



## OPTIMASS 3000 Technical Datasheet

### Sensor for mass flow

- First choice for low flow applications
- Certified secondary pressure containment
- A common footprint for all three sizes, in Hastelloy® or Stainless Steel



The documentation is only complete when used in combination with the relevant documentation for the converter.

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## 1.1 The solution for low flow measurement

The OPTIMASS 3000 is the cost effective solution for accurate measurement in a variety of applications, where there is a low process flow.

Combined with the power of the MFC 300, the OPTIMASS 3000 will provide accurate measurement of mass, volume, density and concentration.



- ① Comprehensive diagnostic capabilities.
- ② Standard process connections available, including hygienic.
- ③ Certified secondary containment in Stainless Steel 316L.
- ④ Standard electronics for all sensors, with redundant storage of calibration and sensor data.
- ⑤ Modular electronics with a range of output options (see separate documentation for details).



- ① Remote terminal box.

## Features:

- Z-shaped measuring tube
- Easily drained and easy to clean
- Optional heating jacket
- Simple installation and start-up
- Modular electronics concept - electronics and sensor are easy to replace
- Data redundancy - accurate plug & play replacement of electronics

## Industries:

- Wastewater
- Chemical
- Food & Beverage
- Paper & pulp
- Pharmaceutical
- Automotive

## Applications:

- Fragrance dispensing and high precision coatings in the pharmaceutical industry
- CO<sub>2</sub> injection and dosing in the food and beverage industry
- Natural gas and propane odorisation
- Engine test beds in the automotive industry

## 1.2 Features and options

### Features



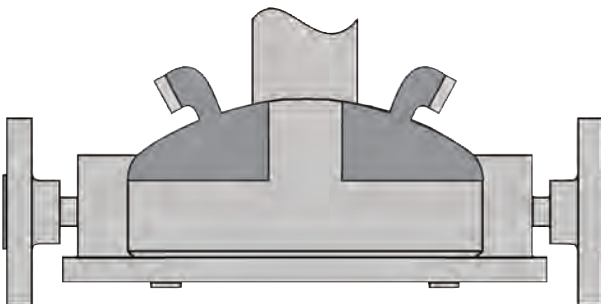
- Low pressure loss, single Z tube design guarantees a low pressure drop across the meter.
- Self draining.
- Certified secondary containment.
- 150 barg / 2175 psig standard measuring tube.

### Connection options



- NPT connections as standard.
- Also available with industry standard hygienic connections.
- A range of flanges up to ASME 600.

### Heating jacket & purge port



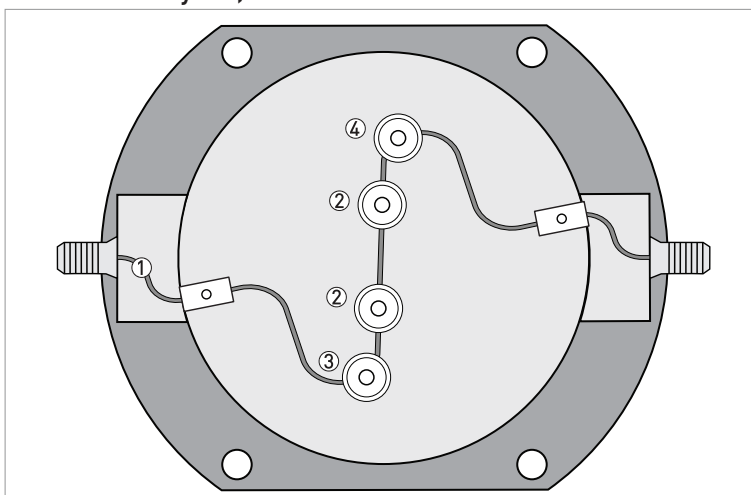
- Heating jacket option for use with temperature dependant products.
- Prevents solidification of process product.
- Purge port option for protection in the event of measuring tube failure.
- The purge port allows hazardous chemicals to be drained away safely.

### 1.3 Meter / converter combinations

Converter	MFC 010	MFC 300			
Configuration	Compact	Compact	Remote field	Remote wall	Remote rack
OPTIMASS 3000	3010C	3300C	3300F	3300W	3300R

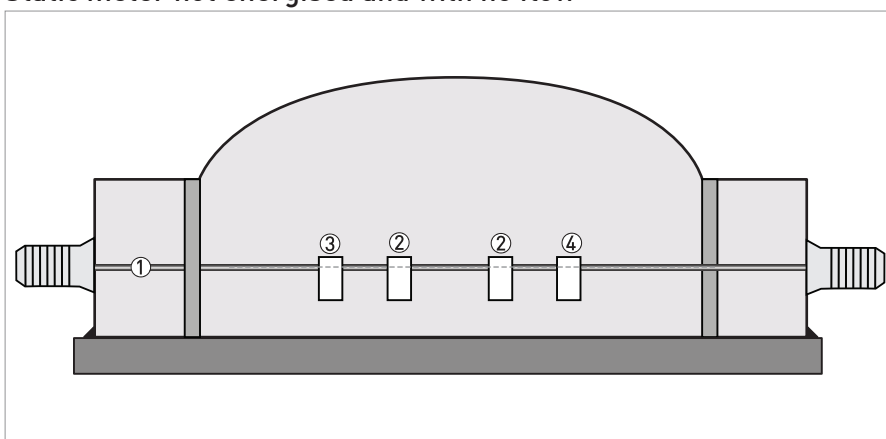
### 1.4 Measuring principle (single Z tube)

Meter tube layout, shown from above



- ① Measuring tube
- ② Drive coils
- ③ Sensor 1
- ④ Sensor 2

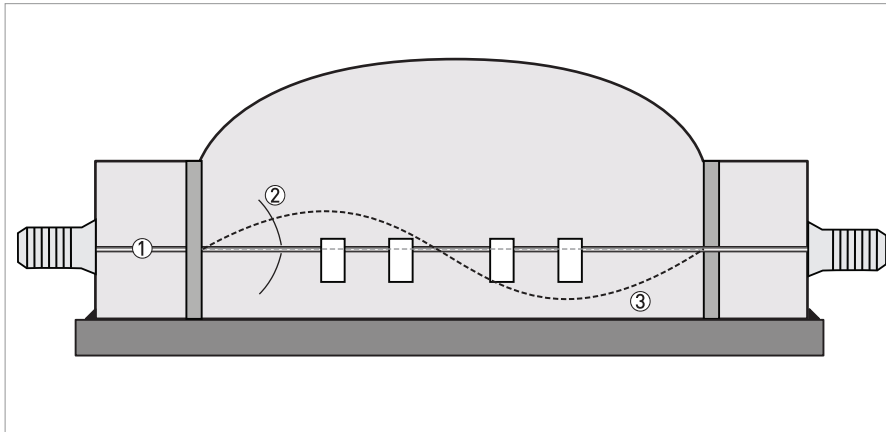
Static meter not energised and with no flow



- ① Measuring tube
- ② Drive coils
- ③ Sensor 1
- ④ Sensor 2

A Coriolis single Z tube mass flowmeter consists of a single Z shaped measuring tube (①) two drive coils (②) and two sensors (③ and ④) that are positioned either side of the drive coils.

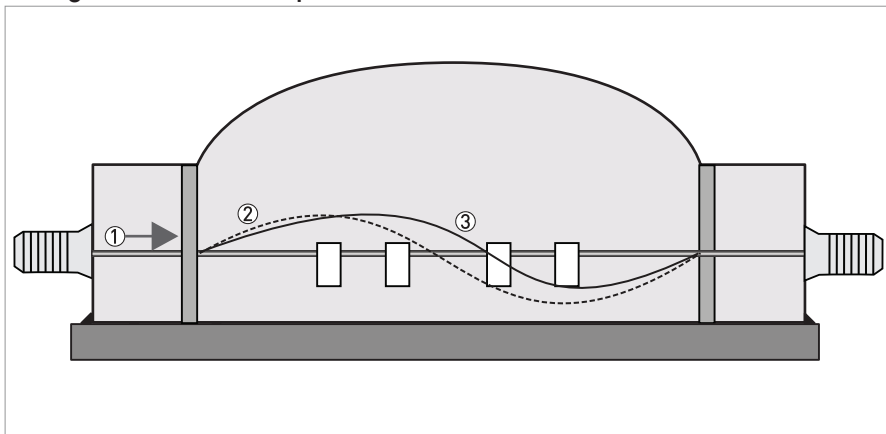
### Energised meter



- ① Measuring tube
- ② Direction of oscillation
- ③ Sine wave

When the meter is energised, the drive coils vibrate the measuring tube causing it to oscillate and produce a sine wave (③). The sine wave is monitored by the two sensors.

### Energised meter with process flow



- ① Process flow
- ② Sine wave
- ③ Phase shift

When a fluid or gas passes through the tube, the Coriolis effect causes a phase shift in the sine wave that is detected by the two sensors. This phase shift is directly proportional to the mass flow.

Density measurement is made by evaluation of the frequency of vibration and temperature measurement is made using a Pt500 sensor.

## 2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

### Measuring system

Measuring principle	Coriolis mass flow
Application range	Mass flow and density measurement of fluids, gases
Measured values	Mass, density, temperature
Calculated values	Volume, referred density, concentration, velocity

### Design

Basic	System consists of a measuring sensor and a converter to process the output signal
Features	Fully welded maintenance free sensor with single Z-shaped measuring tube
<b>Variants</b>	
Compact version	Integral converter
Remote version	Available with field, wall or 19" rack mount versions of the converter
Modbus version	Sensor with integral electronics providing Modbus output for connection to a PLC

### Measuring accuracy

<b>Mass</b>	
Liquid	±0.1% of actual measured flow rate + zero stability
Gas	±0.5% of actual measured flow rate + zero stability
Repeatability	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
<b>Zero stability</b>	
Stainless Steel / Hastelloy®	0.0057% of maximum flow rate with respective sensor size
<b>Reference conditions</b>	
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig
<b>Effect on sensor zero point caused by a shift in process temperature</b>	
Stainless Steel / Hastelloy®	0.0056% per 1°C / 0.0031% per 1°F
<b>Effect on sensor zero point caused by a shift in process pressure</b>	
Stainless Steel / Hastelloy®	0.013% of the max flow rate per 1 barg / 0.0009% of the max flow rate per 1 psig



<b>Density</b>	
Measuring range	400...3000 kg/m <sup>3</sup> / 25...187 lbs/ft <sup>3</sup>
Accuracy	±2 kg/m <sup>3</sup> / ±0.13 lbs/ft <sup>3</sup>
On site calibration	±0.5 kg/m <sup>3</sup> / ±0.033 lbs/ft <sup>3</sup>
<b>Temperature</b>	
Accuracy	±1°C / ±1.8°F

### Operating conditions

<b>Maximum flow rates</b>	
01	20 kg/h / 0.733 lbs/min
03	130 kg/h / 4.766 lbs/min
04	450 kg/h / 16.5 lbs/min
<b>Ambient temperature</b>	
Compact version with Aluminium converter	-40...+60°C / -40...+140°F
	Extended temperature range: 65°C / 149°F for some I/O options. For more information contact manufacturer.
Compact version with Stainless Steel converter	-40...+55°C / -40...+130°F
Remote versions	-40...+65°C / -40...+149°F
<b>Process temperature</b>	
Stainless Steel / Hastelloy®	-40...+150°C / -40...+302°F
<b>Nominal pressure at 20°C / 68°F</b>	
<b>Measuring tube</b>	
Stainless Steel / Hastelloy®	-1...150 barg / -14.5...2175 psig
<b>Outer casing</b>	
PED / CRN approved	-1...30 barg / -14.5...435 psig
	For operating pressures >30barg / 435psig, a burst disc is mandatory
<b>Fluid properties</b>	
Permissible physical condition	Liquids, gases
Permissible gas content (volume)	Contact manufacturer for information.
Permissible solid content (volume)	Contact manufacturer for information.
Protection category (acc. to EN 60529)	IP 67, NEMA 4X

### Installation conditions

Inlet runs	None required
Outlet runs	None required

## Materials

<b>Stainless Steel meter</b>	
Measuring tube	Stainless Steel 316L (1.4435)
Process connections	Stainless Steel 316L (1.4435)
Baseplate	Stainless Steel 316L (1.4435)
Outer casing	Stainless Steel 316L (1.4435)
<b>Hastelloy® meter</b>	
Measuring tube	Hastelloy® C-22
Process connections	Hastelloy® C-22
Baseplate	Stainless Steel 316L (1.4435)
Outer casing	Stainless Steel 316L (1.4435)
<b>Heating jacket version</b>	
Heating jacket	Stainless Steel 316L (1.4435)
<b>All versions</b>	
Sensor electronics housing	Stainless Steel 316L (1.4409)
Junction box (remote version)	Die cast Aluminium (polyurethane coating)
	Optional Stainless Steel 316 (1.4401)

## Process connections

<b>Threaded</b>	
NPT-M	¼"
<b>Flange</b>	
DIN	DN15 / PN40...63
ASME	½" / ASME 150...600
JIS	15A / 20K
<b>Hygienic</b>	
Tri-clover	½"
Tri-clamp DIN 32676	DN10

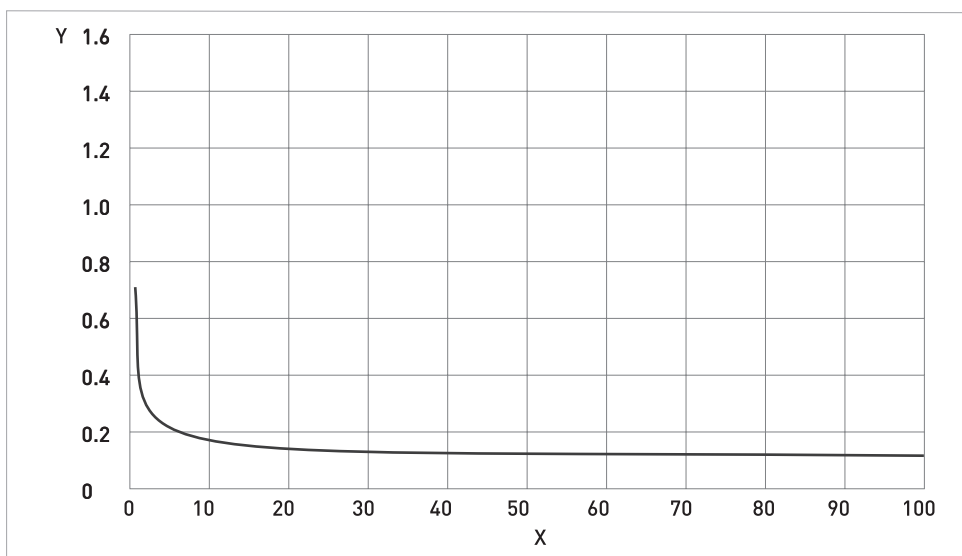
## Electrical connections

Electrical connections	For full details, including: power supply, power consumption etc., see technical data for the relevant converter.
I/O	For full details of I/O options, including data streams and protocols, see technical data for the relevant converter.

## Approvals

<b>Mechanical</b>	
Electromagnetic compatibility (EMC) acc. to CE	Namur NE 21/5.95
	89/336/EEC (EMC)
	72/73/EEC (Low Voltage Directive)
European Pressure Equipment Directive	PED 97-23 EC (acc. to AD 2000 Regelwerk)
Factory Mutual / CSA	Class I, Div 1 groups A, B, C, D
	Class II, Div 1 groups E, F, G
	Class III, Div 1 hazardous areas
	Class I, Div 2 groups A, B, C, D
	Class II, Div 2 groups F, G
	Class III, Div 2 hazardous areas
ANSI / CSA (Dual Seal)	12.27.901-2003
<b>ATEX (acc. 94/9/EC)</b>	
<b>OPTIMASS 3300C non Ex I Signal outputs without heating jacket / insulation</b>	
Ex d connection compartment	II 2 G Ex d [ib] IIC T6...T1
	II 2 D Ex tD A21 IP6x T160°C
Ex e connection compartment	II 2 G Ex de [ib] IIC T6...T1
	II 2 D Ex tD A21 IP6x T160°C
<b>OPTIMASS 3300C non Ex I signal outputs with heating jacket / insulation</b>	
Ex d connection compartment	II 2 G Ex d [ib] IIC T6...T1
	II 2 D Ex tD A21 IP6x T170°C
Ex e connection compartment	II 2 G Ex de [ib] IIC T6...T1
	II 2 D Ex tD A21 IP6x T170°C
<b>OPTIMASS 3300C Ex I signal outputs without heating jacket / insulation</b>	
Ex d connection compartment	II 2(1) G Ex d [ia/ib] IIC T6...T1
	II 2(1) D Ex tD [iaD] A21 IP6x T160°C
Ex e connection compartment	II 2(1) G Ex de [ia/ib] IIC T6...T1
	II 2(1) D Ex tD [iaD] A21 IP6x T160°C
<b>OPTIMASS 3300C Ex I signal outputs with heating jacket / insulation</b>	
Ex d connection compartment	II 2(1) G Ex d [ia/ib] IIC T6...T1
	II 2(1) D Ex tD [iaD] A21 IP6x T170°C
Ex e connection compartment	II 2(1) G Ex de [ia/ib] IIC T6...T1
	II 2(1) D Ex tD [iaD] A21 IP6x T170°C
<b>OPTIMASS 3000 / 3010C</b> without heating / insulation	II 2 G Ex ib IIC T6...T1
	II 2 D Ex ibD 21 T150 °C
<b>OPTIMASS 3000 / 3010C</b> with heating / insulation	II 2 G Ex ib IIC T6...T1
	II 2 D Ex ibD 21 T165 °C

## 2.2 Measuring accuracy



X Flow rate [%]  
 Y Measuring error [%]

### Measuring error

The measuring error is obtained from the combined effects of accuracy and zero stability.

### Reference conditions

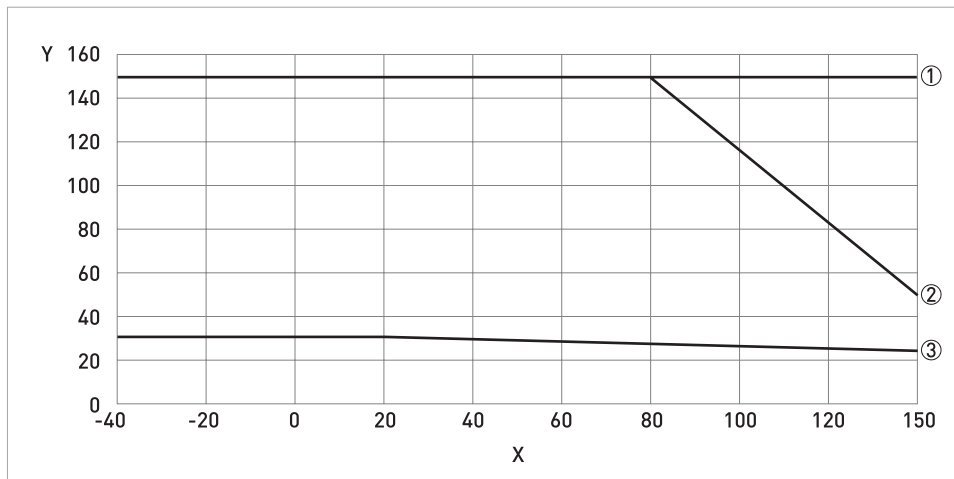
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig

## 2.3 Guidelines for maximum operating pressure

### Notes

- Ensure that the meter is used within its operating limits
- All hygienic process connections have a maximum operating rating of 10 barg at 130°C / 145 psig at 266°F

### Pressure / temperature de-rating for all meter sizes / materials, in metric

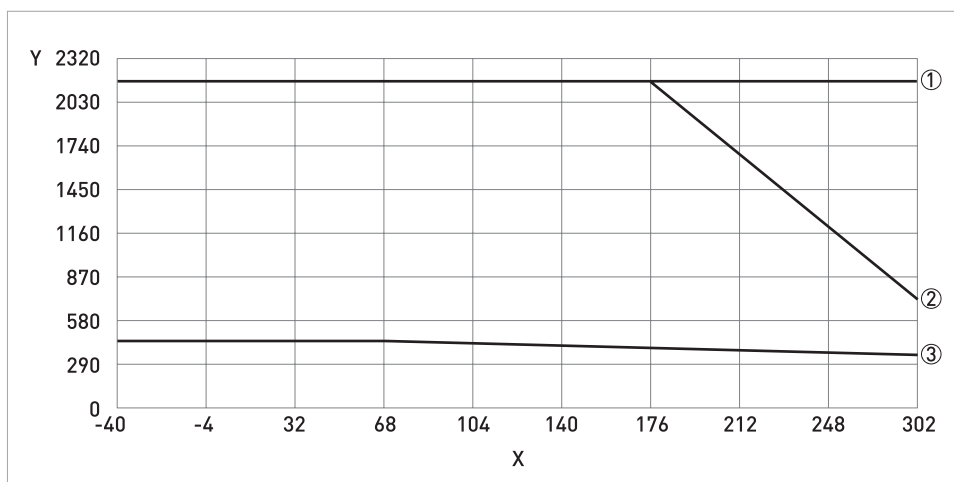


X Temperature [°C]

Y Pressure [barg]

- ① Hastelloy® C22 measuring tube
- ② Stainless Steel 316L measuring tube
- ③ Outer casing

### Pressure / temperature de-rating for all meter sizes / materials, in imperial



X Temperature [°F]

Y Pressure [psig]

- ① Hastelloy® HC22 measuring tube
- ② Stainless Steel 316L measuring tube
- ③ Outer casing

#### Flanges

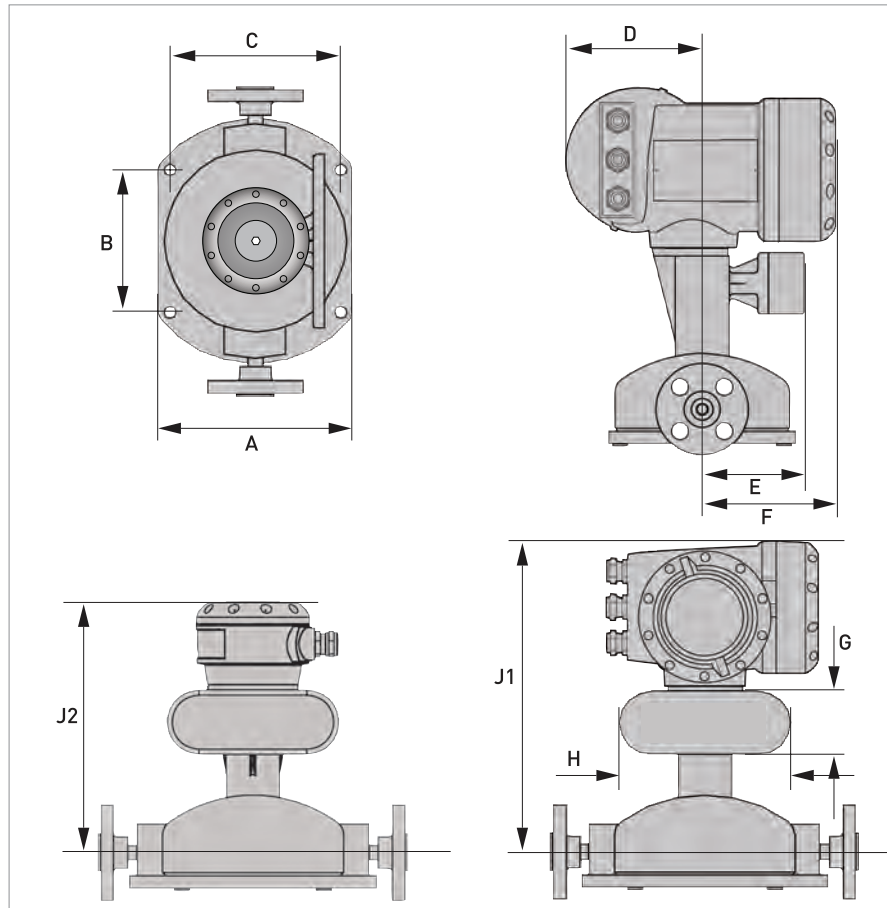
- DIN flange ratings are based on EN 1092-1 2001 table 18, 1% proof stress material group 14E0
- ASME flange ratings are based on ASME B16.5 2003 table 2 material group 2.2
- JIS flange ratings are based on JIS 2220: 2001 table 1 division 1 material group 022a

#### Notes

- The maximum operating pressure will be either the flange rating or the measuring tube rating, **WHICHEVER IS THE LOWER!**
- The manufacturer recommends that the seals are replaced at regular intervals. This will maintain the hygienic integrity of the connection.

## 2.4 Dimensions and weights

### 2.4.1 General dimensions



### Meter weights for Hastelloy® (H) and Stainless Steel (S)

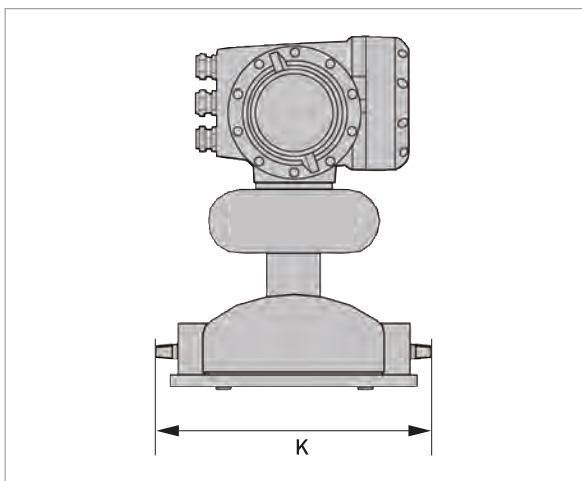
	Weight [kg]		
	H/S 01	H/S 03	H/S 04
Aluminium (compact)	16	16	16
Stainless Steel (compact)	22.1	22.1	22.1
Aluminium (remote)	13.2	13.2	13.2
Stainless Steel (remote)	14	14	14

	Weight [lbs]		
	H/S 01	H/S 03	H/S 04
Aluminium (compact)	35.2	35.2	35.2
Stainless Steel (compact)	48.62	48.62	48.62
Aluminium (remote)	29.04	29.04	29.04
Stainless Steel (remote)	30.8	30.8	30.8

Dimensions

	Size [mm] / [inches]		
	S/H 01	S/H 03	S/H 04
A	180 / 7.1		
B	132 / 5.2		
C	156 / 6.1		
D	123.5 / 4.9		
E	98.5 / 3.9		
F	137 / 5.4		
G	60 / 2.4		
H	160 / 6.3		
J1	348 / 13.7		
J2	269 / 10.6		
Measuring tube inner diameter [mm]	1.2	2.6	4.0

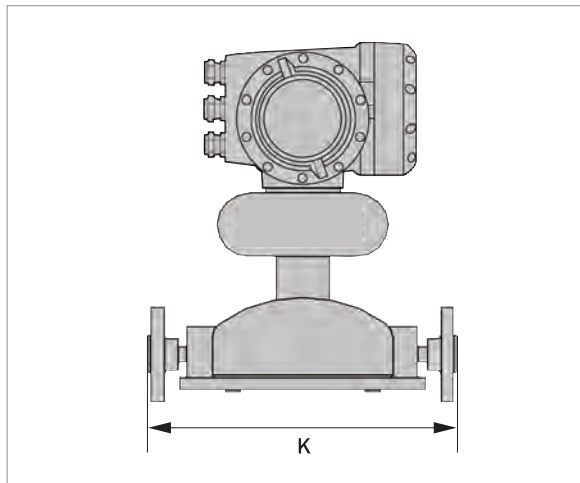
2.4.2 NPT connections



Connection type	Dimension K	
	[mm]	[inches]
1/4" NPT(M)	256±3	10.1 ±0.1

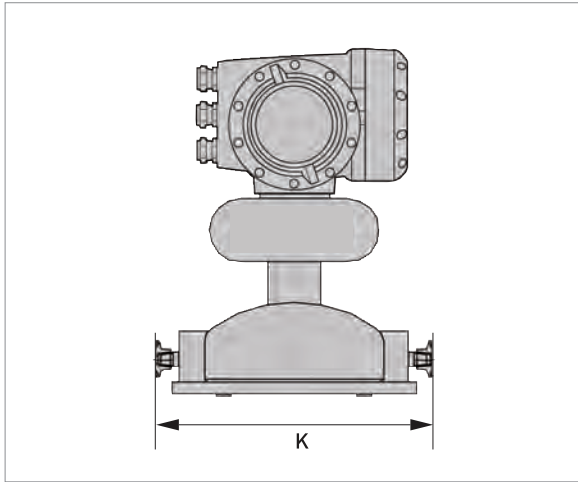


### 2.4.3 Flange connections



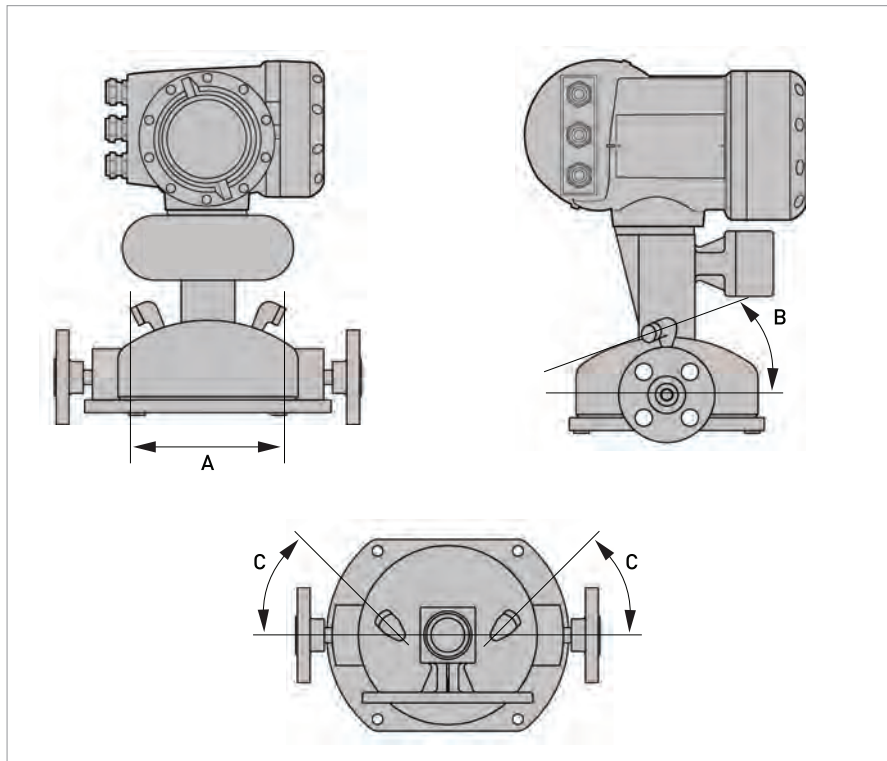
Connection type	Dimension K	
	[mm]	[inches]
ASME150	286±3	11.3 ±0.1
ASME300	286±3	11.3 ±0.1
ASME600	295±3	11.6 ±0.1
DN15 PN40	286±3	11.3 ±0.1
DN15 PN63	295±3	11.6 ±0.1
15A JIS 20K	286±3	11.3 ±0.1

## 2.4.4 Hygienic connections



Connection type	Dimension K	
	[mm]	[inches]
DN10 DIN32676	260±3	10.2 ±0.1
½" Tri-Clover	262±3	10.3 ±0.1

## 2.4.5 Heating jacket / purge port version



Meter size	01	03	04
A [mm] / [inches]		129 ±5.0 / 5.01 ±0.2	
B		45° (approximately)	
C		45° ±6°	

### 3.1 Intended use

This mass flowmeter is designed for the direct measurement of mass flow rate, product density and product temperature. Indirectly, it also enables the measurement of parameters like total mass, concentration of dissolved substances and the volume flow. For use in hazardous areas, special codes and regulations are also applicable and these are specified in a separate documentation.

### 3.2 Plastic Inserts

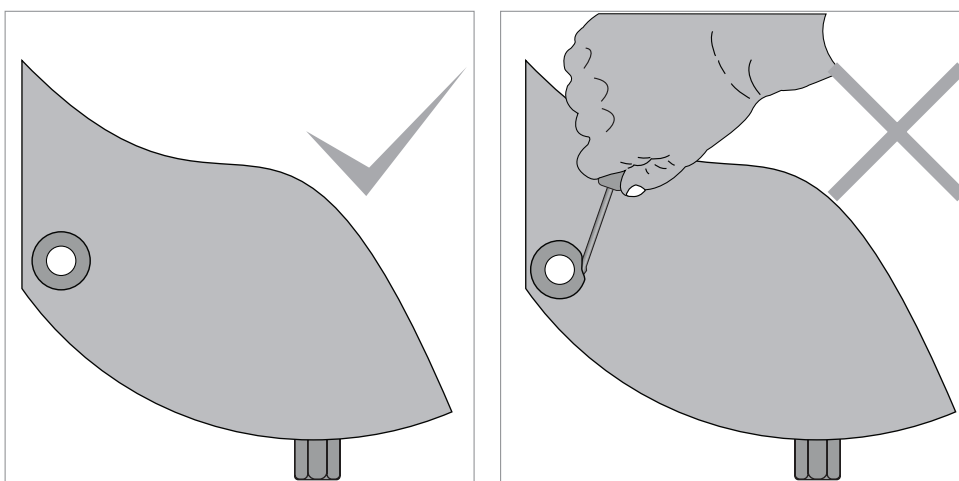


Figure 3-1: Base plate plastic inserts

*The four mounting holes in the meter base plate are fitted with plastic inserts. Do not remove the inserts prior to installation.*

### 3.3 Meter support

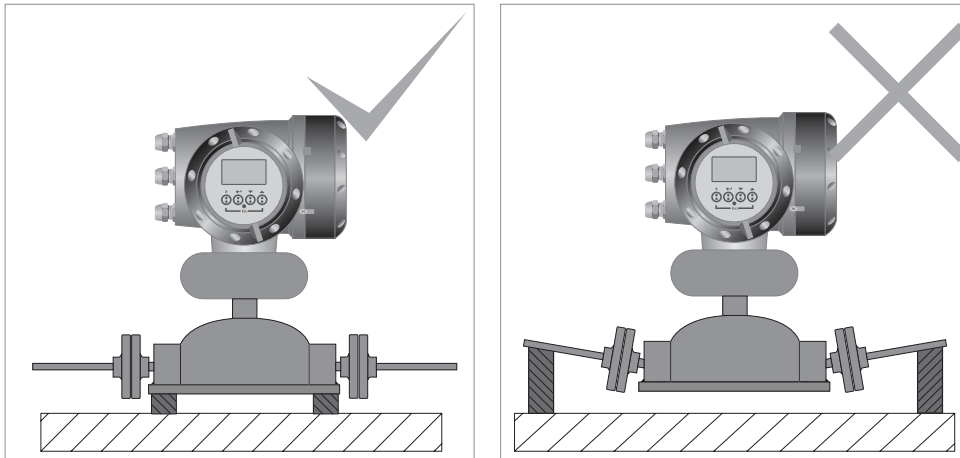


Figure 3-2: Supporting the meter

Use the base plate to mount and fully support the weight of the meter.

*DO NOT use the process pipework to support the weight of the meter. This will cause severe damage.*

### 3.4 Two hole mounting

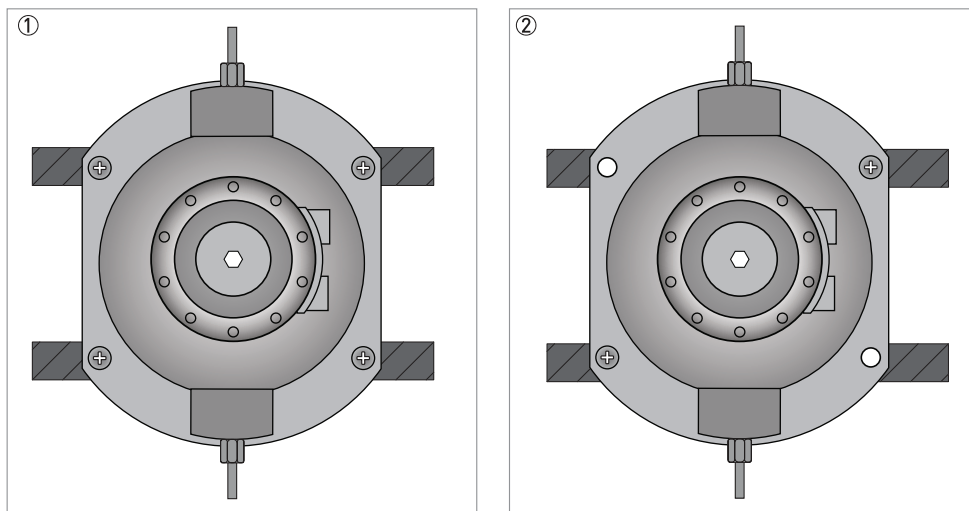


Figure 3-3: Using two holes to mount the meter

- ① It is recommended that ALL four mounting holes are used to secure the meter.
- ② It is possible to secure the meter using only two of the mounting holes.

### 3.5 Horizontal mounting

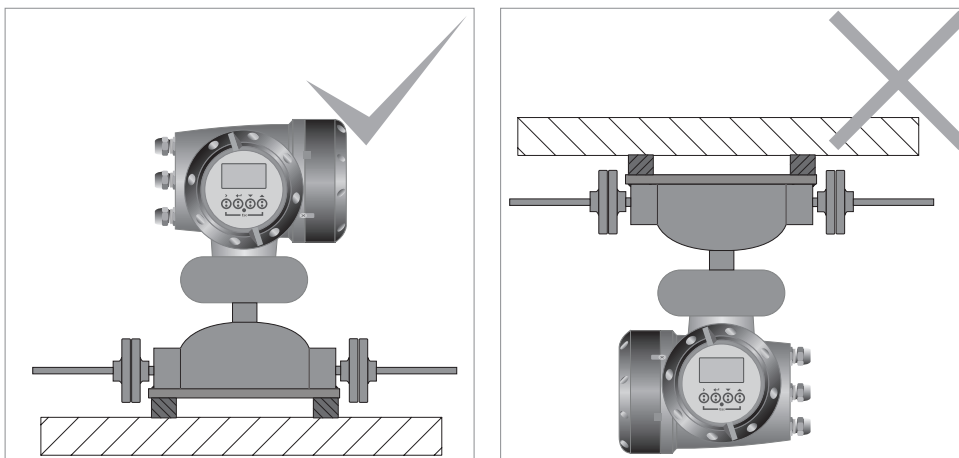


Figure 3-4: Horizontal mounting

Mount the meter on a firm, rigid base.

*DO NOT* mount the meter upside down.

### 3.6 Vertical mounting

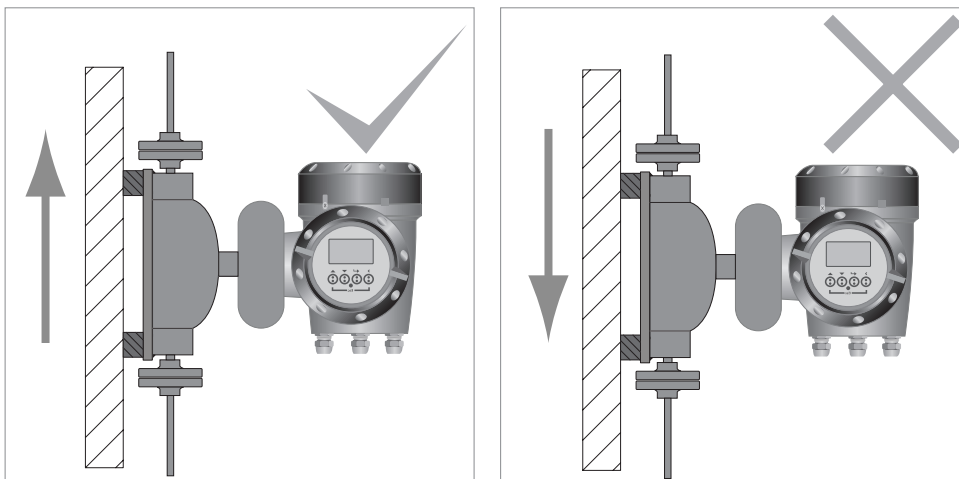


Figure 3-5: Vertical flow direction

If the meter is mounted vertically, the process flow **MUST** be upwards.

## 3.7 Self draining

### Verticle mounting angles for self draining

If the meter is mounted vertically and the installation requires the meter to be self draining, mount the meter at the angle shown in the table. The angles are marked on the meter base plate.

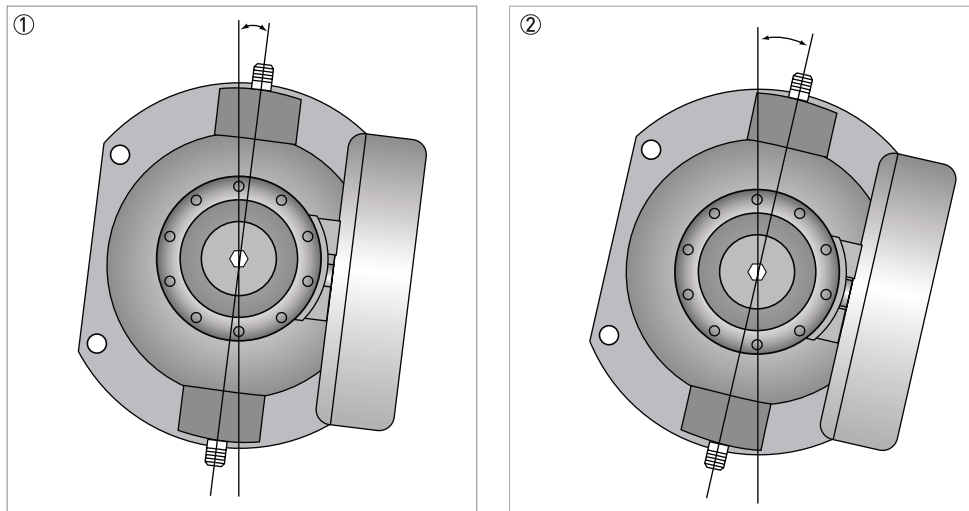


Figure 3-6: Angle of rotation for self draining

- ① 7° of clockwise rotation from the vertical for self draining. (See table for applicable meter sizes).
- ② 13° of clockwise rotation from the vertical for self draining. (See table for applicable meter sizes).

### Set angles

Meter size	Angle of rotation (clockwise)
01	7°
03	13°
04	13°

## 3.8 Purge ports

### Purge ports

- Meters ordered with purge port option, will be fitted with ¼" NPT female connections
- The NPT connections are sealed with NPT plugs and PTFE tape

*DO NOT REMOVE THE NPT plugs!*

*The meter is factory sealed and filled with dry nitrogen gas. If you remove the plugs and allow moisture to get into the meter it will cause damage. If you think that the measuring tube has failed, depressurise the meter (when it is safe to do so) and remove the plugs. Purge the meter case to remove the process product.*

### Burst discs

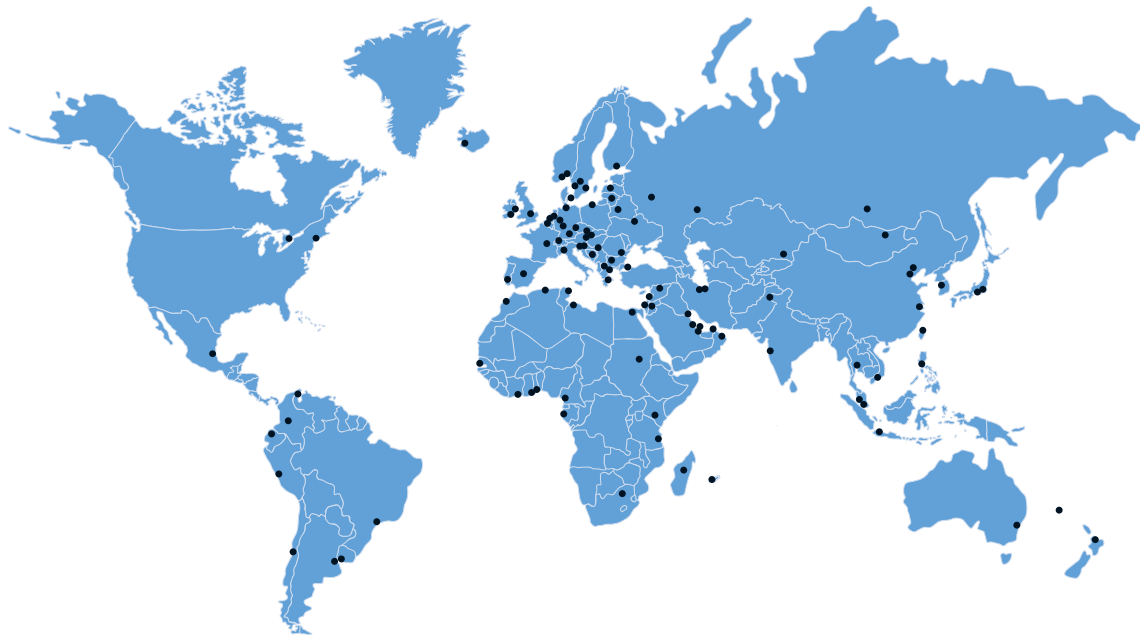
- If the operating pressure is higher than the design pressure of the secondary containment you MUST order the burst disc option.
- The disc failure pressure is 20 barg at 20°C / 290 psig at 68°F.
- If process conditions change from the original order, you MUST contact the manufacturer for advice regarding the suitability of the fitted disc.
- If the process product is hazardous, it is recommended that an exhaust tube is fitted to the NPT male thread so that the discharge can be piped to a safe area.
- Make sure that the arrow on the burst disc is pointing away from the meter.











## KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Measuring systems for the oil and gas industry
- Measuring systems for sea-going tankers

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