



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



Solutions

## Technical Information

# LPGmass

## Coriolis Mass Flow Measuring System

For Fueling with Liquified Petroleum Gas (LPG) and filling in hazardous areas



### Applications

The Coriolis measuring principle works independently of the physical fluid properties.

- Specially designed flowmeter for fueling vehicles with LPG (liquified petroleum gas) and filling in hazardous areas
- Fluid temperature up to +125 °C (+257 °F)
- Process pressures up to 100 bar (1450 psi)
- Mass flow measurement up to 750 kg/min (1654 lb/min)
- Big range of process connections

Approvals for hazardous area:

- ATEX, FM, CSA
- Suitable for systems according MID

Connection to common control systems:

- MODBUS RS485

### Your benefits

The Promass measuring devices allow you record multiple process variables (mass/density/temperature) simultaneously during operation for diverse process conditions. Incl. standard volume calculation according API table 53.

The **transmitter concept** comprises:

- FieldCare for onsite operation and diagnosis
- Very low energy consumption

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

- Space-saving and compact design
- Insensitivity to vibrations thanks to balanced twin-tube measuring system
- Easy installation without taking inlet or outlet runs into account

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## Function and system design

### Measuring principle

The measuring principle is based on the controlled generation of Coriolis forces. These forces always occur in a system where translational (linear) and rotational movements are superimposed simultaneously.

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

$F_C$  = Coriolis force

$\Delta m$  = moving mass

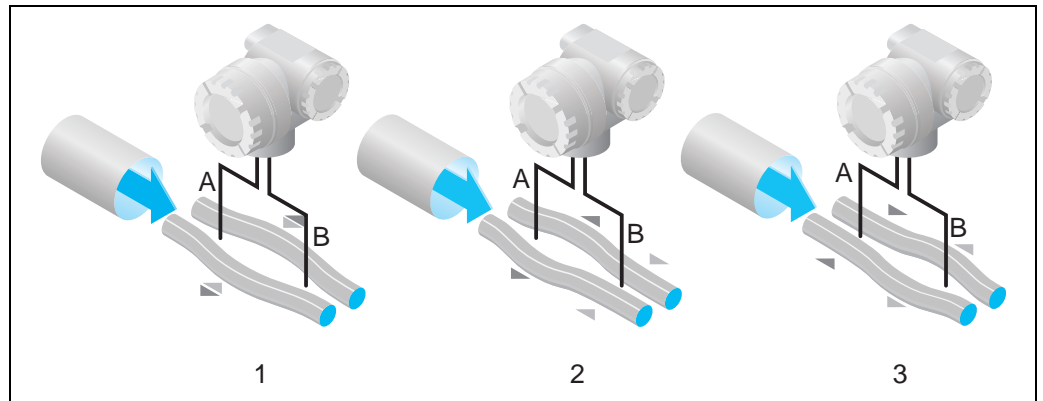
$\omega$  = rotational velocity

$v$  = radial velocity in rotating or oscillating system

The size of the Coriolis force depends on the moving mass  $\Delta m$ , its velocity  $v$  in the system, and thus the mass flow. Instead of a constant rotational velocity  $\omega$ , Promass 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 tube oscillation at the inlet (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 works independently of temperature, pressure, viscosity, conductivity and flow profile.

### Density measurement

The measuring tubes are always 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 exciter frequency. Resonance frequency is thus a function of fluid density. The microprocessor utilizes this relationship to obtain a density signal.

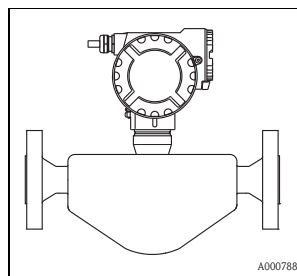
### Temperature measurement

To make calculations to compensate for temperature effects, the temperature of the measuring tubes is measured. This signal corresponds to the process temperature and is also available as an output signal.

### Measuring system

The measuring system consists of the transmitter and sensor which together form a mechanical unit.

### Measuring system LPGmass



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- Without onsite operation
- Configuration via MODBUS RS485 and "FieldCare"
- Limiting medium pressure range max. 100 bar (1450 psi) (dependent on process connection)
- Ambient temperature range: -40 to +60 °C (-40 to +140 °F)

## Input

### Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube which record differences in the pipe oscillation geometry during flow)
- Volume flow (measured from the mass flow and density)
- Fluid density (proportional to the resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

### Measuring ranges

#### Measuring ranges for non-custody transfer operation:

DN		$\dot{m}_{\min}$ to $\dot{m}_{\max}$	
[mm]	[inch]	[kg/h]	[lb/min]
8	3/8"	0 to 2000	0 to 73.5
15	1/2"	0 to 6500	0 to 238
25	1"	0 to 18000	0 to 660
40	1 1/2"	0 to 45000	0 to 1650



Note!

The values of the corresponding custody transfer certificate apply for custody transfer operation.

### Operable flow range

1:100

## Output

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### Output signal

#### Pulse / frequency output

- Passive
- Galvanically isolated
- Open Collector
- Max. 30 V DC
- Max. 25 mA
- Frequency output: end frequency 100 to 5000 Hz, on/off ratio 1:1
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.1 to 1000 ms)

#### Status output

- Passive
- Open Collector
- Max. 30 V DC
- Max. 25 mA

#### MODBUS interface

- MODBUS device type: slave
- Address range: 1 to 247
- Functions codes supported: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Physical interface: RS485 in accordance with standard EIA/TIA-485
- Baud rates supported: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Transmission mode: RTU or ASCII
- Response time = typically 5 ms

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### Signal on alarm

#### Pulse / frequency output

- Behavior can be selected

#### Status output

- Behavior can be selected

#### MODBUS RS485

- Behavior can be selected

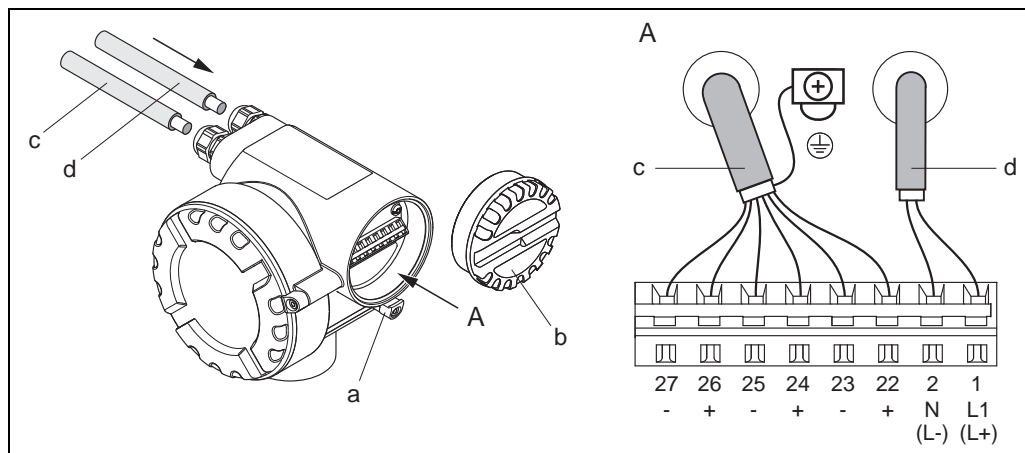
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### Galvanic isolation

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

## Power supply

### Electrical connection, measuring unit



Connecting the transmitter, cable cross-section: max. 2.5 mm<sup>2</sup> (14 AWG)

- A View A  
 a Safety claw  
 b Terminal compartment cover  
 c Signal cable: terminal Nos. 22 to 27 (shield for MODBUS RS485 is mandatory; shield for pulse, frequency and status outputs is not required, but recommended)  
 d Cable for power supply: 20 to 28 V AC, 10 to 30 V DC  
 - Terminal No. 1: L1 for AC, L+ for DC  
 - Terminal No. 2: N for AC, L- for DC

### Electrical connection, terminal assignment

	Terminal No. (inputs/outputs)		
Order version	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
8FE*_*****N	Pulse/frequency/status output 2	Pulse/frequency/status output 1	MODBUS RS485

### Supply voltage

24 V DC nominal voltage (10 to 30 V DC)  
 24 V AC nominal voltage (20 to 28 V AC)

### Cable entries

*Power supply and signal cables (outputs):*

- Cable entry M20 × 1.5 (8 to 12 mm / 0.32 to 0.47")
- Threads for cable entries, ½" NPT, G ½"

### Cable specifications

Each compatible cable, with a temperature specification at least 20°C (68 °F) higher than the ambient temperature prevailing in the application. We recommend using a cable with a temperature specification of +80°C (+176 °F).

for MODBUS RS485:

Characteristic impedance = 120 W

Cable capacitance = < 30 pF/m

Core cross-section = > 0.34 mm<sup>2</sup>, corresponds to AWG 22

Cable type = twisted pairs

Loop-resistance = ≤ 110 Ω/km

Shielding = copper braided shielding or braided shielding and foil shielding

**Power consumption**AC: < 4 VA  
DC: < 3.2 WTypical switch-on current at 24 V DC nominal voltage at  $R_i = 0.1 \Omega$  of the source.

t [ms]	I [A]
0	10
0.1	8
0.2	7.5
0.5	7
1	6
2	4
5	1.5
10	0.125 (operating current)



Note!

The internal resistance of the source may not exceed  $R_i = 10 \Omega$ .

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**Power supply failure**Bridging of at least 20 ms.  
All measuring cell and measuring point data are maintained.

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**Potential equalization**

This measuring instrument is suitable for potentially explosive atmospheres; refer to the correspondingly information in the specific Ex-specific supplementary documentation.

## Performance characteristics

### Reference operating conditions for factory calibration

Error limits following ISO/DIS 11631:

- Fluid: water
- +15 to +45 °C (+59 to +113 °F); 2 to 6 bar (29 to 87 psi)
- Calibration rigs traced to national metrology standards
- Zero point calibrated under operating conditions
- Density adjustment performed

### Maximum measured error

#### Mass flow:

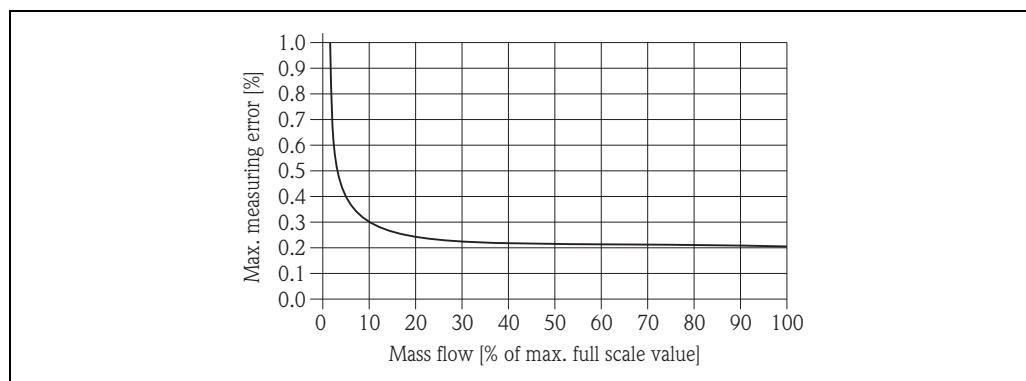
$\pm 0.2\% \pm [(zero\ point\ stability \div measured\ value) \cdot 100]\% \text{ o.r.}$

#### Volume flow:

$\pm 0.3\% \pm [(zero\ point\ stability \div measured\ value) \cdot 100]\% \text{ o.r.}$

### Zero point stability

DN		Zero point stability	
		[kg/h]	[lb/min]
8	3/8"	0.200	0.007
15	1/2"	0.650	0.024
25	1"	1.80	0.066
40	1 1/2"	4.50	0.165



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Calculation example

Given: LPGmass DN 25 (1"), mass flow = 5000 kg/h (11023 lb/h)

Max. measured error:  $\pm 0.2\% \pm [(zero\ point\ stability \div measured\ value) \cdot 100]\% \text{ o.r.}$

Max. measured error  $\rightarrow \pm 0.2\% \pm 1.80\text{ kg/h (3.97 lb/h)} \div 5000\text{ kg/h (11023 lb/h)} \cdot 100\% = \pm 0.236\%$

### Repeatability

#### Mass flow:

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

#### Volume flow:

$\pm 0.15\% \pm [1/2 \cdot (zero\ point\ stability \div measured\ value) \cdot 100]\% \text{ o.r.}$

### Influence of medium temperature

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

### Influence of medium pressure

The following section shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure is negligible.

## Operating conditions: Installation

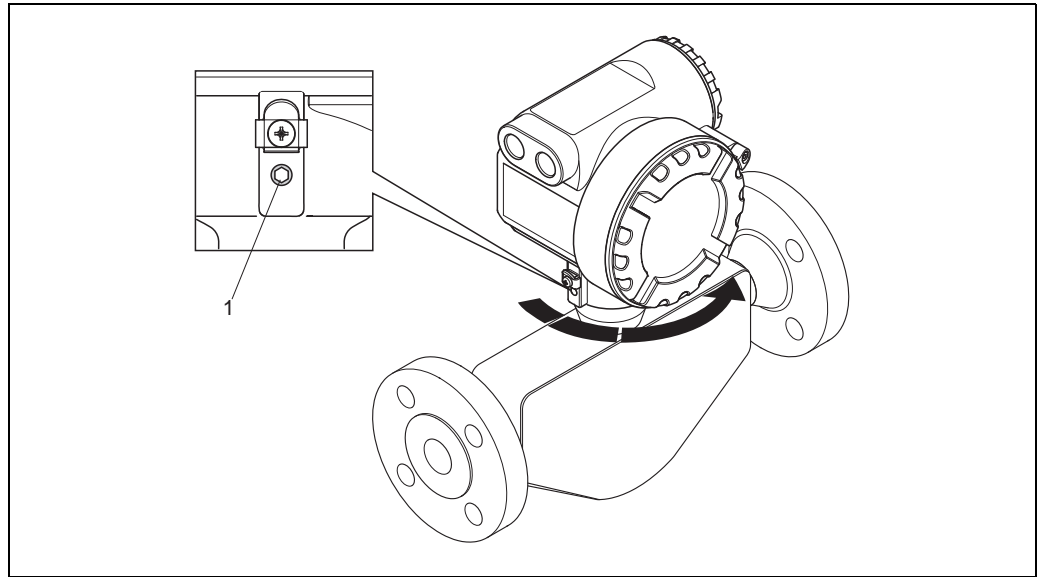
### Installation instructions

Note the following points:

- No special measures such as supports are necessary. The housing absorbs external forces.
- 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.).

### Turning the transmitter housing

The transmitter housing can be rotated counterclockwise continuously up to 360°.



1 = Allen screw

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### Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs.

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## Operating conditions: Environment

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<b>Ambient temperature range</b>	–40 to +60 °C (–40 to +140 °F) (sensor, transmitter)
	Note! Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
<b>Storage temperature</b>	–40 to +80 °C (–40 to +176 °F), preferably +20 °C (+68 °F)
<b>Degree of protection</b>	Standard: IP 67 (NEMA 4X) for transmitter and sensor
<b>Shock resistance</b>	In accordance with IEC 68-2-31 and EN 60721 (Class 2M3)
<b>Vibration resistance</b>	In accordance with IEC 68-2-31 and EN 60721 (Class 2M3)
<b>Electromagnetic compatibility (EMC)</b>	As per IEC/EN 61326 and NE 21

## Operating conditions: Process

**Medium temperature range** –40 to +125 °C (–40 to +257 °F)

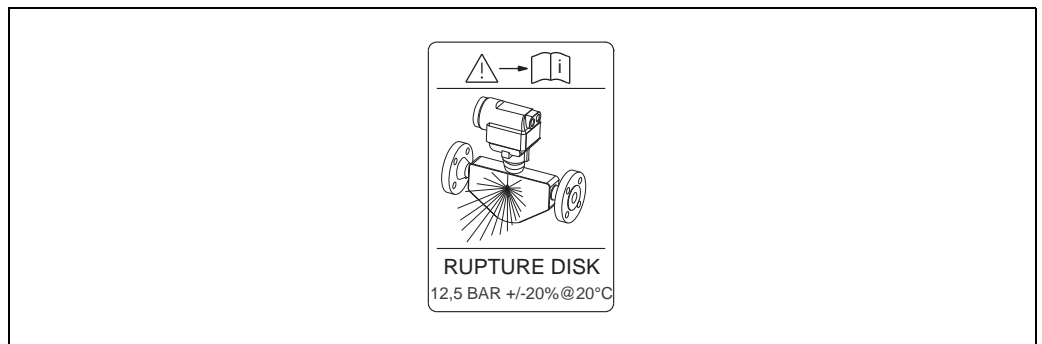
**Medium pressure range (nominal pressure)** Measuring tubes, connector: max. 100 bar (1450 psi)  
(dependent on process connection)

**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 (217.5 psi) 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 / 145 to 217.5 psi) can be used, which is available for order as a separate option.

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.



Additional sign regarding the position of the rupture disk

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**Limiting flow** See information in the "Measuring range" Section → 4

**Pressure loss in SI units**

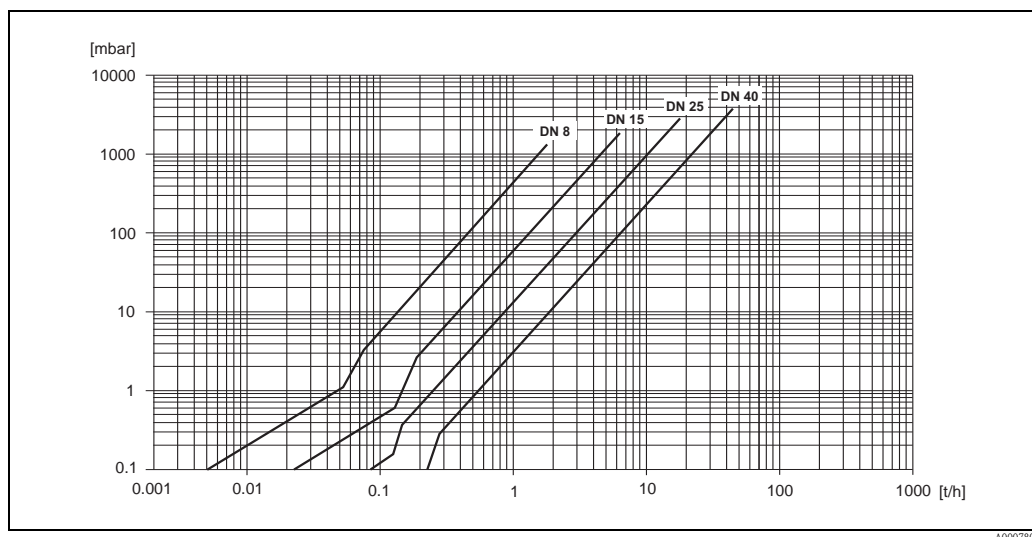
Pressure loss depends on the fluid properties and on the flow rate. The following formulae can be used to approximately calculate the pressure loss for liquids:

**Pressure loss formulae**

Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$	A0004623
$Re \geq 2300$	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$	A0004626
$Re < 2300$	$\Delta p = K1 \cdot \nu \cdot \dot{m} + \frac{K2 \cdot \nu^{0.25} \cdot \dot{m}^2}{\rho}$	A0004628
$\Delta p$ = pressure loss [mbar] $\nu$ = kinematic viscosity [m <sup>2</sup> /s] $\dot{m}$ = mass flow [kg/s]	$\rho$ = density [kg/m <sup>3</sup> ] $d$ = internal diameter of measuring tubes [m] K to K2 = constants (depending on nominal diameter)	

### Pressure loss coefficients

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	$17.60 \cdot 10^{-3}$	$4.42 \cdot 10^5$	$1.35 \cdot 10^6$	$1.38 \cdot 10^5$



Pressure loss diagram with water

### Pressure loss in US units

Pressure loss is dependent on fluid properties nominal diameter. Consult Endress+Hauser for Applicator PC software to determine pressure loss in US units. All important instrument data is contained in the Applicator software program in order to optimize the design of measuring system. The software is used for following calculations:

- Nominal diameter of the sensor with fluid characteristics such as viscosity, density, etc.
- Pressure loss downstream of the measuring point.
- Converting mass flow to volume flow, etc.
- Simultaneous display of various meter size.
- Determining measuring ranges.

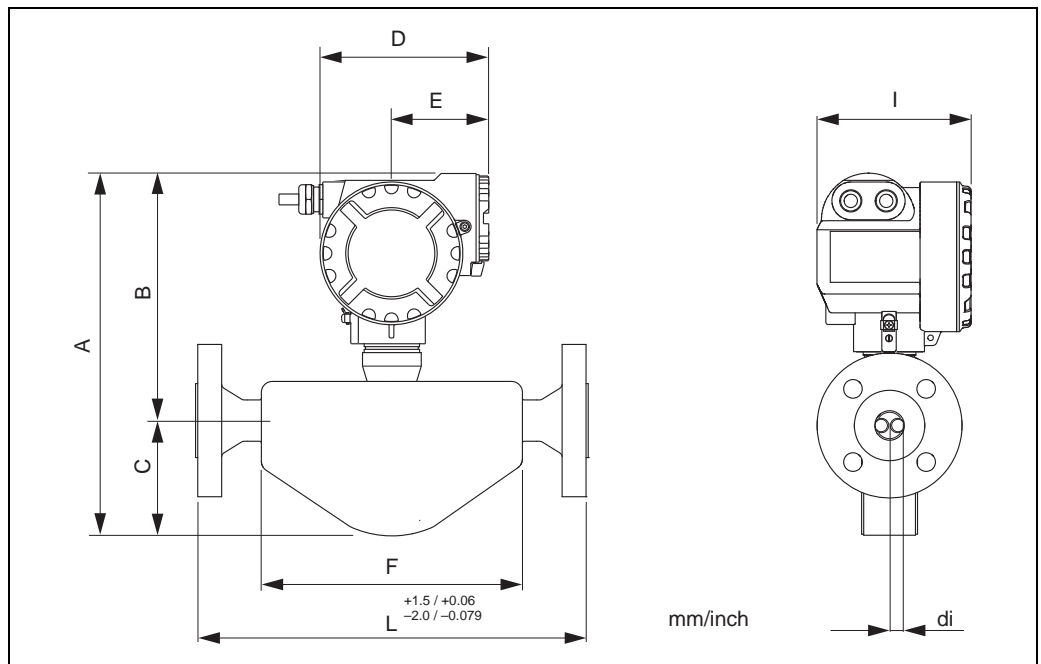
The Applicator runs on any IBM compatible PC with windows.

## Mechanical construction

### Design/dimensions

Dimensions:	
LPGmass dimensions	→ <a href="#">13</a>
Flange connections EN (DIN), ASME, JIS	→ <a href="#">14</a>
Tri-Clamp connections	→ <a href="#">16</a>
DIN 11851 (threaded hygienic connection)	→ <a href="#">17</a>
DIN 11864-1 Form A (threaded hygienic connection)	→ <a href="#">18</a>
VCO connections	→ <a href="#">19</a>

### LPGmass dimensions



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#### Dimensions in SI units

DN	A	B	C	D	E	F	L	I	2 × di
8	314	221	93	160	92	146	*	139	5.35
15	330	225	105	160	92	189	*	139	8.30
25	338	232	106	160	92	240	*	139	12.00
40	359	238	121	160	92	337	*	139	17.60

All dimensions in [mm]

\* dependent on respective flange connection

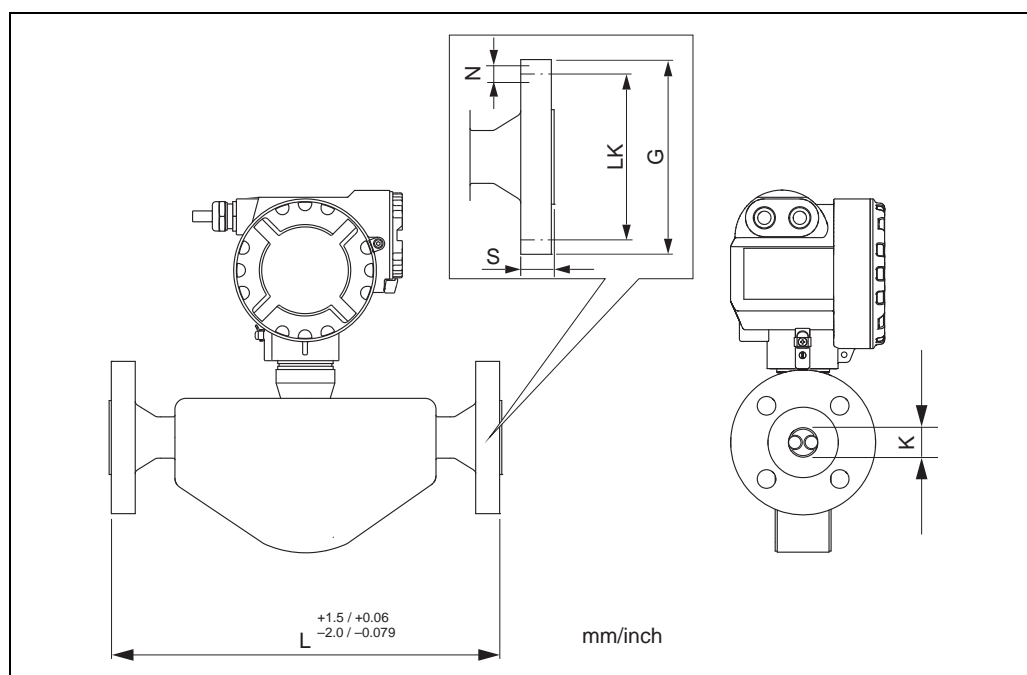
#### Dimensions in US units

DN	A	B	C	D	E	F	L	I	2 × di
8	8.70	3.66	6.30	3.62	5.75	*	5.47	0.21	12.36
15	8.86	4.13	6.30	3.62	7.44	*	5.47	0.33	12.99
25	9.13	4.17	6.30	3.62	9.45	*	5.47	0.47	13.31
40	9.37	4.76	6.30	3.62	13.27	*	5.47	0.69	14.13

All dimensions in [inch]

\* dependent on respective flange connection

## Flange connections EN (DIN), ASME, JIS



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## Dimensions in SI units

Flange EN 1092-1 (DIN 2501, DIN 2512 N <sup>1)</sup> ) / PN 40: 1.4404/316L						
DN	G	K	L	LK	N	S
8	95	17.3	232	65	4 × Ø 14	16
15	95	17.3	279	65	4 × Ø 14	16
25	115	28.5	329	85	4 × Ø 14	18
40	150	43.1	445	110	4 × Ø 18	18

<sup>1)</sup> Flange with groove to EN 1092-1 Form D (DIN 2512 N) available  
All dimensions in [mm]; other dimensions → 13


Flange according to ASME B16.5 / Cl. 150: 1.4404/316L						
DN	G	K	L	LK	N	S
8	88.9	15.7	232	60.5	4 × Ø 15.7	11.2
15	88.9	15.7	279	60.5	4 × Ø 15.7	11.2
25	108.0	26.7	329	79.2	4 × Ø 15.7	14.2
40	127.0	40.9	445	98.6	4 × Ø 15.7	17.5

All dimensions in [mm]; other dimensions → 13


Flange according to ASME B16.5 / Cl. 300: 1.4404/316L						
DN	G	K	L	LK	N	S
8	95.2	15.7	232	66.5	4 × Ø 15.7	14.2
15	95.2	15.7	279	66.5	4 × Ø 15.7	14.2
25	123.9	26.7	329	88.9	4 × Ø 19.0	17.5
40	155.4	40.9	445	114.3	4 × Ø 22.3	20.6

All dimensions in [mm]; other dimensions → 13


Flange JIS B2220 / 20K: SUS316L						
DN	G	K	L	LK	N	S
8	95	15	232	70	4 × Ø 15	14
15	95	15	279	70	4 × Ø 15	14
25	125	25	329	90	4 × Ø 19	16
40	140	40	445	105	4 × Ø 19	18

All dimensions in [mm]; other dimensions →  13

Flange JIS B2220 / 40K: SUS316L						
DN	G	K	L	LK	N	S
8	115	15	261	80	4 × Ø 19	20
15	115	15	300	80	4 × Ø 19	20
25	130	25	375	95	4 × Ø 19	22
40	160	38	496	120	4 × Ø 23	24


All dimensions in [mm]; other dimensions →  13

Flange JIS B2220 / 63K: SUS316L						
DN	G	K	L	LK	N	S
8	120	12	282	85	4 × Ø 19	23
15	120	12	315	85	4 × Ø 19	23
25	140	22	383	100	4 × Ø 23	27
40	175	35	515	130	4 × Ø 25	32


All dimensions in [mm]; other dimensions →  13

#### *Dimensions in US units*

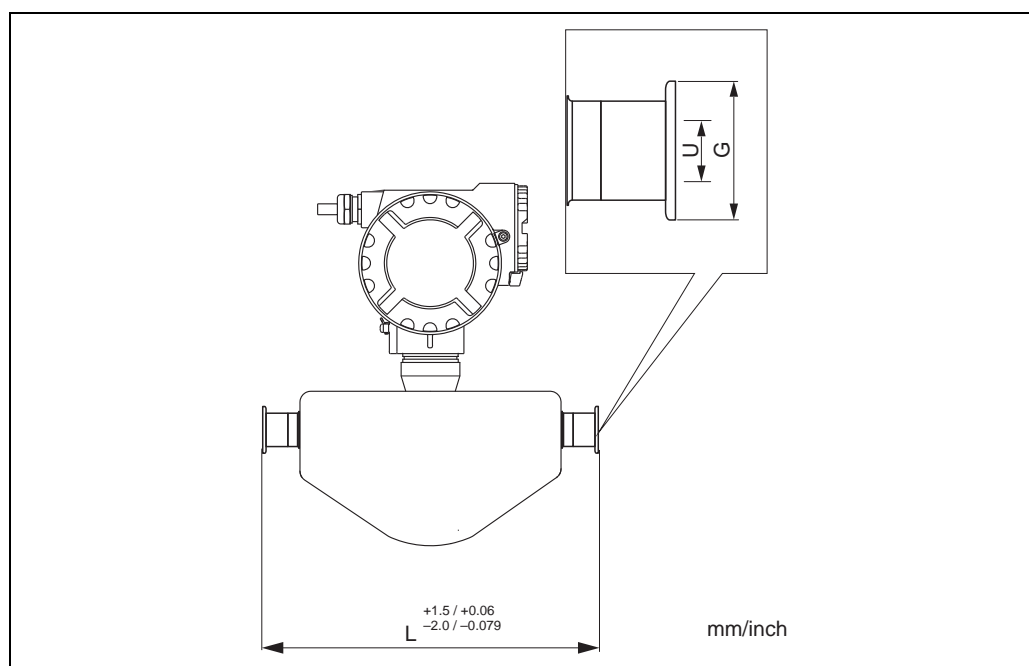
Flange according to ASME B16.5 / Cl. 150: 1.4404/316L						
DN	G	K	L	LK	N	S
8	3.75	0.62	9.13	2.62	4 × 0.62	0.44
15	3.75	0.62	10.98	2.62	4 × 0.62	0.44
25	4.88	1.05	12.95	3.50	4 × 0.75	0.56
40	6.12	1.61	17.52	4.50	4 × 0.88	0.69

All dimensions in [inch]; other dimensions →  13

Flange according to ASME B16.5 / Cl. 300: 1.4404/316L						
DN	G	K	L	LK	N	S
8	3.75	0.62	9.13	2.62	4 × 0.62	0.56
15	3.75	0.62	10.98	2.62	4 × 0.62	0.56
25	4.88	1.05	12.95	3.50	4 × 0.62	0.69
40	6.12	1.61	17.52	4.50	4 × 0.62	0.81

All dimensions in [inch]; other dimensions →  13

## Tri-Clamp connections



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## Dimensions in SI units

Tri-Clamp: 1.4404/316L				
DN	Clamp	G	L	U
8	½"	25.0	229	9.5
	¾"	25.0	229	16
	1"	50.4	229	22.1
15	½"	25.0	273	9.5
	¾"	25.0	273	16
	1"	50.4	273	22.1
25	1"	50.4	324	22.1
40	1½"	50.4	456	34.8

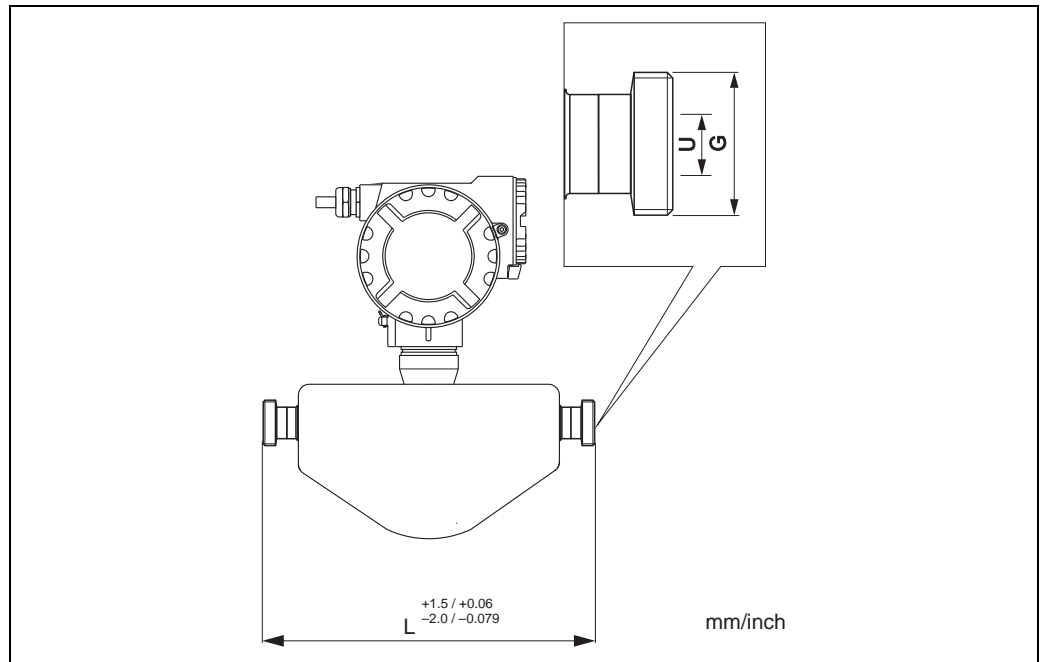
All dimensions in [mm]; other dimensions → 13  
 3A-version also available ( $R_a \leq 0.8 \mu\text{m}/150$  grit)

## Dimensions in US units

Tri-Clamp: 1.4404/316L				
DN	Clamp	G	L	U
8	½"	0.98	9.02	0.37
	¾"	0.98	9.02	0.63
	1"	1.98	9.02	0.87
15	½"	0.98	10.75	0.37
	¾"	0.98	10.75	0.63
	1"	1.98	10.75	0.87
25	1"	1.98	12.76	0.87
40	1½"	1.98	17.95	1.37

All dimensions in [inch]; other dimensions → 13  
 3A-version also available ( $R_a \leq 0.8 \mu\text{m}/150$  grit)

## DIN 11851 (threaded hygienic connection)



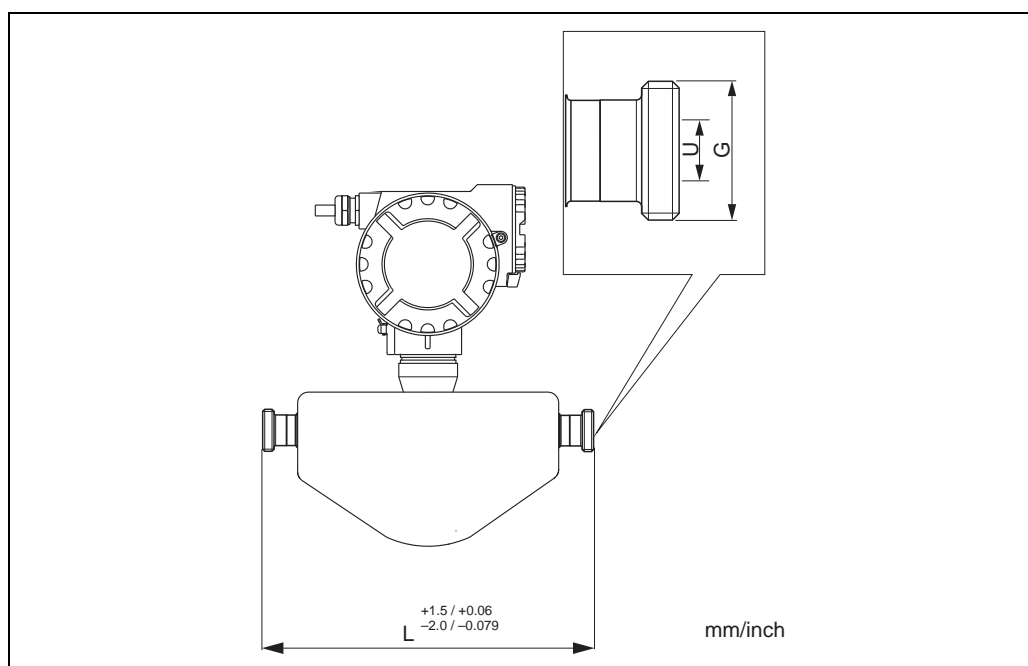
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Sanitary connection DIN 11851: 1.4404/316L

DN	G	L	U
8	Rd 34 × 1/8"	229	16
15	Rd 34 × 1/8"	273	16
25	Rd 52 × 1/6"	324	26
40	Rd 65 × 1/6"	456	38

All dimensions in [mm]; other dimensions → 13  
 3A-version also available ( $Ra \leq 0.8 \mu\text{m}/150$  grit)

## DIN 11864-1 Form A (threaded hygienic connection)

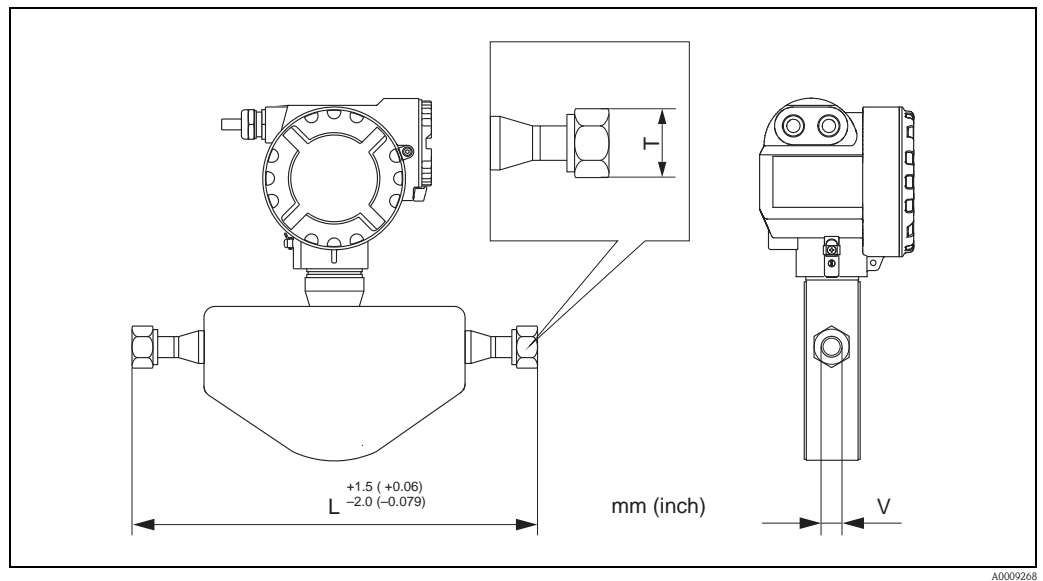


A0009253

Threaded joint DIN 11864-1 Form A: 1.4404/316L			
DN	G	L	U
8	Rd 28 × 1/8"	229	10
15	Rd 34 × 1/8"	273	16
25	Rd 52 × 1/6"	324	26
40	Rd 65 × 1/6"	456	38

All dimensions in [mm]; other dimensions → [13](#)  
 3A-version also available (Ra ≤ 0.8 μm/150 grit)

## VCO connections



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## Dimensions in SI units

8-VCO-4 (1/2"): 1.4404/316L			
DN	L	T	V
8	252	SW 1"	10.2

All dimensions in [mm]; other dimensions → 13

12-VCO-4 (3/4"): 1.4404/316L			
DN	L	T	V
15	305	SW 1 1/2"	15.7

All dimensions in [mm]; other dimensions → 13

## Dimensions in US units

8-VCO-4 (1/2"): 1.4404/316L			
DN	L	T	V
8	9.92	SW 1"	0.4

All dimensions in [inch]; other dimensions → 13

12-VCO-4 (3/4"): 1.4404/316L			
DN	L	T	V
15	12.01	SW 1 1/2"	0.62

All dimensions in [inch]; other dimensions → 13

**Weight**

DN in mm	8	15	25	40
Weight in kg	6.7	7.2	8.8	13.7

DN in inch	3/8"	1/2"	1"	1 1/2"
Weight in lbs	14.7	15.8	19.4	30.2

The weights refer to devices with DIN flanges PN 40.

**Material****Transmitter housing**

Powder coated die-cast aluminum

**Housing of sensor/secondary containment**

Acid-resistant and alkali-resistant external surface, stainless steel 1.4301/304

**Process connections**

Stainless steel 1.4404/316L:

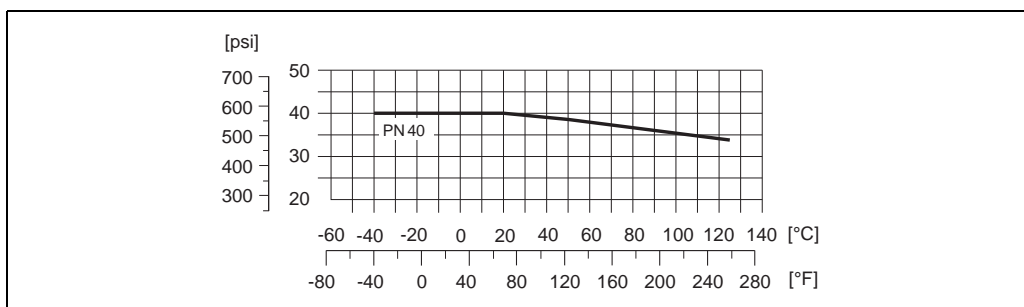
- Flanges EN 1092-1 (DIN 2501, DIN 2512 N), ASME, JIS
- Tri-Clamp connections
- DIN 11851 (threaded hygienic connection)
- DIN 11864-1 Form A (threaded hygienic connection)
- VCO coupling

**Measuring tubes**

Stainless steel 1.4539/904L

**Material load diagram****Flange connection to EN 1092-1 (DIN 2501, DIN 2512 N)**

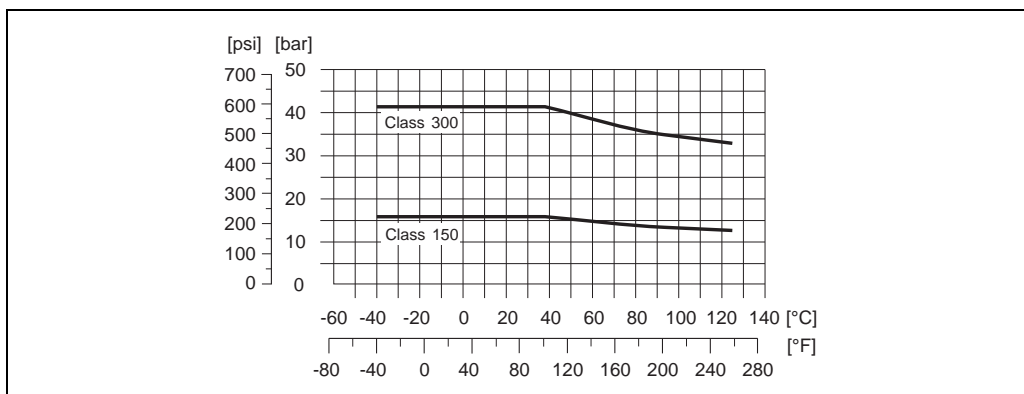
Connection material: 1.4404/316L



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**Flange connection according to ASME B16.5**

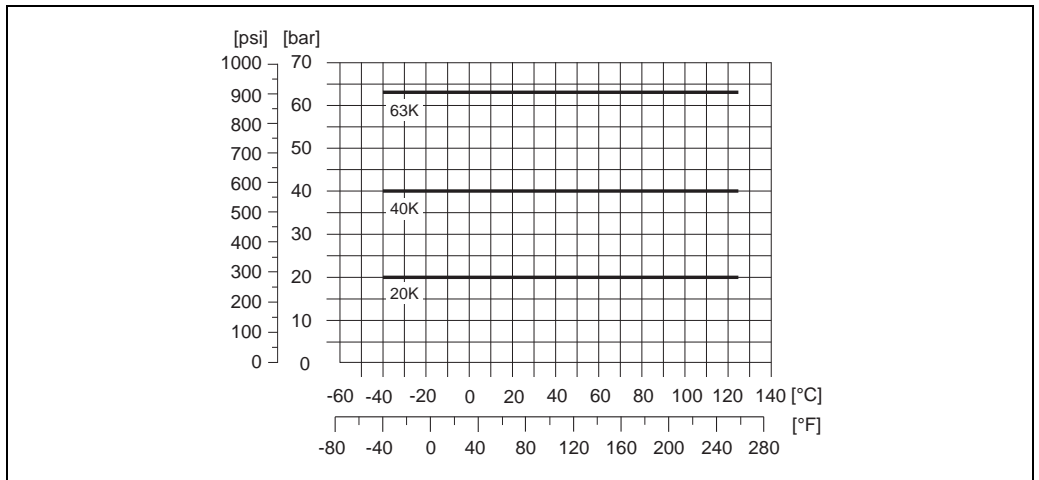
Connection material: 1.4404/316L



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**Flange connection to JIS B2220**

Connection material: 1.4404/316L



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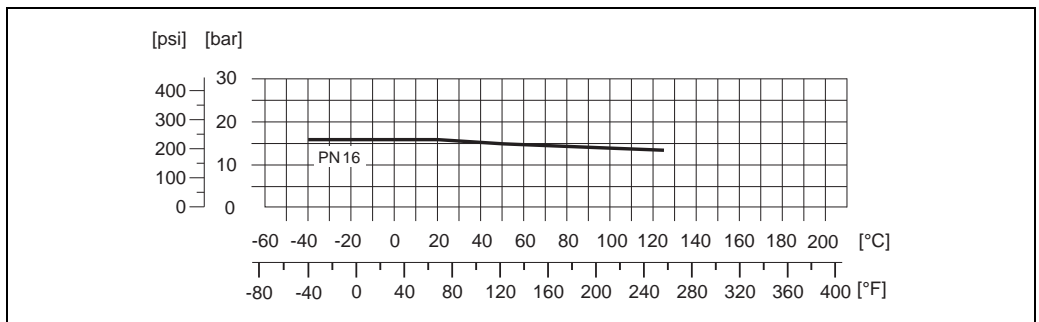
**Tri-Clamp process connection**

PS = 16 bar (232 psi)

The clamp connections are suitable up to a maximum pressure of 16 bar (232 psi). Please observe the operating limits of the clamp and seal used as they could be under 16 bar (232 psi). The clamp and seal do not form part of the scope of supply.

**DIN 11851 (threaded hygienic connection)**

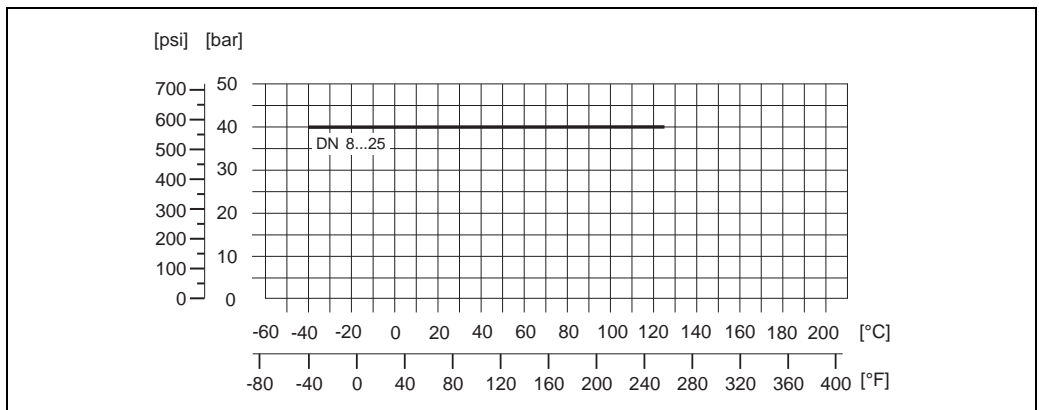
Connection material: 1.4404/316L



A0008607

**DIN 11864-1 (threaded hygienic connection)**

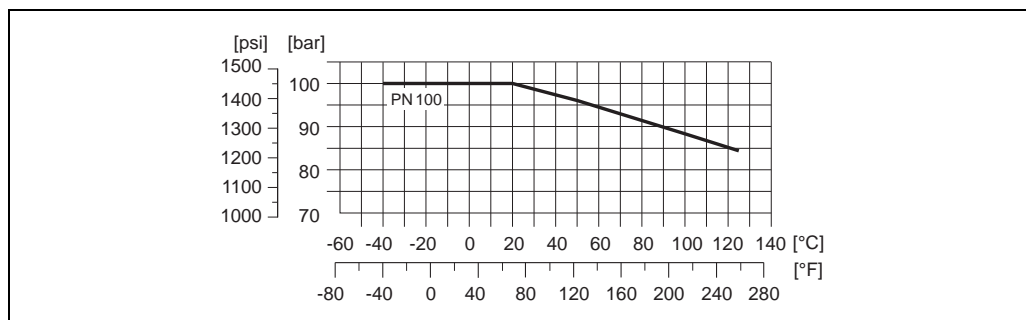
Connection material: 1.4404/316L



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**VCO coupling**

Connection material: 1.4404/316L



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**Process connections**

→ 20 → Material → Process connections

## Human interface

### Display elements

#### Status LED

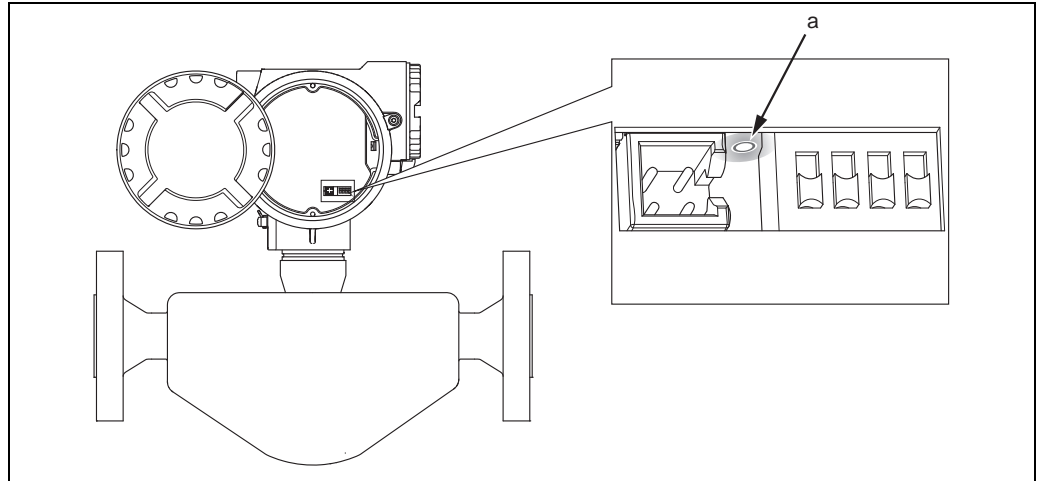
There is a Light Emitting Diode (LED) on the meter electronics board that allows simple fault diagnostics:

- If the status output was not configured to output errors or notes.
- If fault diagnostics are no longer possible via the Fieldtool operating program.



#### Warning!

Risk of explosion! The electronics compartment may not be opened while there is an explosive atmosphere. This type of fault diagnostics can no longer be carried out in Ex-protected areas.

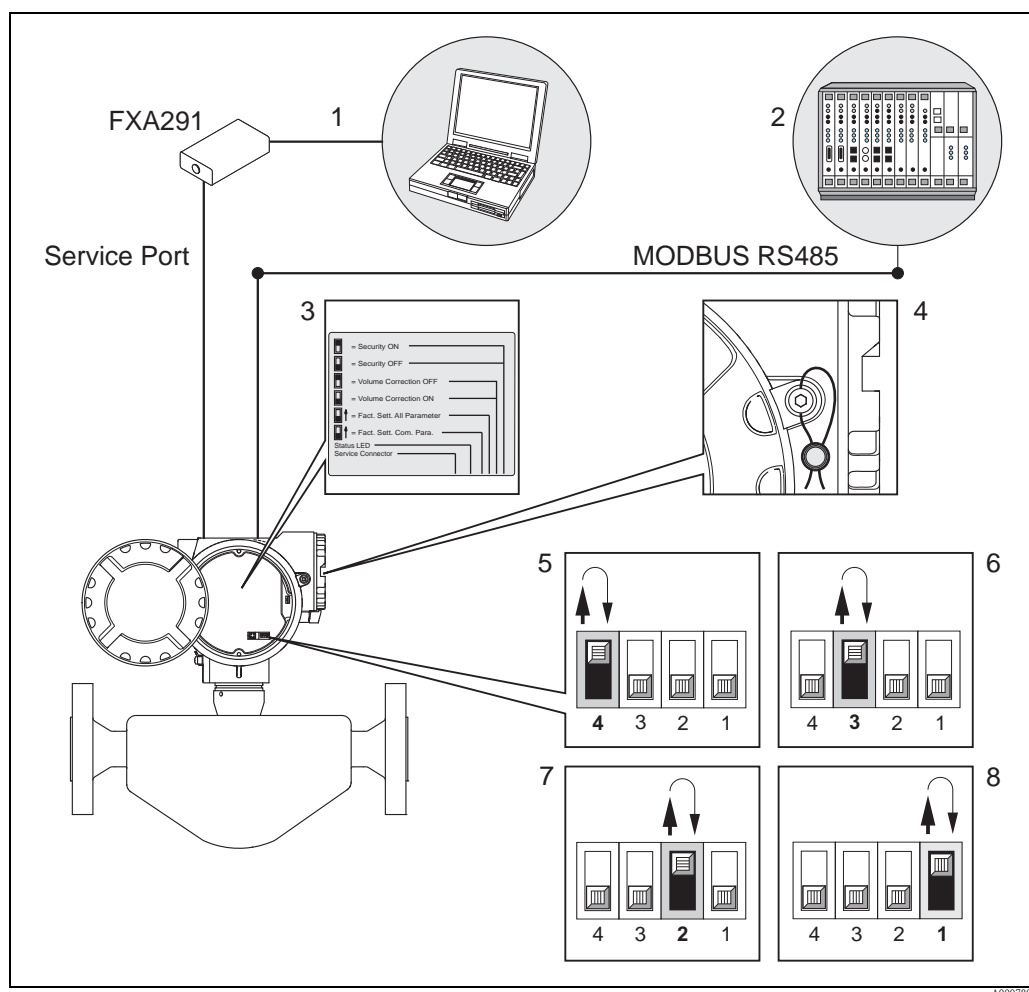


*Fault diagnostics using light emitting diode (a)*

Status of light emitting diode (LED)	Status of measuring system
LED illuminated in green	Measuring system OK, creepage is active
LED flashes green (once per second)	Measuring system OK, operation
LED not illuminated	Measuring system no longer working
LED flashes red (three times per second)	<ul style="list-style-type: none"> <li>– Operation not possible</li> <li>– Error (fault message) pending</li> </ul>
LED flashes red/green (once per second)	<ul style="list-style-type: none"> <li>– Operation possible, but may be limited by application conditions.</li> <li>– Notice message pending</li> </ul>
LED flashes red/green (three times per second)	Zero point adjustment running
LED flashes green/orange (approx. 3 seconds long)	Secure, locked operation initiated
LED flashes red/orange (approx. 3 seconds long)	Secure, locked operation exited
LED flashes red/(pause)/green (approx. 3 seconds long)	SW update active

## Remote operation

You have the following option for configuring and commissioning the device:




- 1 Configuration/operating program for operating via the FXA291 service interface (e.g. FieldCare)
- 2 Operation via process control system MODBUS RS485
- 3 Situation sticker for the various DIP switch positions and their functions
- 4 Possibility for affixing a lead seal
- 5 Operation via device-internal DIP switch (4):  
If the DIP switch (4) is switched upwards, the device restores the factory settings of the communication parameters of the MODBUS RS485 (then return to the original position (downwards)).
- 6 Operation via device-internal DIP switch (3):  
If the DIP switch (3) is switched upwards, the device restores the factory settings of all the parameters (then return to the original position (downwards)).
- 7 Operation via device-internal DIP switch (2):  
If the DIP switch (2) is switched upwards, the volume flow is calculated with the density currently measured regardless of what is set under "VOLUME CALCULATION". If the DIP switch (2) is switched downwards again, the option selected under "VOLUME CALCULATION" (→ BA00133D/06) applies again.
- 8 Operation via device-internal DIP switch (1):  
If the DIP switch (1) is switched upwards, the device is in the secure measuring mode. Secure means that write access is not possible. An exception is the totalizer 3. Its parameters also remains writable in the safe operation; that means that it also can be reset in safe operation. If the DIP switch is switched downwards again, write access is possible again.  
This secure/locked operating mode can be applied for use in measuring systems subject to legal metrology controls.



## Note!

The DIP switches must stay at least two seconds in the desired position, until the appropriate reaction takes place. The parameters can take several minutes to be reset, after which the device restarts. Meanwhile the light emitting diode permanently shines orange. The power supply must not be switched off while the factory settings are being restored.

## Certificates and approvals

<b>CE mark</b>	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.
<b>C-Tick symbol</b>	The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)"
<b>Ex approval</b>	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 Ex documentation, which is available upon request.
<b>MODBUS certification</b>	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.
<b>Pressure measuring device approval</b>	<p>The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.</p> <ul style="list-style-type: none"> <li>■ With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.</li> <li>■ Devices with this identification (with PED) are suitable for the following types of fluid: <ul style="list-style-type: none"> <li>– Fluids of Group 1 and 2 with a steam pressure of greater or less than 0.5 bar (7.3 psi)</li> <li>– Unstable gases</li> </ul> </li> <li>■ Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.</li> </ul>
<b>Measuring instrument approval</b>	<p>LPGmass is a flowmeter for volume measurement which is a suitable component in measuring systems for LPG (liquefied petroleum gas) subject to legal metrology controls in accordance with Annex MI-005 of the European Measuring Instruments Directive 2004/22/EC (MID). LPGmass is qualified to OIML R117-1 and has an MID Evaluation Certificate<sup>1)</sup> which confirms compliance with the fundamental requirements of the Measuring Instruments Directive.</p> <p> Note! According to the Measuring Instruments Directive, however, only the complete measuring system (e.g. LPG gasoline pump) is licensable, covered by an EC type-examination certificate and bears the conformity marking.</p>
<b>Other standards and guidelines</b>	<ul style="list-style-type: none"> <li>■ EN 60529: Degrees of protection by housing (IP code)</li> <li>■ EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use</li> <li>■ IEC/EN 61326: "Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements)</li> <li>■ EN 60721: Shock and vibration resistance</li> <li>■ OIML R117-1: Requirements for measuring systems for liquids apart from water.</li> </ul>

1) The Evaluation Certificate results from the WELMEC approach (cooperation between the legal metrology services of the member states of the European Union and EFTA) towards modular component certification for measuring systems in accordance with Annex MI-005 (measuring systems for the continuous and dynamic measurement of quantities of liquids other than water) of the Measuring Instruments Directive 2004/22/EC.

## Ordering information

Endress+Hauser reserves the right to change or modify product, specifications and ordering information at any time without notice. Please consult Endress+Hauser or your local representative for the most recent informations.

## Accessories

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



Note!

Detailed information on the order codes in question can be obtained from your Endress+Hauser service organization.

## Documentation

- Operating Instructions (BA00133D/06)
- Ex supplementary documentation ATEX (II2G): (XA00117D/06)
- Ex supplementary documentation FM, CSA (Div. 1): (XA00118D/06)
- Special documentation on Pressure Equipment Directive: (SD00118D/06)
- Flow measuring technology (FA00005D/06)

## Registered trademarks

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MODBUS®

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