lowest point in a vertical pipe.

Operating conditions (environment)

Ambient temperature range	Standard: –20...+60 °C (sensor, transmitter) Optional: –40...+60 °C (sensor, transmitter) Note! ▪ Install the device in 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...+80 °C (preferably +20 °C) Note! The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
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...150 Hz, following IEC 68-2-6
Electromagnetic compatibility (EMC)	To EN 61326/A1 and NAMUR recommendation NE 21

Operating conditions (process)

Medium temperature range	Sensor: –40...+125 °C Seals: no internal seals
Limiting medium pressure range (nominal pressure)	Flanges: EN (DIN) PN 40...100 / ANSI Cl 150, Cl 300, Cl 600 / JIS 10K, 20K, 40K, 63K The sensor Promass E has no secondary containment.
Limiting flow	See Page 4 ("Measuring range") Select nominal diameter by optimizing between required flow range and permissible pressure loss. See Page 4 for a list of full scale values by nominal diameter. ▪ The minimum recommended full scale value is approx. $^1/_{20}$ of the max. full scale value. ▪ In most applications, 20...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 (see formula on Page 4).

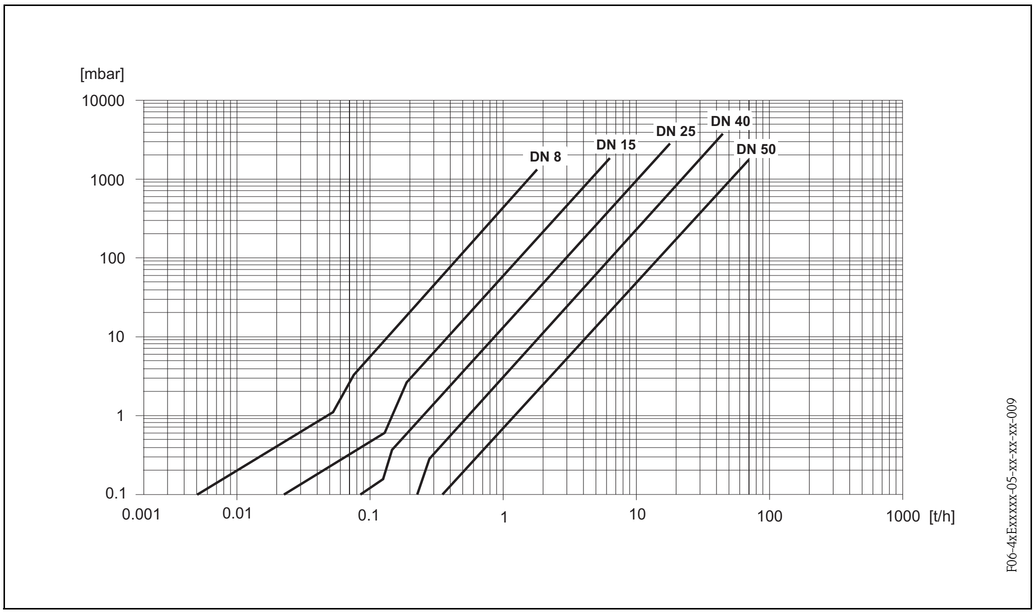
Pressure loss

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

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

Pressure loss coefficient 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	$26.00 \cdot 10^{-3}$	$8.54 \cdot 10^{4}$	$4.02 \cdot 10^{5}$	$2.31 \cdot 10^{4}$

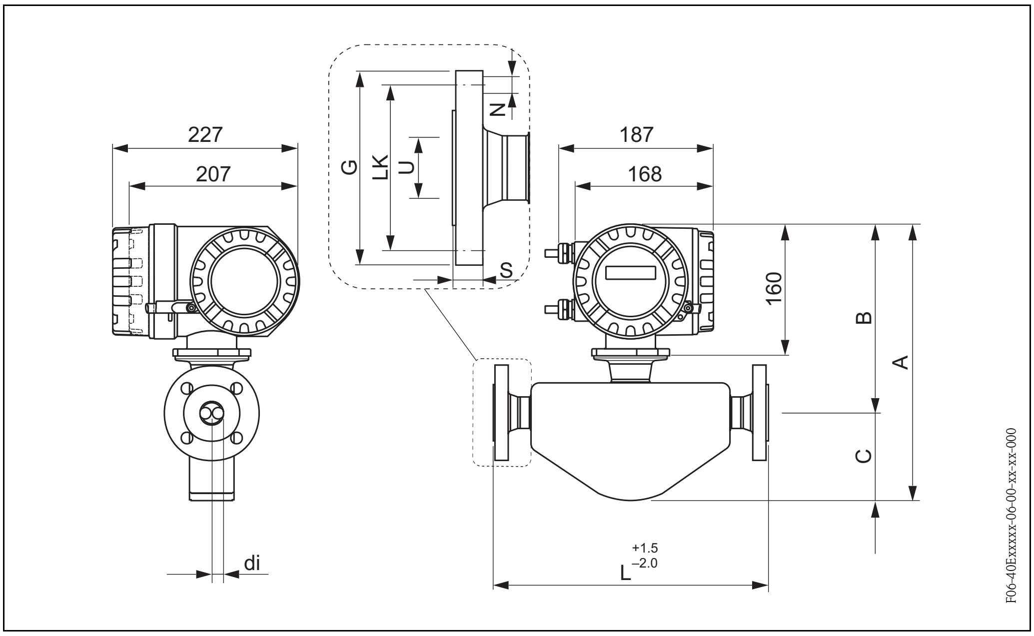


Pressure loss diagram for water

Mechanical construction

Design / dimensions

Dimensions: flange connections EN (DIN), ANSI, JIS



Flange EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	95	232	4 x Ø14	16	65	17.3	5.35
15	331	226	105	95	279	4 x Ø14	16	65	17.3	8.30
25	337	231	106	115	329	4 x Ø14	18	85	28.5	12.00
40	358	237	121	150	445	4 x Ø18	18	110	43.1	17.60
50	423	253	170	165	556	4 x Ø18	20	125	54.5	26.00
[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										
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 [1]) / PN 63: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
50	423	253	170	180	565	4 x Ø22	26	135	54.5	26.00
[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										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	105	261	4 x Ø14	20	75	17.3	5.35
15	331	226	105	105	295	4 x Ø14	20	75	17.3	8.30
25	337	231	106	140	360	4 x Ø18	24	100	28.5	12.00
40	358	237	121	170	486	4 x Ø22	26	125	42.5	17.60
50	423	253	170	195	581	4 x Ø26	28	145	53.9	26.00
[1] Flange with groove to EN 1092-1 Form D (DIN 2512N) available										

Flange ANSI B16.5 / Cl 150: 1.4404/316L											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	317	224	93	88.9	232	4 x Ø15.7	11.2	60.5	15.7	5.35
15	1/2"	331	226	105	88.9	279	4 x Ø15.7	11.2	60.5	15.7	8.30
25	1"	337	231	106	108.0	329	4 x Ø15.7	14.2	79.2	26.7	12.00
40	1 1/2"	358	237	121	127.0	445	4 x Ø15.7	17.5	98.6	40.9	17.60
50	2"	423	253	170	152.4	556	4 x Ø19.1	19.1	120.7	52.6	26.00

Flange ANSI B16.5 / Cl 300: 1.4404/316L											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	317	224	93	95.2	232	4 x Ø15.7	14.2	66.5	15.7	5.35
15	1/2"	331	226	105	95.2	279	4 x Ø15.7	14.2	66.5	15.7	8.30
25	1"	337	231	106	123.9	329	4 x Ø19.0	17.5	88.9	26.7	12.00
40	1 1/2"	358	237	121	155.4	445	4 x Ø22.3	20.6	114.3	40.9	17.60
50	2"	423	253	170	165.1	556	8 x Ø19.0	22.3	127.0	52.6	26.00

Flange ANSI B16.5 / Cl 600: 1.4404/316L											
DN		A	B	C	G	L	N	S	LK	U	di
8	3/8"	317	224	93	95.3	261	4 x Ø15.7	20.6	66.5	13.9	5.35
15	1/2"	331	226	105	95.3	295	4 x Ø15.7	20.6	66.5	13.9	8.30
25	1"	337	231	106	124.0	380	4 x Ø19.1	23.9	88.9	24.3	12.00
40	1 1/2"	358	237	121	155.4	496	4 x Ø22.4	28.7	114.3	38.1	17.60
50	2"	423	253	170	165.1	583	8 x Ø19.1	31.8	127.0	49.2	26.00

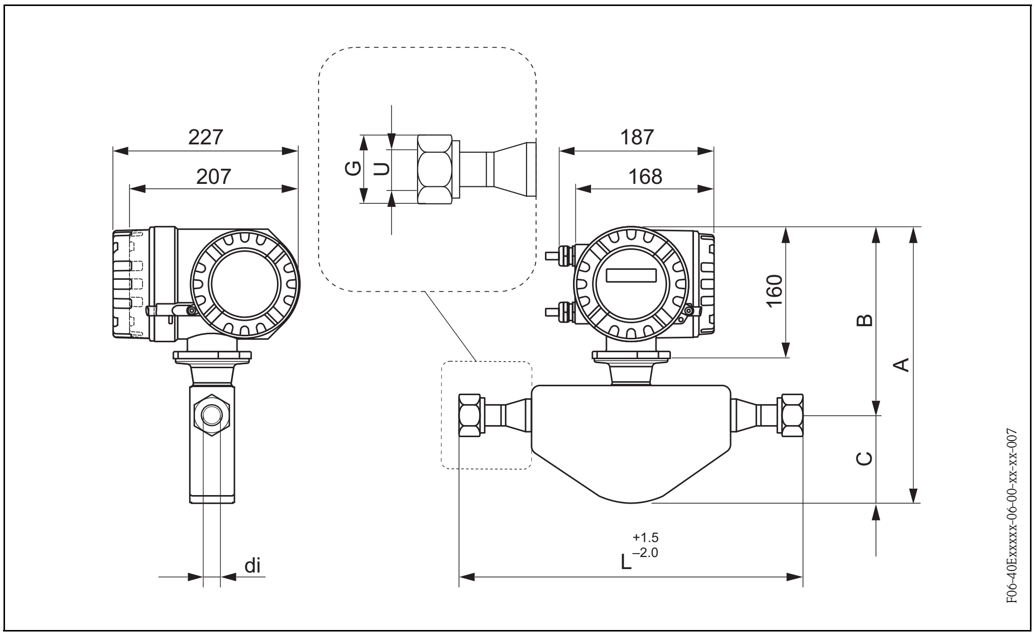
Flange JIS B2238 / 10K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
50	423	253	170	155	556	4 x Ø19	16	120	50	26.00

Flange JIS B2238 / 20K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	95	232	4 x Ø15	14	70	15	5.35
15	331	226	105	95	279	4 x Ø15	14	70	15	8.30
25	337	231	106	125	329	4 x Ø19	16	90	25	12.00
40	358	237	121	140	445	4 x Ø19	18	105	40	17.60
50	423	253	170	155	556	8 x Ø19	18	120	50	26.00

Flange JIS B2238 / 40K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	115	261	4 x Ø19	20	80	15	5.35
15	331	226	105	115	300	4 x Ø19	20	80	15	8.30
25	337	231	106	130	375	4 x Ø19	22	95	25	12.00
40	358	237	121	160	496	4 x Ø23	24	120	38	17.60
50	423	253	170	165	601	8 x Ø19	26	130	50	26.00

Flange JIS B2238 / 63K: 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	120	282	4 x Ø19	23	85	12	5.35
15	331	226	105	120	315	4 x Ø19	23	85	12	8.30
25	337	231	106	140	383	4 x Ø23	27	100	22	12.00
40	358	237	121	175	515	4 x Ø25	32	130	35	17.60
50	423	253	170	185	616	8 x Ø23	34	145	48	26.00

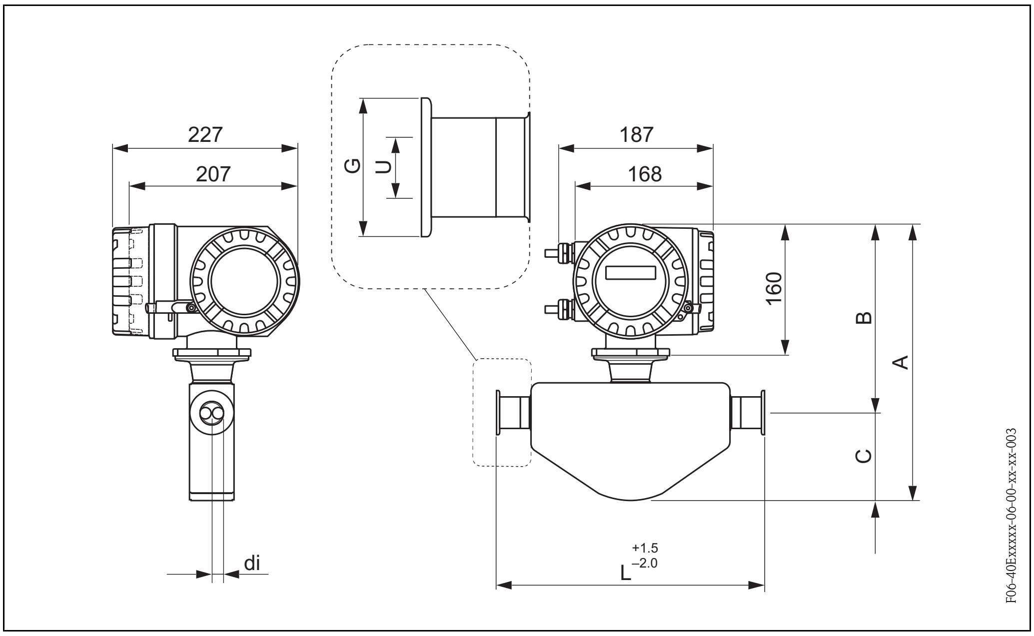
Dimensions: VCO connections



8-VCO-4 (1/2"): 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	a/f 1"	252	10.2	5.35

12-VCO-4 (3/4"): 1.4404/316L							
DN	A	B	C	G	L	U	di
15	331	226	105	a/f 1 1/2"	305	15.7	8.30

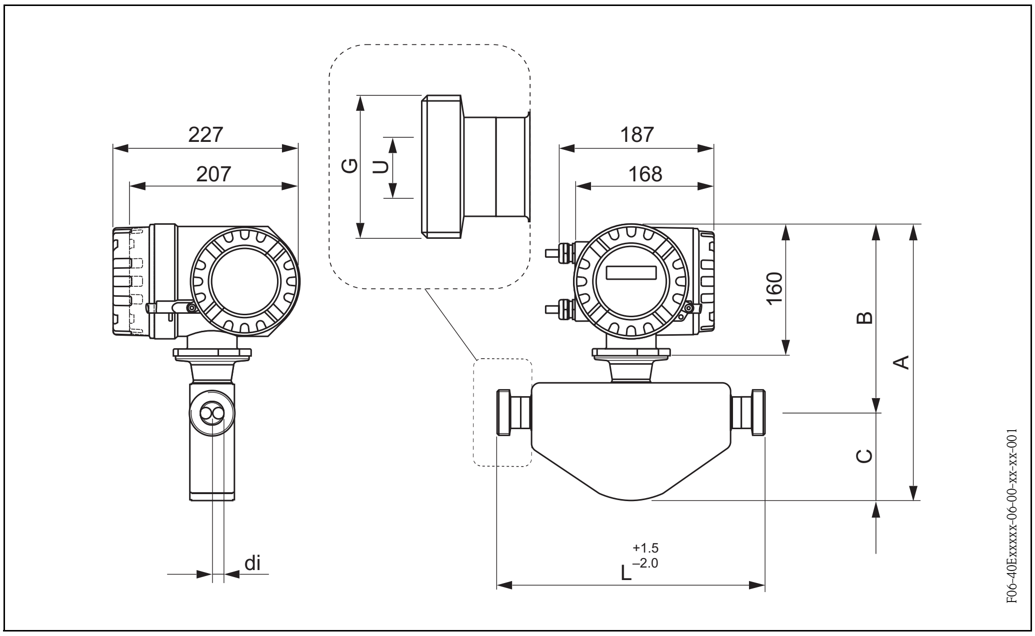
Dimensions: Tri-Clamp connections



Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1"	317	224	93	50.4	229	22.1	5.35
15	1"	331	226	105	50.4	273	22.1	8.30
25	1"	337	231	106	50.4	324	22.1	12.00
40	1 1/2"	358	237	121	50.4	456	34.8	17.60
50	2"	423	253	170	63.9	562	47.5	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)								

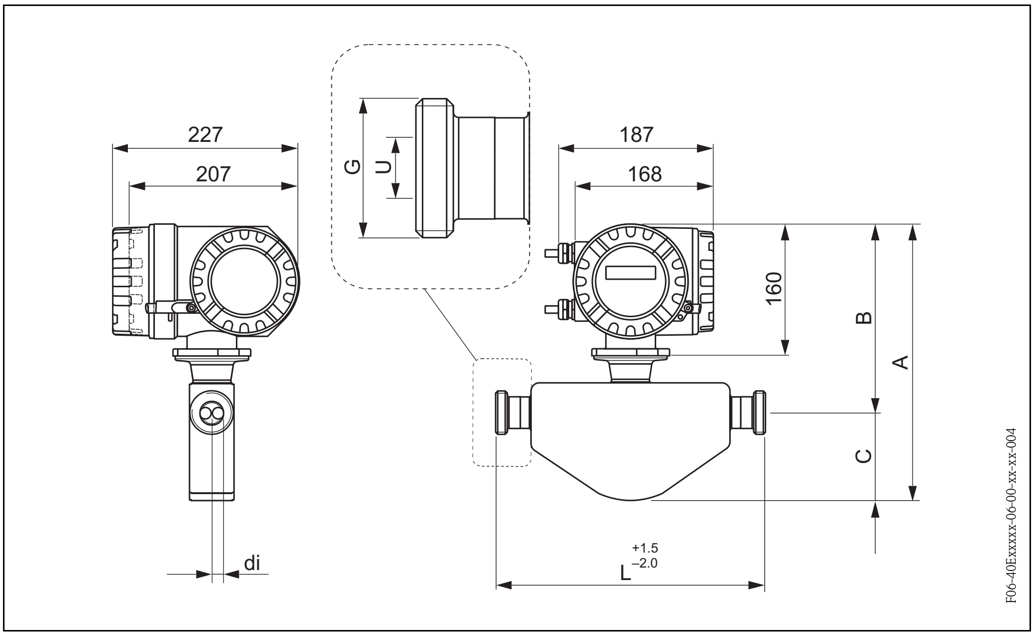
1/2" Tri-Clamp: 1.4404/316L								
DN	Clamp	A	B	C	G	L	U	di
8	1/2"	317	224	93	25.0	229	9.5	5.35
15	1/2"	331	226	105	25.0	273	9.5	8.30
3A version also available (Ra ≤ 0.8 µm/150 grit)								

Dimensions: DIN 11851 connections (hygienic coupling)



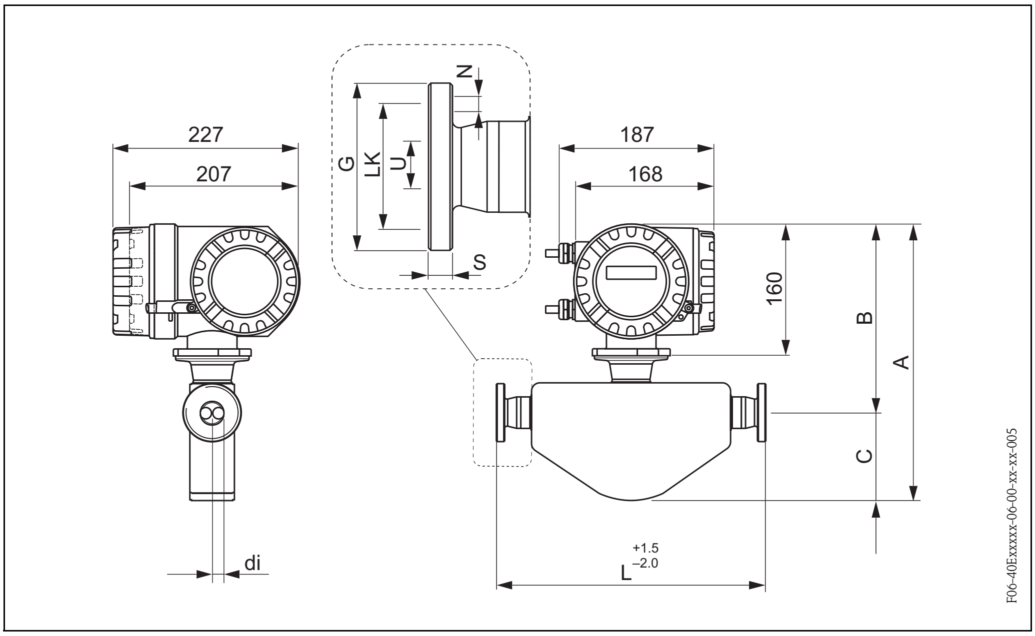
Hygienic coupling DIN 11851: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	Rd 34 x 1/8"	229	16	5.35
15	331	226	105	Rd 34 x 1/8"	273	16	8.30
25	337	231	106	Rd 52 x 1/6"	324	26	12.00
40	358	237	121	Rd 65 x 1/6"	456	38	17.60
50	423	253	170	Rd 78 x 1/6"	562	50	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)							

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



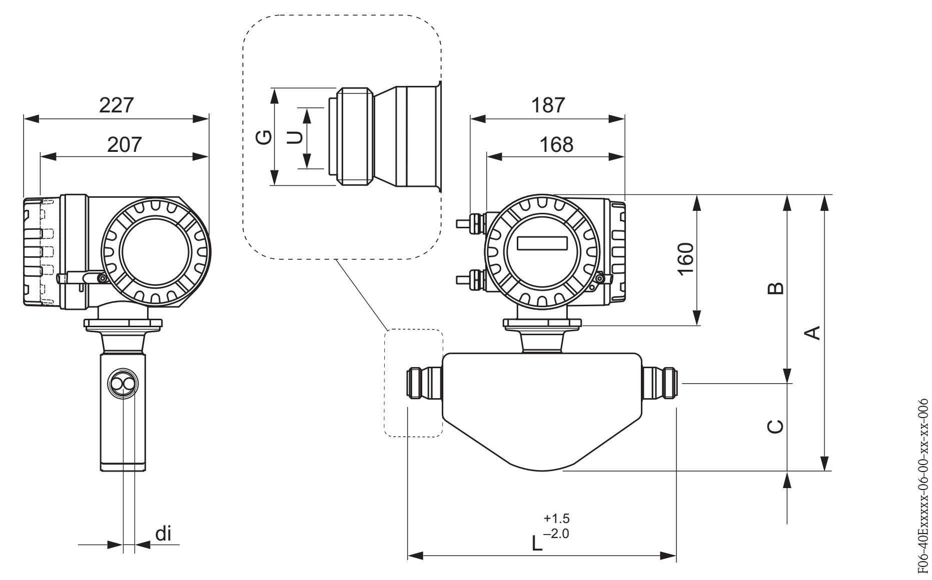
Coupling DIN 11864-1 Form A: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	Rd 28 x 1/8"	229	10	5.35
15	331	226	105	Rd 34 x 1/8"	273	16	8.30
25	337	231	106	Rd 52 x 1/6"	324	26	12.00
40	358	237	121	Rd 65 x 1/6"	456	38	17.60
50	423	253	170	Rd 78 x 1/6"	562	50	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Dimensions: flange connections DIN 11864-2 Form A (flat flange)



Flange DIN 11864-2 Form A (flat flange): 1.4404/316L										
DN	A	B	C	G	L	N	S	LK	U	di
8	317	224	93	54	249	4 x Ø9	10	37	10	5.35
15	331	226	105	59	293	4 x Ø9	10	42	16	8.30
25	337	231	106	70	344	4 x Ø9	10	53	26	12.00
40	358	237	121	82	456	4 x Ø9	10	65	38	17.60
50	423	253	170	94	562	4 x Ø9	10	77	50	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)										

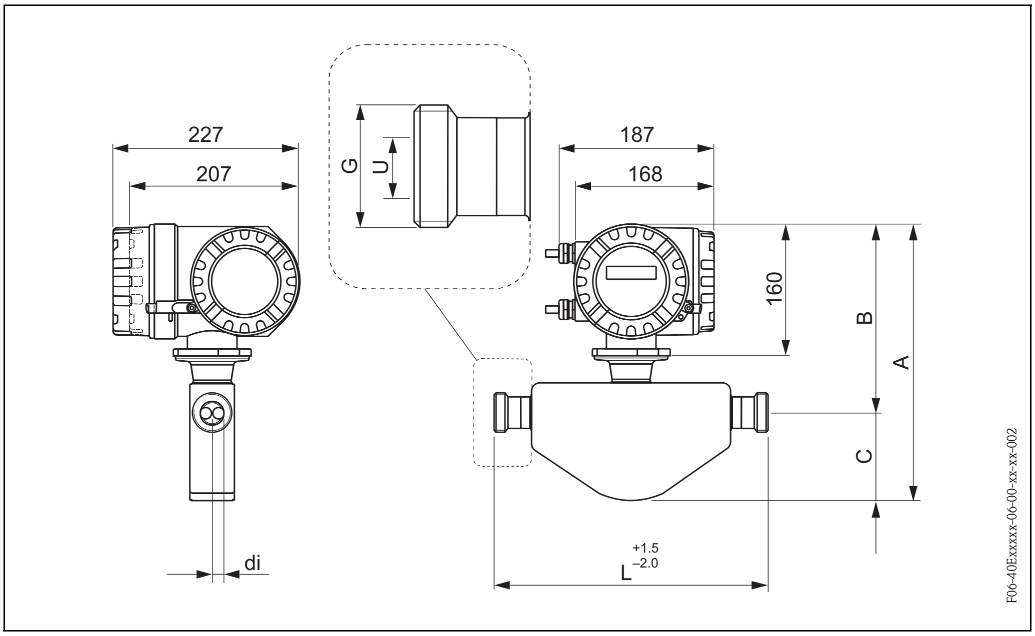
Dimensions: ISO 2853 connections (couplings)



Coupling ISO 2853: 1.4404/316L							
DN	A	B	C	G [1]	L	U	di
8	317	224	93	37.13	229	22.6	5.35
15	331	226	105	37.13	273	22.6	8.30
25	337	231	106	37.13	324	22.6	12.00
40	358	237	121	52.68	456	35.6	17.60
50	423	253	170	64.16	562	48.6	26.00

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

Dimensions: SMS 1145 connections (hygienic coupling)



Hygienic coupling SMS 1145: 1.4404/316L							
DN	A	B	C	G	L	U	di
8	317	224	93	Rd 40 x 1/6"	229	22.5	5.35
15	331	226	105	Rd 40 x 1/6"	273	22.5	8.30
25	337	231	106	Rd 40 x 1/6"	324	22.5	12.00
40	358	237	121	Rd 60 x 1/6"	456	35.5	17.60
50	423	253	170	Rd 70 x 1/6"	562	48.5	26.00
3A version also available (Ra ≤ 0.8 µm/150 grit)							

Weight

Promass E / DN	8	15	25	40	50
Weight in [kg]	8	8	10	15	22

Materials

Transmitter housing:
- Compact housing: powder coated die-cast aluminium

Sensor housing:
- Acid and alkali resistant outer surface; stainless steel 1.4301/304

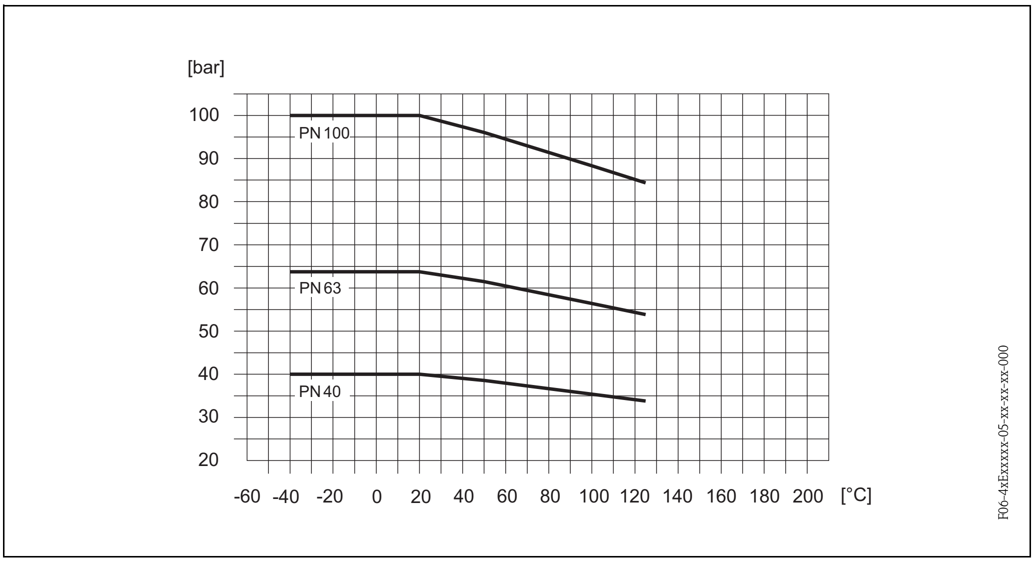
Process connections:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Stainless steel 1.4404/316L
- Flange DIN 11864-2 Form A (flat flange) → Stainless steel 1.4404/316L
- VCO connection → Stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → Stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 Form A → Stainless steel 1.4404/316L
- Tri-Clamp → Stainless steel 1.4404/316L

Measuring tubes
- DN 8...50: Stainless steel 1.4539/904L

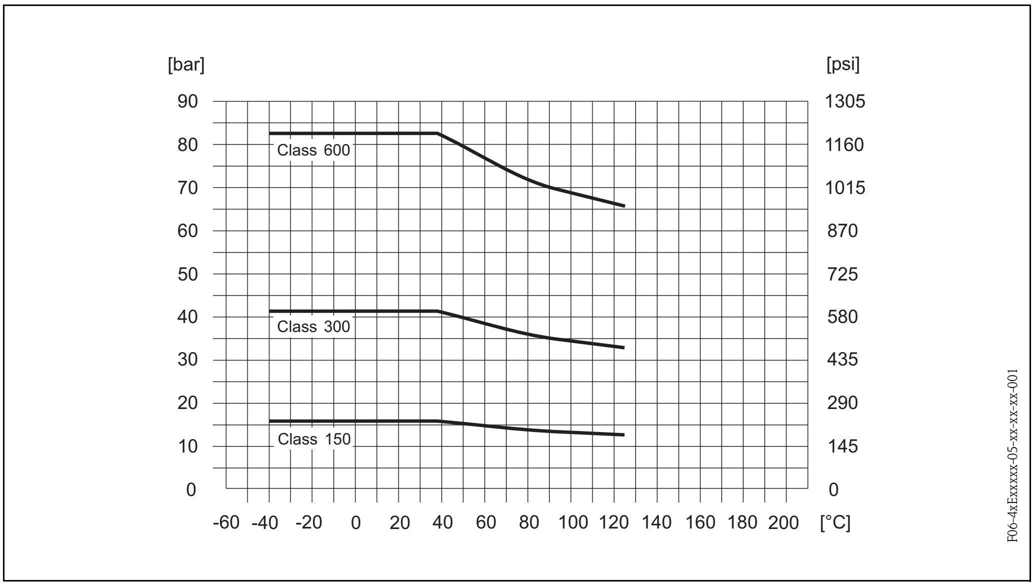
Seals:
- Welded process connections without internal seals

Material load diagram

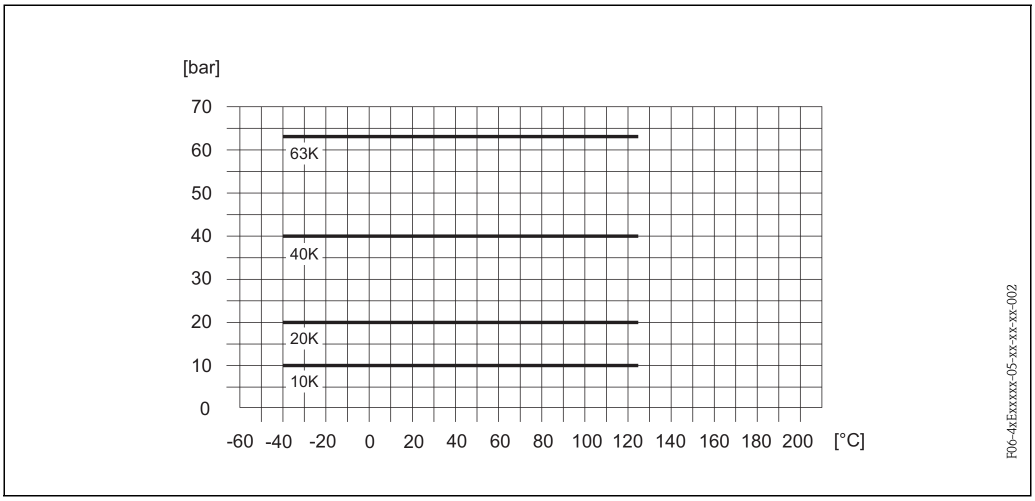
Flange connection to EN 1092-1 (DIN 2501)
Flange material: 1.4404/316L



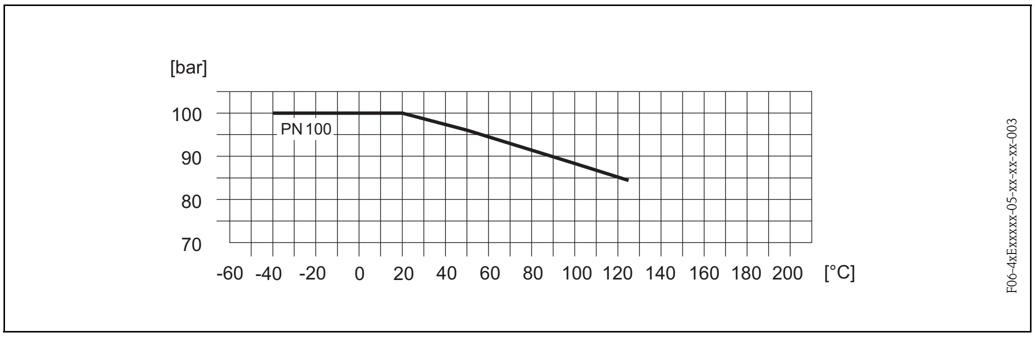
Flange connection to ANSI B16.5
Flange material: 1.4404/316L



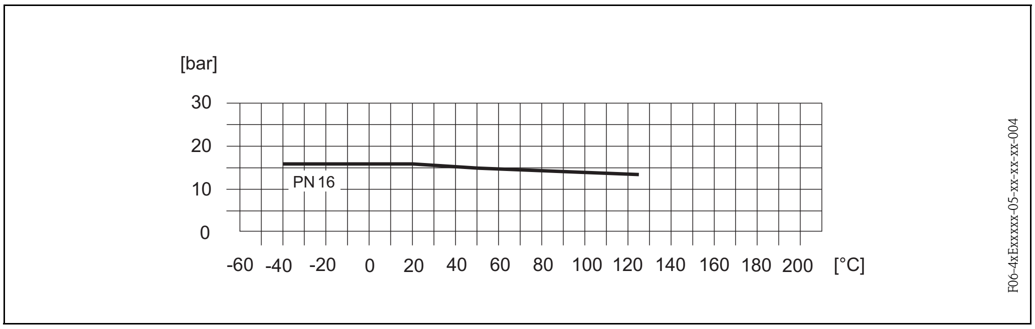
Flange connection to JIS B2238
Flange material: 1.4404/316L



VCO process connection
Coupling material: 1.4404/316L

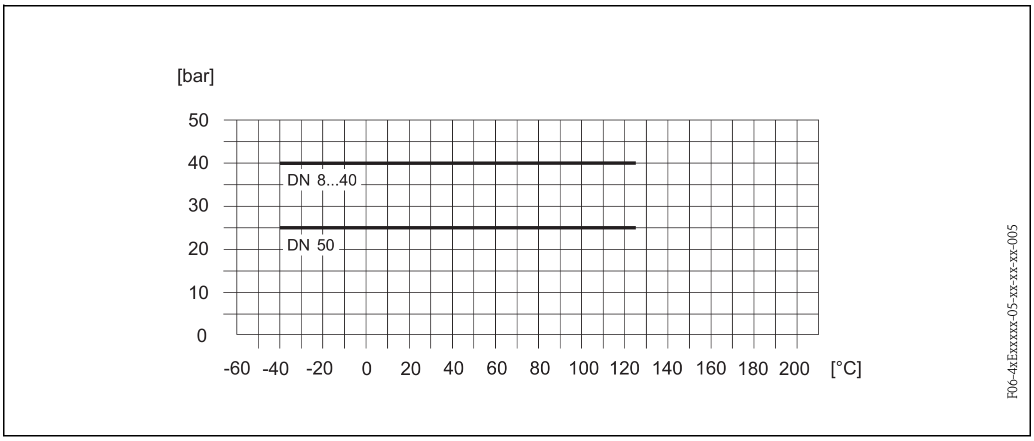


Hygienic coupling to DIN 11851 / SMS 1145
Coupling material: 1.4404/316L

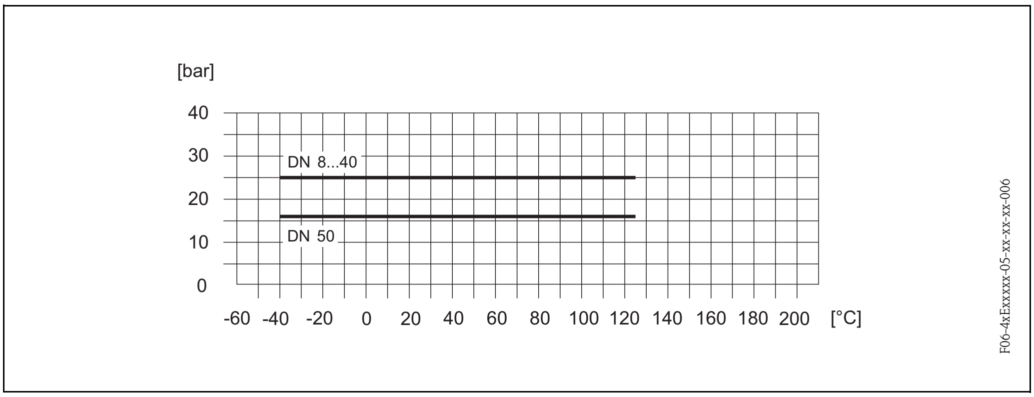


Tri-Clamp process connection
The load limit is defined exclusively by the material properties of the outer clamp used.
This clamp is not included in the scope of delivery.

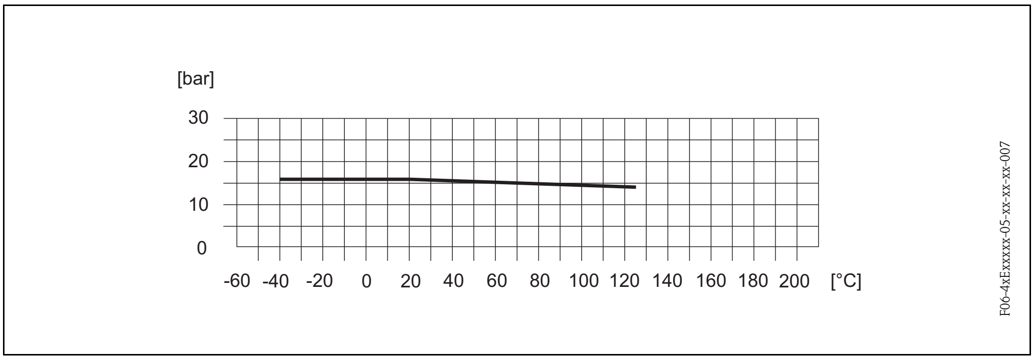
Coupling to DIN 11864-1 Form A
Coupling material: 1.4404/316L



Flange connection to DIN 11864-2 Form A (flat flange)
Flange material: 1.4404/316L



Coupling to ISO 2853
Coupling material: 1.4404/316L



Process connection

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

Human interface

Display elements

- Liquid-crystal display (optional): illuminated, two lines with 16 characters per line
- Selectable display of different measured values and status variables
- Display languages: French, Spanish, Italian, Dutch, Portuguese, German, English

Operating elements

No operating elements

Remote operation

Operation by means of:
- HART protocol (handheld communicator)
- “ToF Tool - Fieldtool Package” configuration and service software or “FieldCare” from Endress+Hauser
- AMS configuration programs (Fisher Rosemount), SIMATIC PDM (Siemens)

Certificates and approvals

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Sanitary compatibility

3A authorization

Pressure device approval

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 engineer practice. For larger nominal diameters, optional approvals according to Cat. II/III are available when required (depends on fluid and process pressure).

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 mark

The measuring system is in conformity with the EMC requirements of the Australian Communications Authority (ACA).

Other standards, 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.

EN 61326/A1 (IEC 1326)
“Emission in accordance with requirements for Class A”.
Electromagnetic compatibility (EMC requirements)

NAMUR NE 21:
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.

NAMUR NE 43:
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

NAMUR NE 53:
Software of field devices and signal-processing devices with digital electronics

Ordering information

The E+H service organization can provide detailed ordering information and information on the order codes on request.

Accessories

There are no accessories, neither for the sensor nor for the transmitter.

Documentation

- Operating Instructions Promass 40 (BA 061D/06/en)
- Description of Device Functions Promass 40 (BA 062D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA

Registered trademarks

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

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

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

Subject to modification

International Head Quarter

Endress+Hauser
GmbH+Co. KG
Instruments International
Colmarer Str. 6
79576 Weil am Rhein
Deutschland

Tel. +49 76 21 9 75 02
Fax +49 76 21 9 75 34 5
www.endress.com
info@ii.endress.com

Endress+Hauser
People for Process Automation

TI055D/06/en/06.05
50098284
FM+SGML 6.0