OPTIMASS 3400 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 signal converter.

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1.1 The solution for low flow measurement

The OPTIMASS 3400 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 400, the OPTIMASS 3400 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 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
- Oil and gas

Applications:

- Fragrance dispensing and high precision coatings in the pharmaceutical industry
- CO_2 injection and dosing in the food and beverage industry
- Natural gas and propane odorisation
- Engine test beds in the automotive industry
- Chemical injection

1.2 Features and options

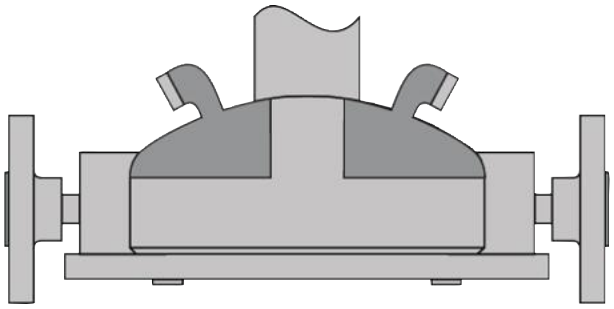
Features

- 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.
- 300 barg / 4351 psig Hastelloy® measuring tube.
- With advanced Entrained Gas Management (EGM^{TM}) the meter maintains operation over a wide range of gas fractions and complex flow conditions.

Connection options

- NPT connections as standard.
- Also available with industry standard hygienic connections.
- A range of flanges up to ASME 300 / PN40.

Heating jacket & purge port



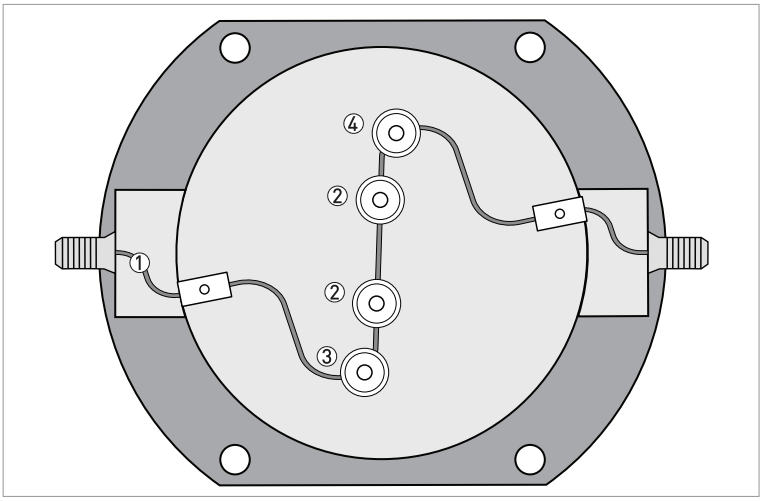
- Heating jacket option for use with temperature dependant products.
- Prevents solidification of process product.
- Purge port option for protection in the event of measuring tube failure.
- The purge port allows hazardous chemicals to be drained away safely.

1.3 Meter / converter combinations

Converter	MFC 400	
Configuration	Compact	Remote field
OPTIMASS 3400	3400C	3400F

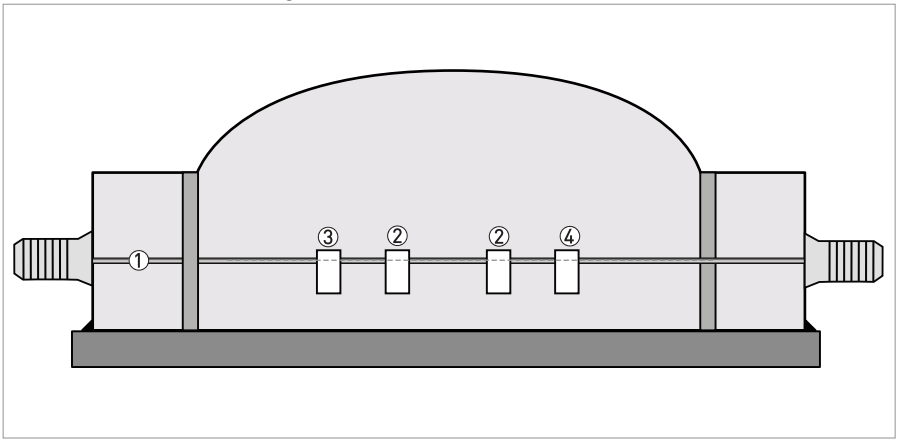
1.4 Measuring principle (single Z tube)

Meter tube layout, shown from above



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

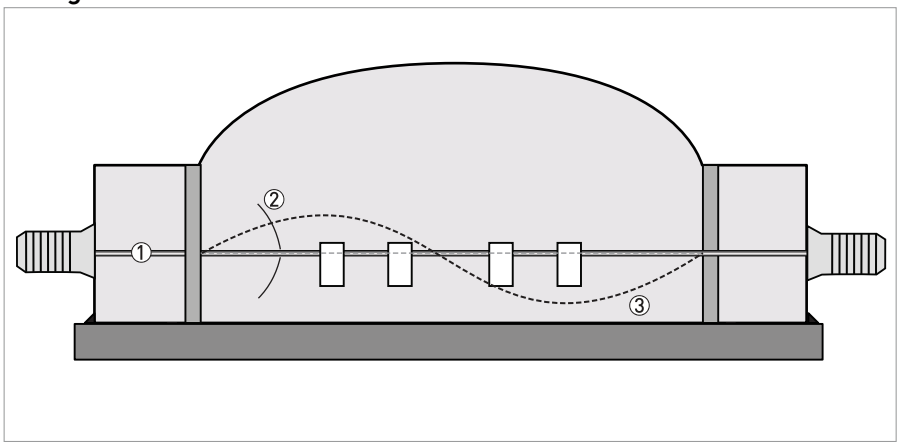
Static meter not energised and with no flow



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.

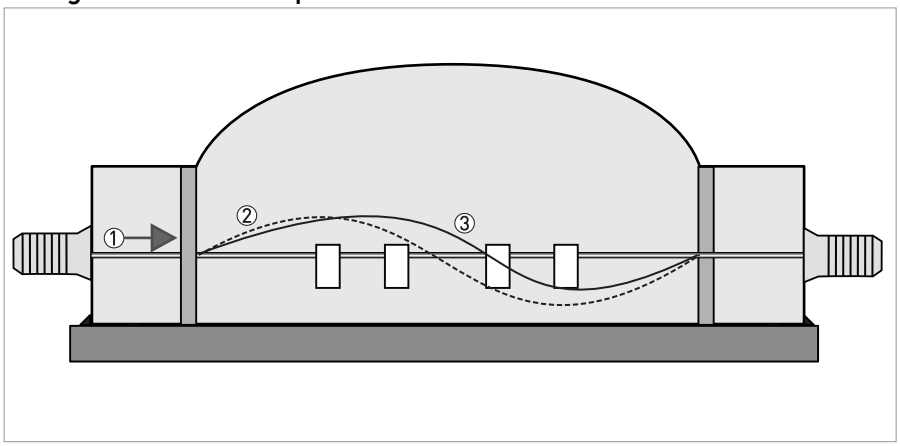
Energised meter



① Measuring tube
② Direction of oscilation
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 sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

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
Variants	
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

Mass	
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)
Zero stability	
Stainless Steel / Hastelloy®	0.0057% of maximum flow rate with respective sensor size
Reference conditions	
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig
Effect on sensor zero point caused by a shift in process temperature	
Stainless Steel / Hastelloy®	0.0056% per 1°C / 0.0031% per 1°F
Effect on sensor zero point caused by a shift in process pressure	
Stainless Steel / Hastelloy®	0.013% of the max flow rate per 1 barg / 0.0009% of the max flow rate per 1 psig
Density	
Measuring range	400...3000 kg/m^3 / 25...187 lbs/ft^3
Accuracy	±2 kg/m^3 / ±0.13 lbs/ft^3
On site calibration	±0.5 kg/m^3 / ±0.033 lbs/ft^3

Temperature	
Accuracy	±1°C / ±1.8°F

Operating conditions

Maximum flow rates	
01	20 kg/h / 0.733 lbs/min
03	130 kg/h / 4.766 lbs/min
04	450 kg/h / 16.5 lbs/min
Ambient temperature	
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
Process temperature	
Stainless Steel / Hastelloy®	-40...+150°C / -40...+302°F
Nominal pressure at 20°C / 68°F	
Measuring tube	
Stainless Steel	-1...150 barg / -14.5...2175 psig
Hastelloy®	-1...300 barg / -14.5...4351 psig
Outer casing	
PED / CRN approved	-1...30 barg / -14.5...435 psig
	For operating pressures >30barg / 435psig, a burst disc is mandatory
Fluid properties	
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

Stainless Steel meter	
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)
Hastelloy® meter	
Measuring tube	Hastelloy® C-22
Process connections	Hastelloy® C-22
Baseplate	Stainless Steel 316L (1.4435)
Outer casing	Stainless Steel 316L (1.4435)

Heating jacket version	
Heating jacket	Stainless Steel 316L (1.4435)
All versions	
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

Threaded	
NPT-M	¼"
Flange	
DIN	DN15 / PN40
ASME	½" / ASME 150...300
JIS	15A / 20K
Hygienic	
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

CE / UKCA	The device fulfils the statutory requirements of the relevant CE directives and UK designated standards. The manufacturer certifies that these requirements have been met by applying the CE and UKCA marks.
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
Hazardous area markings	
OPTIMASS 3400C	

2.2 ATEX temperature limits

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class (gas)	Max. surface temp. °C (dust)
-40...+55	150	T3 - T1	T165
-40...+60	145	T3 - T1	T155
-40...+65	70	T6 - T1	T80
	85	T5 - T1	T95
	120	T4 - T1	T130
	130	T3 - T1	T160
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

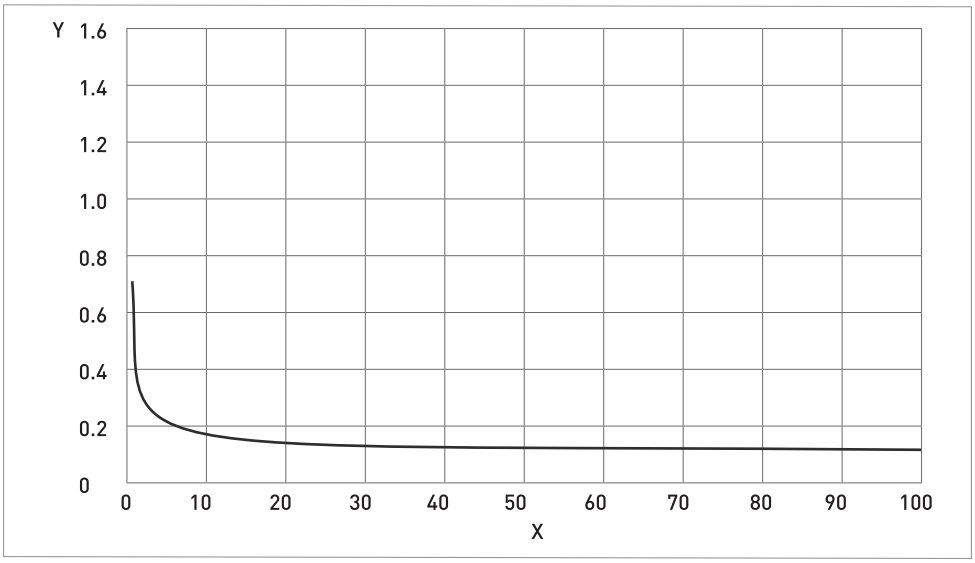
with aluminium converter housing

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class (gas)	Max. surface temp. °C (dust)
-40...+50	150	T3 - T1	T165
-40...+55	115	T4 - T1	T130
-40...+60	80	T5 - T1	T95
	90	T4 - T1	T105
-40...+65	65	T6 - T1	T80
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

with Stainless Steel converter housing

Ambient temp. T_{amb} °C	Max. process temp. T_m °C	Temp. class (gas)	Max. surface temp. °C (dust)
-40...+30	150	T3 - T1	T165
-40...+35	145	T3 - T1	T160
-40...+40	115	T4 - T1	T130
	125	T3 - T1	T140
-40...+45	110	T4 - T1	T125
-40...+50	80	T5 - T1	T95
	90	T4 - T1	T105
-40...+55	65	T6 - T1	T80
	75	T5 - T1	T90
-40...+60	60	T6 - T1	T75
Minimum process temperature: $T_{amb} \geq$ -35°C T_m = -50°C, T_{amb} <-35°C T_m = -40°C			

2.3 Measuring accuracy



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

Measuring error

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

Reference conditions

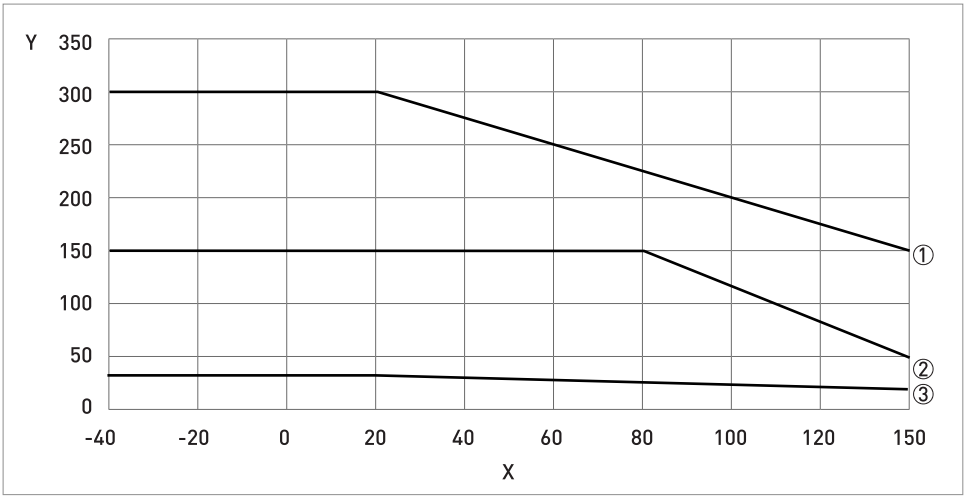
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig

2.4 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

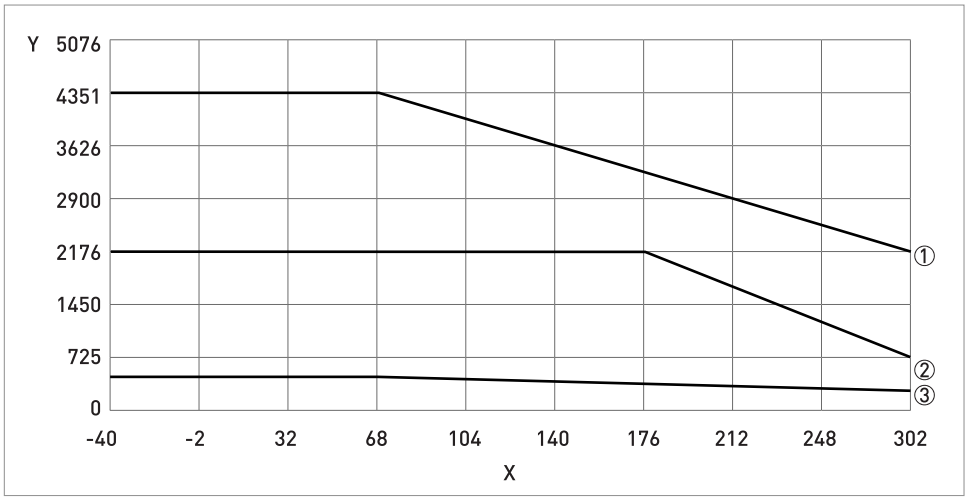
Pressure / temperature de-rating for all meter sizes / materials, in metric



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

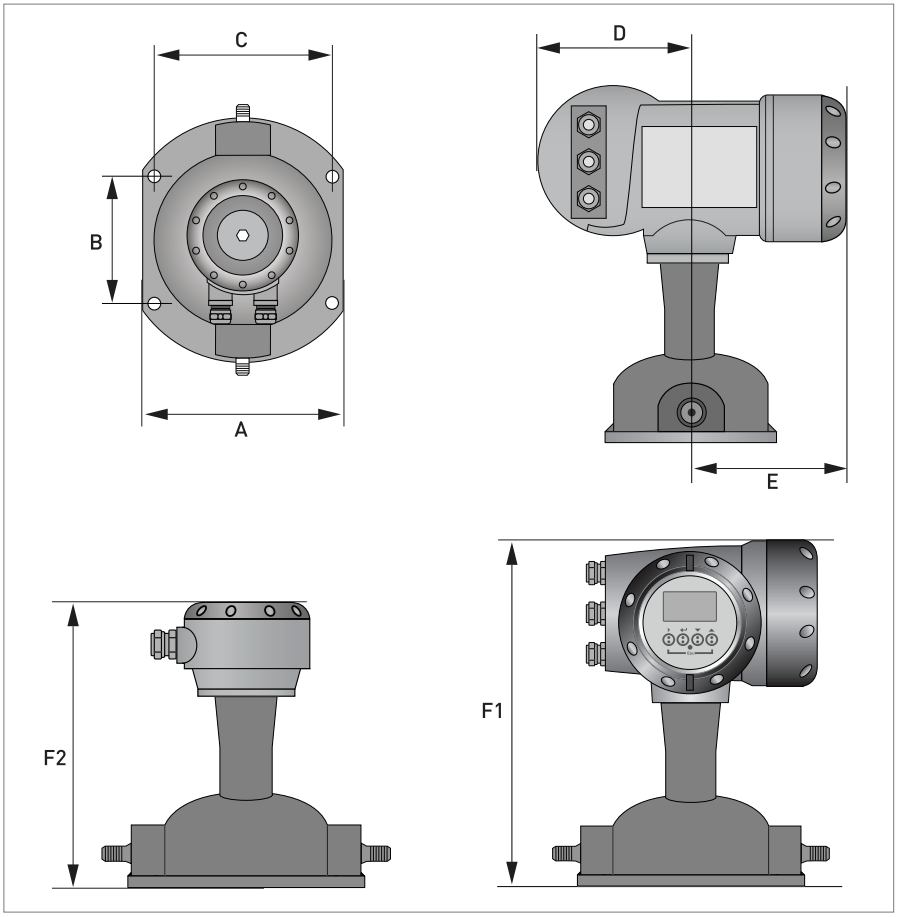
- DIN flange ratings are based on EN 1092-1 2001 table 18, 1% proof stress material group 14E0
- ASME flange ratings are based on ASME B16.5 2003 table 2 material group 2.2
- JIS flange ratings are based on JIS 2220: 2001 table 1 division 1 material group 022a

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.

2.5 Dimensions and weights

2.5.1 General dimensions



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

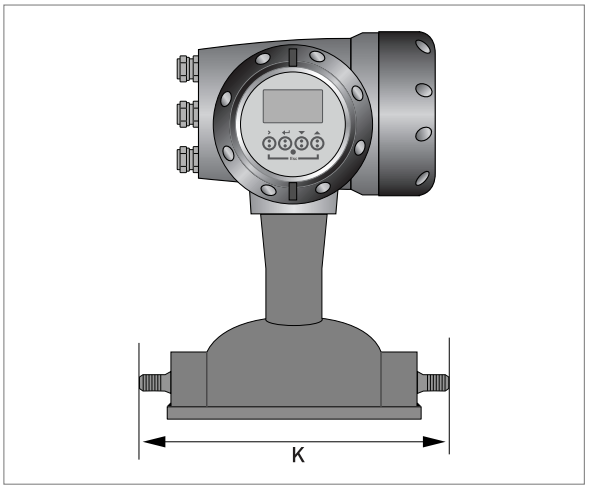
	Weight [kg]		
	H/S 01	H/S 03	H/S 04
Aluminium (compact)	16	16	16
Stainless Steel (compact)	22.1	22.1	22.1
Aluminium (remote)	13.2	13.2	13.2
Stainless Steel (remote)	14	14	14

	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

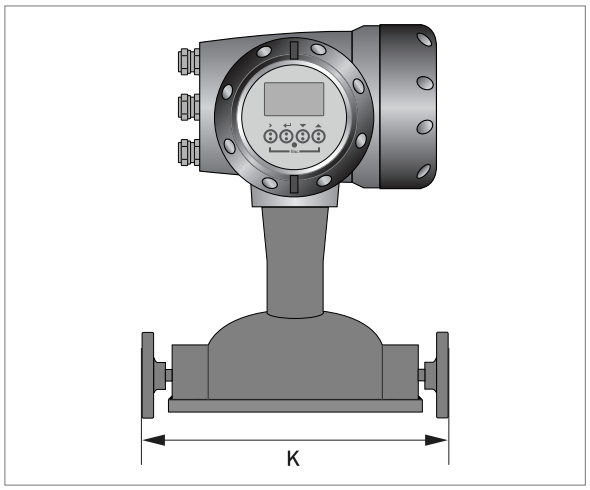
	Size [mm] / [inches]		
	S/H 01	S/H 03	S/H 04
A	180 / 7.1		
B	132 / 5.2		
C	156 / 6.1		
D	123.5 / 4.9		
E	98.5 / 3.9		
F	137 / 5.4		
G	60 / 2.4		
H	160 / 6.3		
J1	348 / 13.7		
J2	269 / 10.6		
Measuring tube inner diameter [mm]	1.2	2.6	4.0

2.5.2 NPT connections



Connection type	Dimension K	
	[mm]	[inches]
¼¨ NPT(M)	256±3	10.1 ±0.1

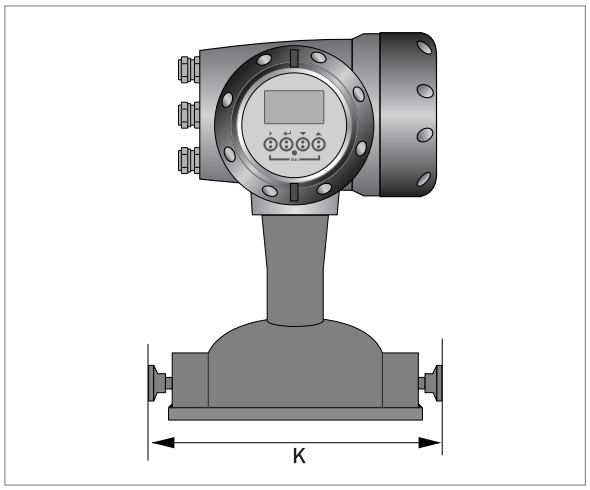
2.5.3 Flange connections



Connection type	Dimension K	
	[mm]	[inches]
ASME150	286±3	11.3 ±0.1
ASME300 ①	286±3	11.3 ±0.1
DN15 PN40 ②	286±3	11.3 ±0.1
15A JIS 20K	286±3	11.3 ±0.1

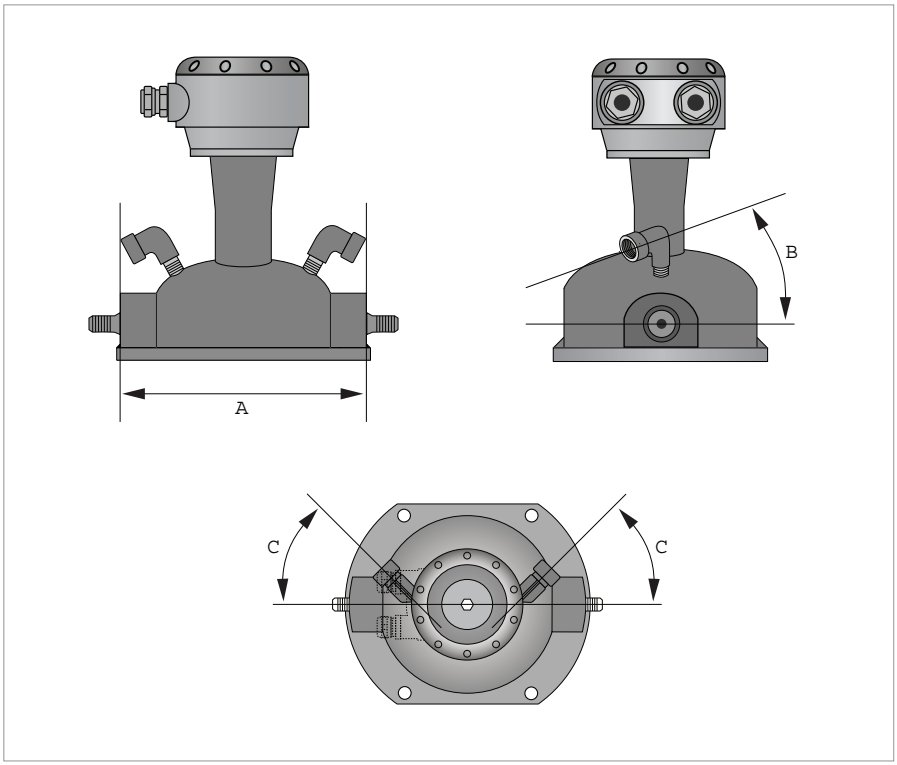
① For RJT raised faces add 8mm / 0.31 inches
② Type C, D, E & F

2.5.4 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

2.5.5 Heating jacket 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 separate documentation.

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

3.2 Plastic Inserts

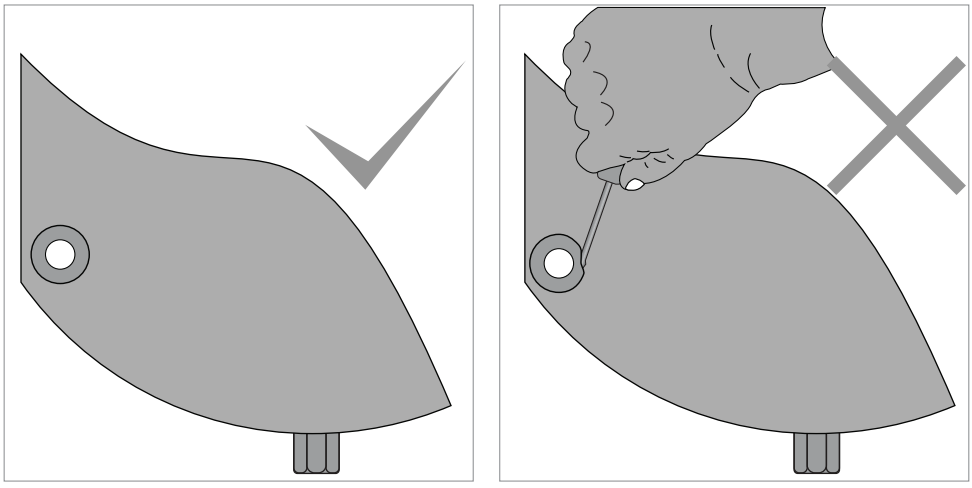
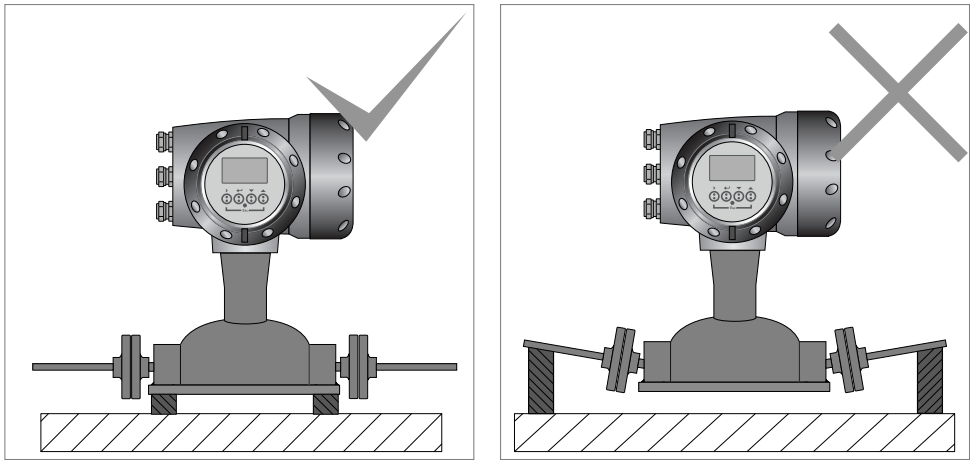


Figure 3-1: Base plate plastic inserts

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



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

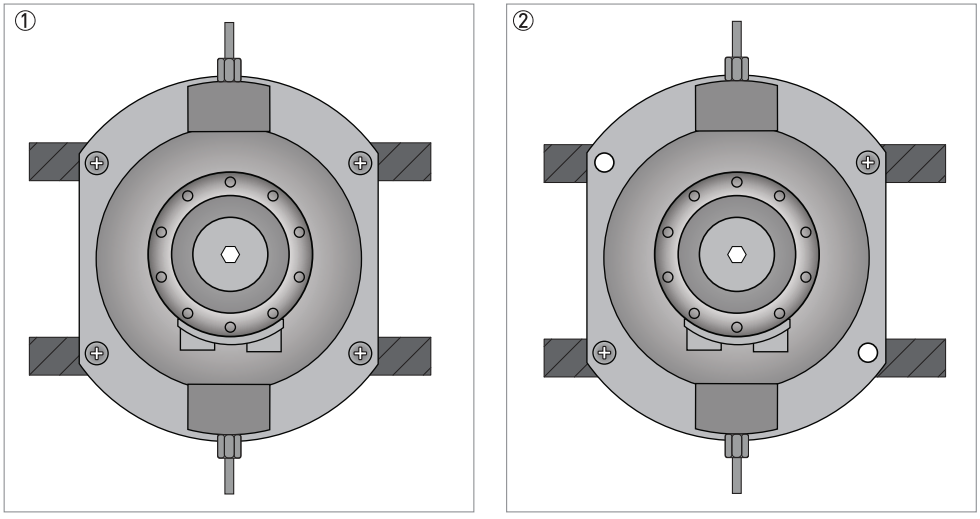
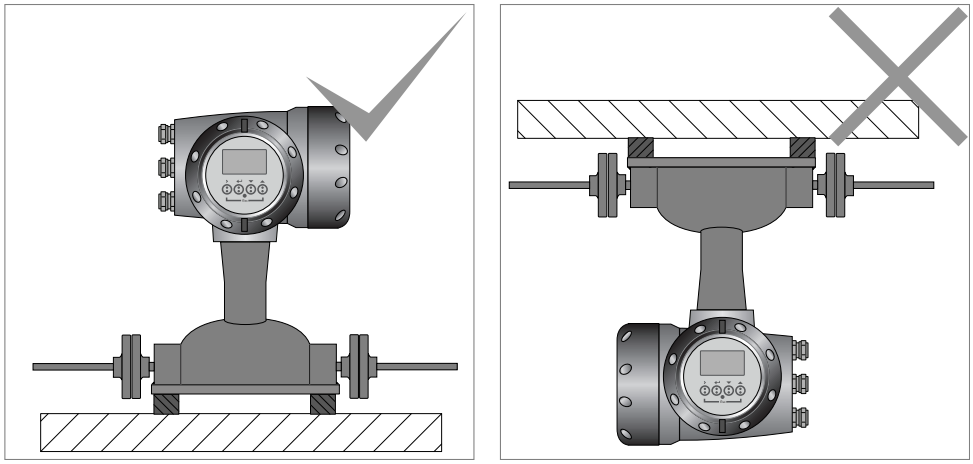


Figure 3-2: Using two holes to mount the meter

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.

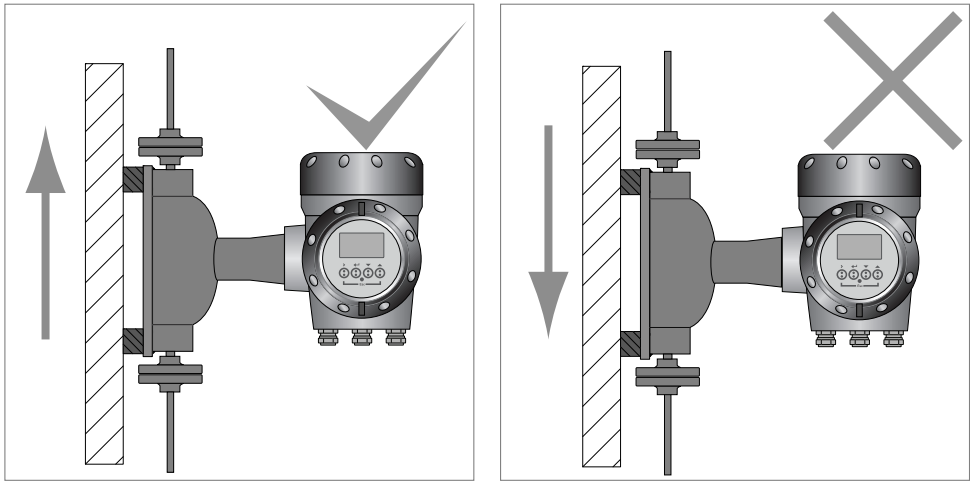
3.5 Horizontal mounting



Mount the meter on a firm, rigid base.

DO NOT mount the meter upside down.

3.6 Vertical mounting



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.

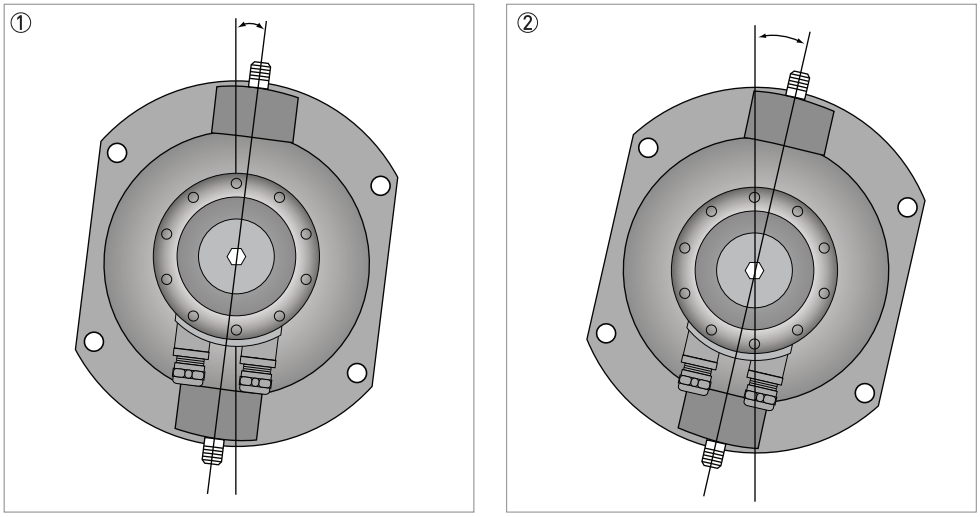


Figure 3-3: Angle of rotation for self draining

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.

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- Process instrumentation for flow, level, temperature, pressure measurement and process analytics
- Flow metering, monitoring, wireless and remote metering solutions
- Engineering, commissioning, calibration, maintenance and training services

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