



OPTIBATCH 4011 C Handbook

Mass flowmeter for process batching

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1	Safety instructions	5
1.1	Intended use	5
1.2	CE certification	5
1.3	Associated documents	5
1.4	Safety instructions from the manufacturer	6
1.4.1	Copyright and data protection	6
1.4.2	Disclaimer	6
1.4.3	Product liability and warranty	7
1.4.4	Information concerning the documentation	7
1.4.5	Warnings and symbols used	8
1.5	Safety instructions for the operator	8
2	Device description	9
2.1	Scope of delivery	9
2.2	Device description	9
3	Installation	10
3.1	Storage	10
3.2	Notes on installation	10
3.3	Mounting restrictions	11
3.3.1	General installation principles	11
3.3.2	Carousel installation	12
3.3.3	3A and EHEDG approval	13
4	Electrical connections	14
4.1	Safety instructions	14
4.2	Plug connections	14
4.3	Power supply	15
4.4	Schematic layout (pulse output)	16
5	Start-up	18
5.1	Configuration with Toolbox	18
5.1.1	Manual connection	19
5.1.2	Automatic connection	20
5.1.3	Connection dialogue	20
5.1.4	Outputs	21
5.1.5	Setup	21
5.1.6	Zero calibration	23
6	Service	24
6.1	Spare parts availability	24
6.2	Availability of services	24

6.3 Returning the device to the manufacturer.....	24
6.3.1 General information.....	24
6.3.2 Form (for copying) to accompany a returned device.....	25
6.4 Disposal	25
 7 Technical data	 26
<hr/>	
7.1 Measuring principle.....	26
7.2 Technical data.....	28
7.3 Measuring accuracy	31
7.4 Pressure drop.....	32
7.5 Dimensions and weights	34
7.5.1 Dimensions	34
7.5.2 Weights.....	35

1.1 Intended use

This flowmeter has been specifically designed for the fast batching measurement of mass or volume and is intended for use in filling machines or bespoke applications.

1.2 CE certification

CE marking



This device conforms with the following EC directives:

- EMC Directive 2004/108/EC
- Low Voltage Directive 2006/95/EC
- Pressure Equipment Directive 97/23/EC

The manufacturer declares conformity and the device carries the CE mark.

1.3 Associated documents

This handbook should be read in conjunction with relevant documents in relation to:

- hazardous areas
- communications
- concentration
- corrosion

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

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The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

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We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect, incidental, punitive and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



DANGER!

This information refers to the immediate danger when working with electricity.



DANGER!

This warning refers to the immediate danger of burns caused by heat or hot surfaces.



DANGER!

This warning refers to the immediate danger when using this device in a hazardous atmosphere.



DANGER!

These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.



WARNING!

Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.



CAUTION!

Disregarding these instructions can result in damage to the device or to parts of the operator's plant.



INFORMATION!

These instructions contain important information for the handling of the device.



LEGAL NOTICE!

This note contains information on statutory directives and standards.



• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➡ **RESULT**

This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator

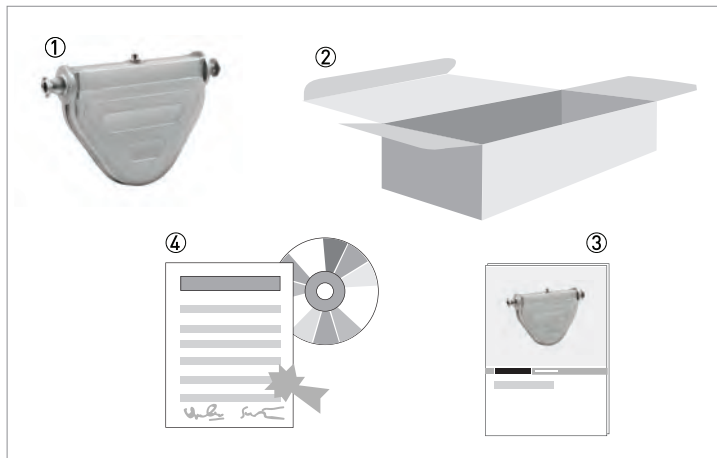


WARNING!

In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery



- ① Mass flowmeter.
- ② Carton.
- ③ Documentation.
- ④ CD-ROM and calibration certificate.

If any items are missing, please contact the manufacturer.

2.2 Device description

This device has been designed for the mass or volume measurement of liquid products in batching and filling machines.

With excellent repeatability and low flow stability, the device is supplied ready to install and operate. The operating data is factory set according to the order specification but can be changed with the use of Toolbox.

3.1 Storage

- Store the device in a dry and dust-free location.
- Avoid direct exposure to the sun.
- Store the device in its original packing.
- Do not allow the ambient temperature to fall below -50°C / -58°F or rise above +85°C / +185°F.

3.2 Notes on installation

**INFORMATION!**

Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**

Check the packing list to check if you received completely all that you ordered.

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.3 Mounting restrictions

3.3.1 General installation principles

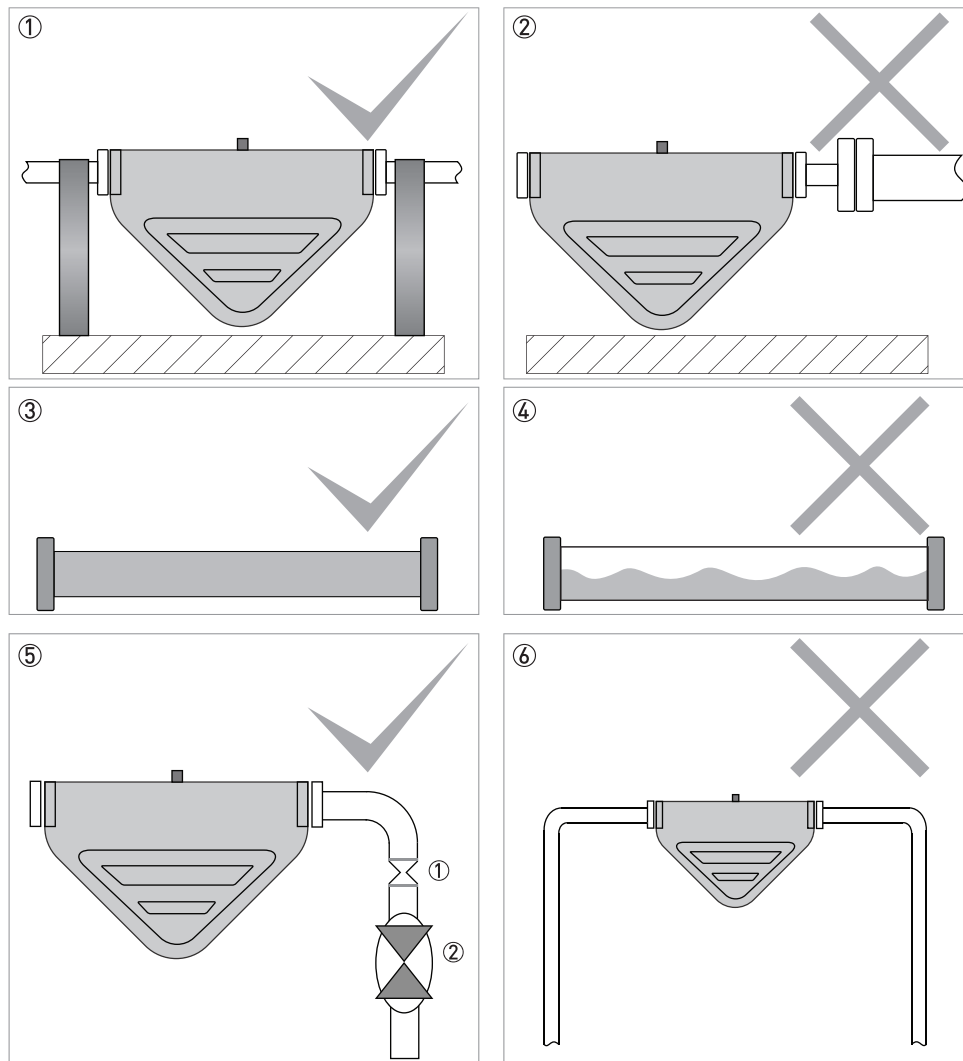


Figure 3-1: General mounting restrictions

- ① Fully support the weight of the meter. The meter can be supported with clamps close to the connecting flanges.
- ② Do not use extreme reductions in process pipework size.
- ③ Make sure that the process pipework is full at all times.
- ④ Do not let the flow fall in the process pipework. Low process flow will cause a measuring error.
- ⑤ If the meter has been installed with an open-ended down-pipe, Install an orifice plate or restrictor (①) to make sure that the pipework remains full during measurement. A fast-acting batch or shut-off valve (②) should also be installed downstream of the meter.
- ⑥ It is recommended that you DO NOT mount the meter at the highest point in the pipework because it can cause air / gas to collect in the meter.

3.3.2 Carousel installation

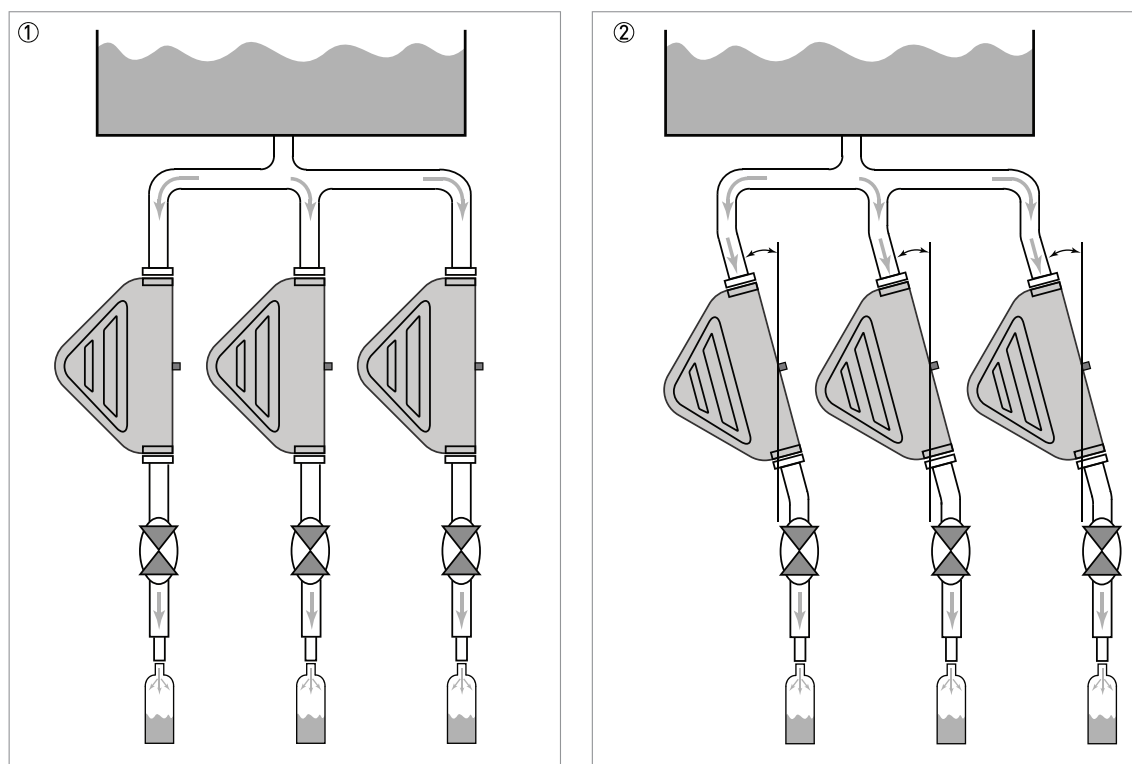
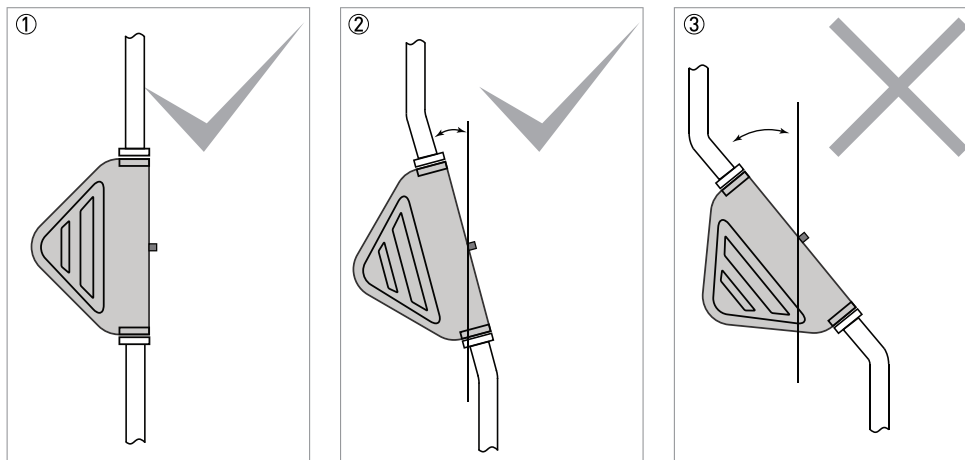


Figure 3-2: Carousel installation

- ① Typical installation
- ② Installation showing the maximum offset angle which is 12° from the vertical

- Where the meter has to be installed at an angle, DO NOT exceed the maximum offset angle.
- If the maximum angle is exceeded, the meter will not self drain.

3.3.3 3A and EHEDG approval



- ① Mount the meter vertically to allow self-draining.
- ② If you are installing at an angle, the maximum offset angle for the meter to be self-draining is 12°.
- ③ DO NOT install the meter with an offset angle greater than 12°. This will prevent the meter from self-draining.

To satisfy the sanitary requirements of the European Hygienic Engineering and Design Group, when installing this meter you **MUST** give consideration to:

- Installation - install the meter at an angle to allow self-draining (see illustration).
- Cleaning fluids - cleaning fluids should flow uphill with a velocity rate greater than 1.5 m/s / 5 ft/s. If the process flow is downhill, install a flow restrictor downstream of the meter. This will make sure that the meter is completely filled with the cleaning fluid.
- Process connections and seals **MUST** be in accordance with EHEDG documentation.

The manufacturer also recommends that you refer to EHEDG (www.ehedg.org) document number 8 "HYGIENIC EQUIPMENT DESIGN CRITERIA".

4.1 Safety instructions


DANGER!

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!


DANGER!

Observe the national regulations for electrical installations!


DANGER!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

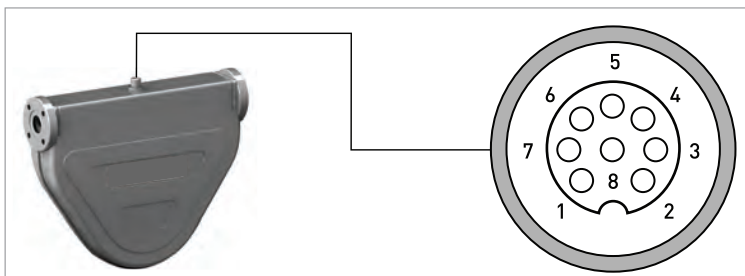

WARNING!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.


INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

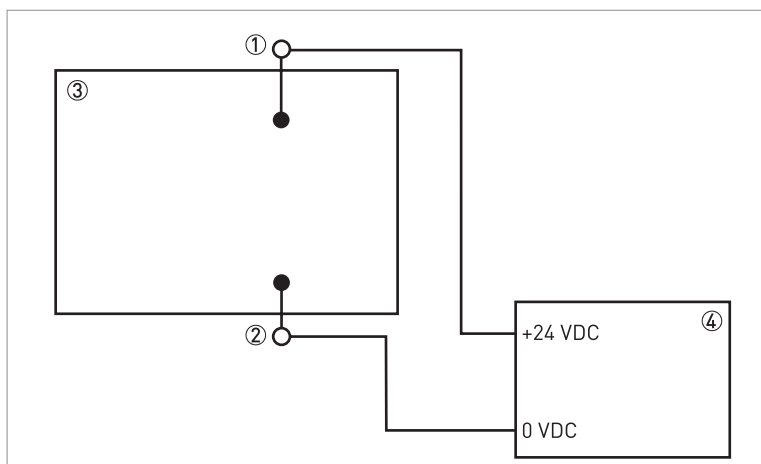
4.2 Plug connections



Plug / pin connections

Pin	Colour	Function
1	White	PSU + 24 V
2	Brown	RS485 A
3	Green	RS485 B
4	Yellow	PSU + 0 V
5	Grey	Pulse +
6	Pink	Pulse -
7	Blue	N / C
8	Screen	N / C

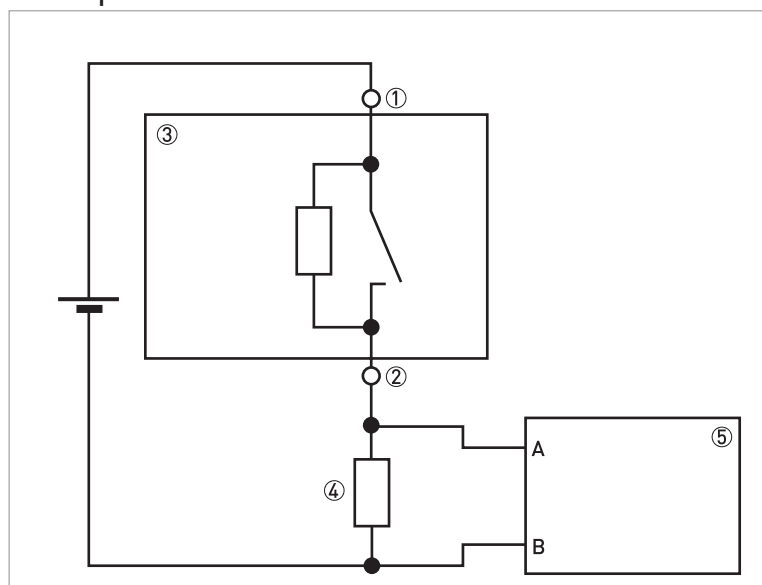
4.3 Power supply



- ① Connection plug pin 1
- ② Connection plug pin 4
- ③ Meter
- ④ Protected extra-low voltage (PELV) power supply

4.4 Schematic layout (pulse output)

Sink input



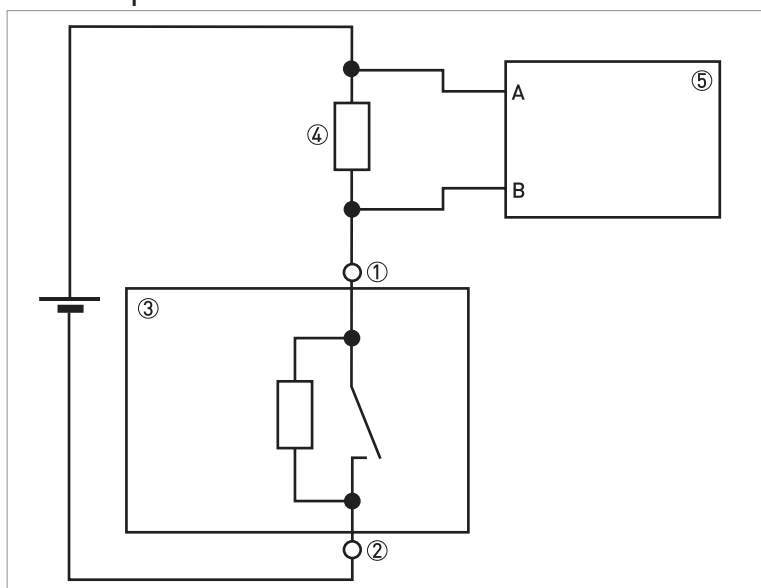
A Input
B Ground

- ① Connection plug pin 5
- ② Connection plug pin 6
- ③ Galvanically isolated pulse output of the meter
- ④ Load resistor. See table for typical values
- ⑤ Batch processor or PLC sink input with an impedance greater than 10 k Ω

Typical load resistor values

Input	Load resistor
5 V TTL input	330 Ω
10...24 V input	1 k Ω

Source input 10...24 V



A V+
B Input

- ① Connection plug pin 5
- ② Connection plug pin 6
- ③ Galvanically isolated passive pulse output of the meter
- ④ Load resistor. Typical value is 1 k Ω
- ⑤ PLC source input with an impedance greater than 10 k Ω

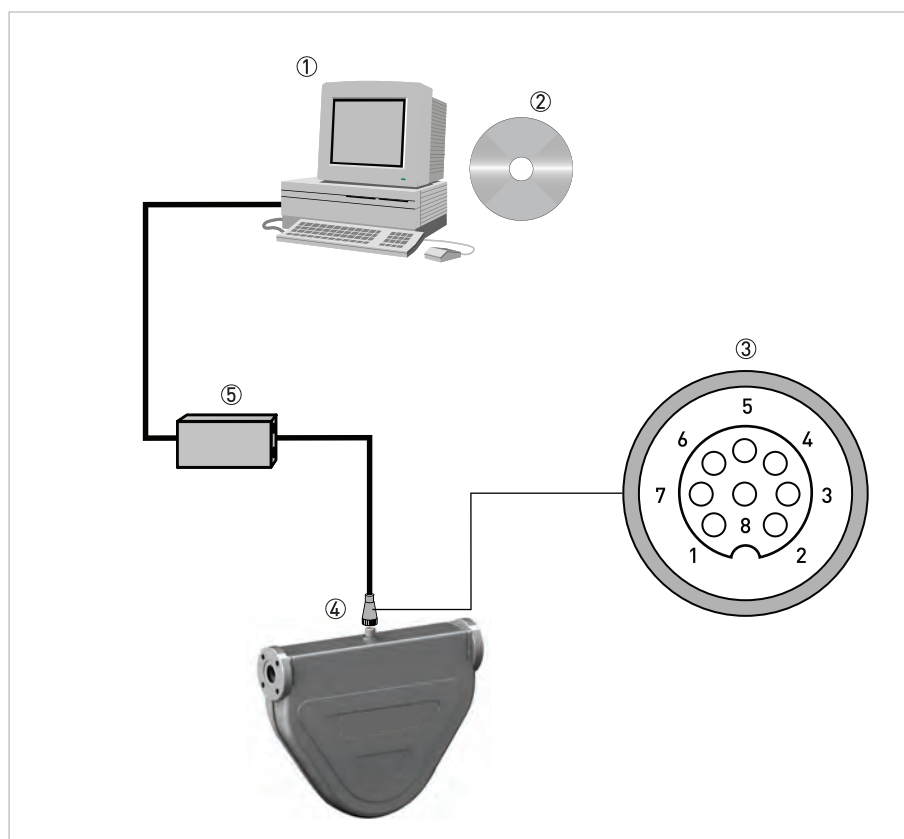
5.1 Configuration with Toolbox

The meter can be configured using the supplied software and adaptor, which allows connection to a personal computer (PC) or a laptop.



INFORMATION!

When the meter is in configuration mode, the pulse output is not available.



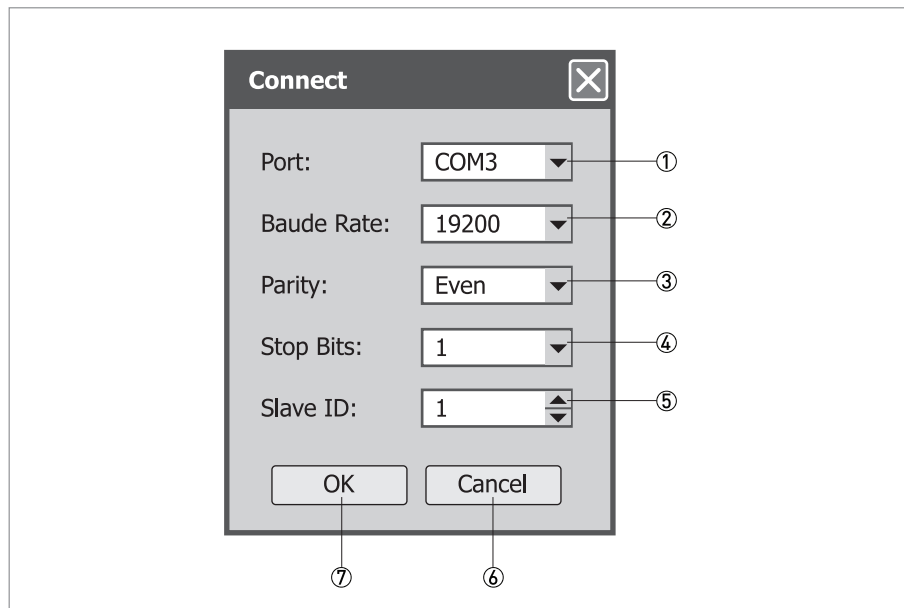
- ① Personal computer or laptop
- ② Toolbox software CD
- ③ Connection plug
- ④ Mass flowmeter
- ⑤ RS458 to USB converter



Connection with Toolbox

- Connect the meter to a personal computer or laptop using the converter.
- Launch Toolbox but DO NOT try to connect to the meter.
- Connect the meter to the power supply.
- Select either Connection > Connect or Connection > Auto Connect to connect Toolbox to the meter. This MUST be done within 10 seconds of energising the meter.

5.1.1 Manual connection



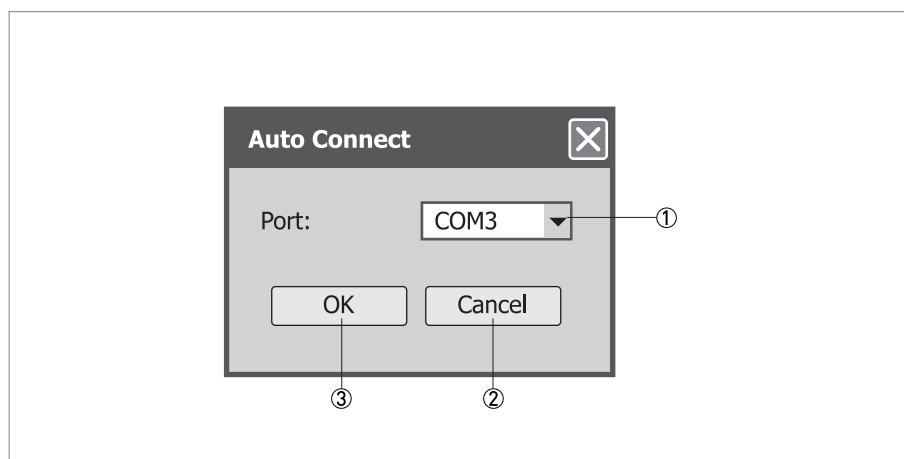
- ① Connection Port
- ② Baud Rate
- ③ Parity
- ④ Stop Bits
- ⑤ Slave ID
- ⑥ Cancel button
- ⑦ OK button



- Press <F3> or select Connection > Auto Connect.
- ➡ The Connect dialogue box will open.
- Select the Port you wish to connect through. The default values for: Baud Rate, Parity, Stop Bits and Slave ID are shown.
- Select OK or Cancel
- ➡ Toolbox will connect to the meter.

5.1.2 Automatic connection

An automatic connection can be made with a single meter on a point-to-point basis.



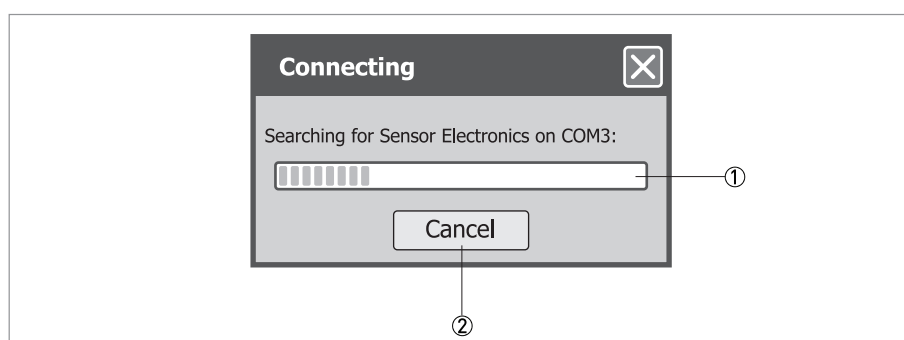
- ① Connection port
- ② Cancel button
- ③ OK button



- Press F5 or select: Connection > Auto Connect.
- ➡ The Auto Connect dialogue box opens.
- Select the Port you wish to connect through.
- Select OK or Cancel
- ➡ Toolbox will connect to the meter.

5.1.3 Connection dialogue

While Toolbox is connecting to the meter, the dialogue box will show the progress.

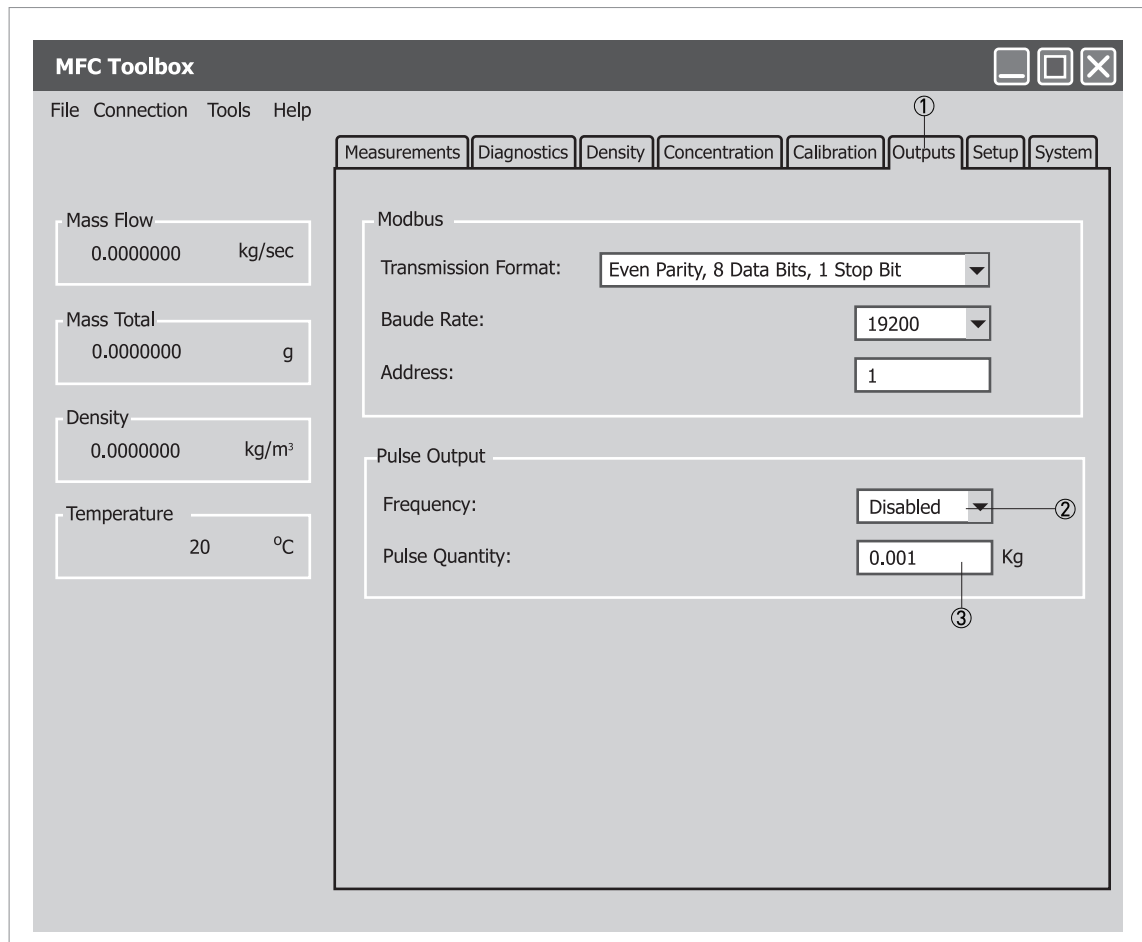


- ① Connection progress
- ② Cancel button

If you want to stop the connection process, use the **Cancel** button. When the connection has been made, the dialogue box will close.

5.1.4 Outputs

The meter is pre-configured according to the customer's order. If it is necessary to change output parameters, it is recommended that only Frequency and Pulse Quantity are changed.



① Output tab

② Frequency - sets the maximum pulse frequency to 1 kHz or 10 kHz / mass or volume

③ Pulse Quantity - sets the quantity of each pulse. The units are the same as for Mass Total

5.1.5 Setup

High-speed valves can cause "ringing" and it might be necessary to use Pressure Suppression to prevent this. This can be done by setting the relevant parameters in the Setup tab

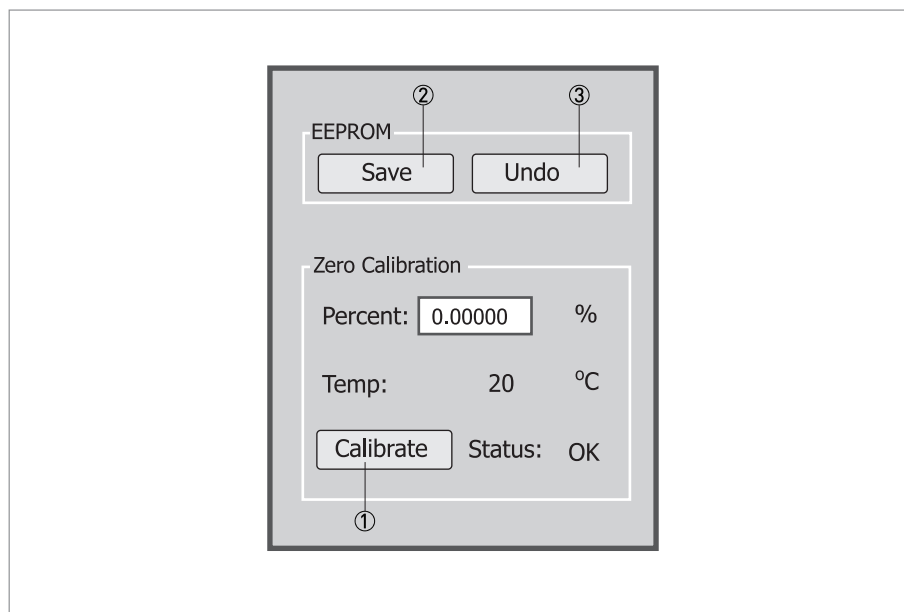
The screenshot shows the 'MFC Toolbox' software interface. The 'Setup' tab is selected, indicated by a circled 1. The interface is divided into a left sidebar and a main content area. The sidebar contains four input fields: 'Mass Flow' (0.0000000 kg/sec), 'Mass Total' (0.0000000 g), 'Density' (0.0000000 kg/m³), and 'Temperature' (20 °C). The main content area has a tabbed interface with 'Measurements', 'Diagnostics', 'Density', 'Concentration', 'Calibration', 'Outputs', 'Setup' (selected), and 'System'. The 'Setup' tab is further divided into 'General' and 'Flow Cut-off' sections. The 'General' section includes 'Flow Direction' (Forwards), 'Flow Mode' (Flow >0), 'Pipe Diameter' (5.53 mm), 'Flow Offset' (0 kg/sec), 'Tube amplitude' (80 %), and 'Time Constant' (4 Sec). The 'Flow Cut-off' section includes 'Suppression Cut-off' (0 %, marked with a circled 4), 'Suppression Time' (5 sec, marked with a circled 2), and 'Low Flow Threshold' (0.5, marked with a circled 3).

- ① Setup tab
- ② Suppression time
- ③ Low Flow Threshold
- ④ Suppression Cut-Off

5.1.6 Zero calibration

The meter is supplied with a factory set zero calibration but in certain circumstances it might be necessary to re-set the zero calibration. These might be:

- where the highest accuracy is required with very low flow rates
- extreme process conditions (for example where the meter is being used to measure high viscosity liquids).



- ① Zero calibration button
- ② Save button
- ③ Undo button



Zero calibration procedure

- Flush the process fluid through the meter
- Close the downstream valve
- Maintain the process pressure
- Select Calibrate. This will start the zero calibration procedure
- When the zero calibration has been set, select Save to store the calibration data

6.1 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are under normal operating conditions subjects to wear and tear.

6.2 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, technical support and training.



INFORMATION!

For more precise information, please contact your local representative.

6.3 Returning the device to the manufacturer

6.3.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



CAUTION!

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



CAUTION!

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

6.3.2 Form (for copying) to accompany a returned device

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no.:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:		water-hazardous	
		toxic	
		caustic	
		flammable	
		We checked that all cavities in the device are free from such substances.	
		We have flushed out and neutralized all cavities in the device.	
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

6.4 Disposal

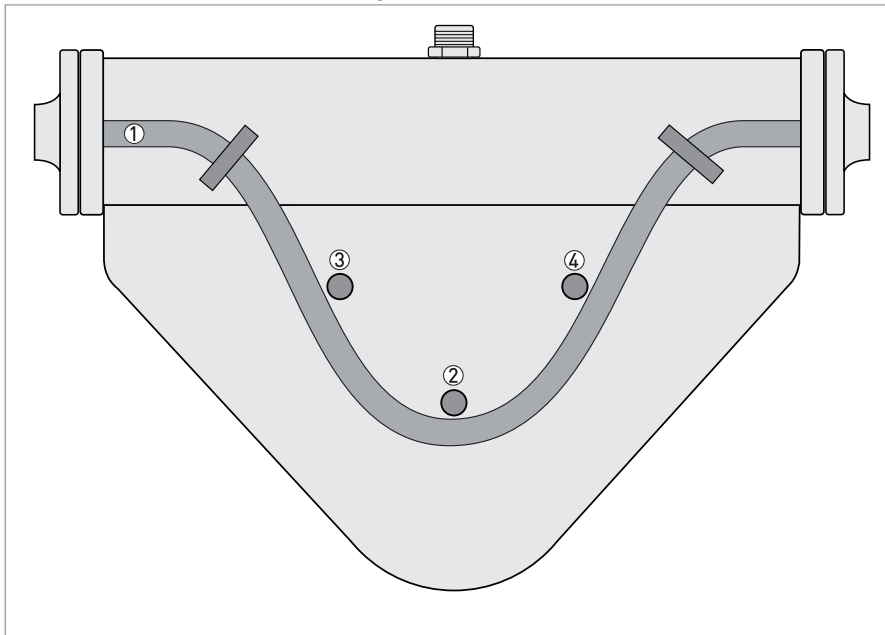


CAUTION!

Disposal must be carried out in accordance with legislation applicable in your country.

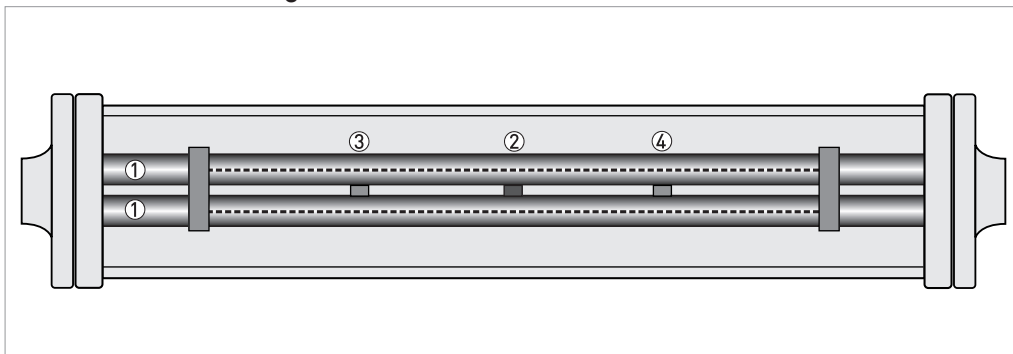
7.1 Measuring principle

Meter from the side, showing tube layout



- ① Measuring tubes
- ② Drive coil
- ③ Sensor 1
- ④ Sensor 2

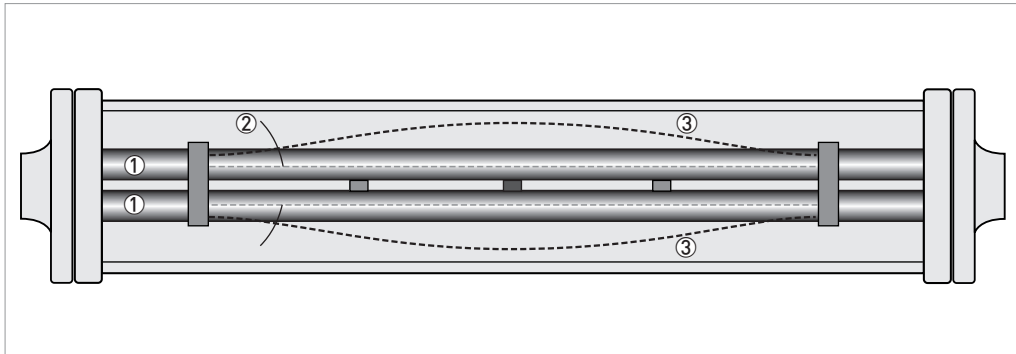
Static meter not energised and with no flow



- ① Measuring tubes
- ② Drive coil
- ③ Sensor 1
- ④ Sensor 2

A Coriolis twin-tube mass flowmeter consists of two measuring tubes (①) a drive coil (②) and two sensors (③ and ④) that are positioned either side of the drive coil.

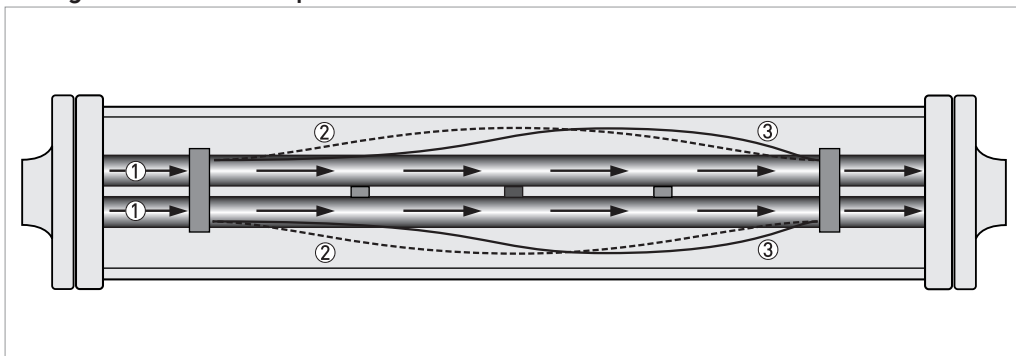
Energised meter



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

When the meter is energised, the drive coil vibrates the measuring tubes causing them 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 tubes, 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.

7.2 Technical data



INFORMATION!

- 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 (Download Center).

Measuring system

Measuring principle	Coriolis mass flow
Application range	Measurement of liquids in batching and filling machines
Measured values	Mass
Calculated values	Volume

Design

Basic	System consists of a measuring sensor with integral converter to process the output signal
Features	Fully welded maintenance- free sensor with twin U-shaped measuring tube
Variants	
Compact version	Integral converter

Measuring accuracy

Mass	
$Q_{nom} \times 0.1 \leq Q$	$\pm 0.15\%$ of actual measured flow rate
$Q < Q_{nom} \times 0.1$	$\pm 0.1\%$ of actual measured flow rate + zero stability
Volume	
$Q_{nom} \times 0.1 \leq Q$	$\pm 0.2\%$ of actual measured flow rate
$Q < Q_{nom} \times 0.1$	$\pm 0.15\%$ of actual measured flow rate + zero stability
Zero stability	
Stainless Steel	0.005% of nominal flow
Repeatability (at reference conditions)	
Filling time	Standard deviation
$1.5 \text{ s} < \text{Filling time} \leq 3 \text{ s}$	0.13%
$3 \text{ s} < \text{Filling time} \leq 5 \text{ s}$	0.07%
$5 \text{ s} < \text{Filling time}$	0.04%
Reference conditions	
Warm-up time	15 min
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig
Accreditation	UKAS to EN17025

Operating conditions

Nominal flow rates	
S10	22 kg/min / 48.4 lb/min
S15	72 kg/min / 158.4 lb/min
Ambient temperature	
Compact version	-40...+55°C / -40...+131°F
Process temperature	
Operating temperature	0...+100°C / 32...+212°F
SIP/CIP	Maximum +120°C / +248°F
	Maximum 1h duration
Nominal pressure at 20°C / 68°F	
Measuring tube	
Stainless Steel	-1...40 barg / -14.5...580 psig
Fluid properties	
Permissible physical condition	Liquids
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 6

Installation conditions

Inlet runs	None required
Outlet runs	None required

Materials

Stainless Steel meter	
Measuring tube	Stainless Steel 316L (1.4404)
Surface finish (wetted parts)	Standard Ra 0.8 µm
	Optional Ra 0.5 µm
Process connections	Stainless Steel 316L (1.4404)
Outer casing	Stainless Steel 316 (1.4401), hermetically sealed as standard
	Optional polishing of all externals

Process connections

Hygienic	
Tri-clover	½...1"
Tri-clamp DIN 32676	DN10...25
Tri-clamp ISO 2852	1"
Clamp IDF	10...15A
DIN 11864-2 Form A	DN20
Male thread DIN 11851	DN10...25
Male thread SMS	1"
Male thread RJT	1"

Electrical Connection

Connection	
Electrical connections	Micro (M12) male, 8 pole (Lumberg PRSFM 8/0.5M)
Power Supply	
Voltage	24 VDC $\pm 20\%$
Power consumption	3 W
Power supply type	Protected extra-low voltage (PELV)
Pulse/Frequency Output	
Pulse rate for Q = 100%	Maximum 10 kHz
	Factory set according to customer requirements
Pulse width	Selectable 1 kHz or 10 kHz symmetrical pulse
	Factory set according to customer requirements
Connection	External voltage: $U_{\text{ext}} \leq 30 \text{ VDC} / \leq 24 \text{ VAC}$
	Load rating: $I_{\text{max}} = 20 \text{ mA}$

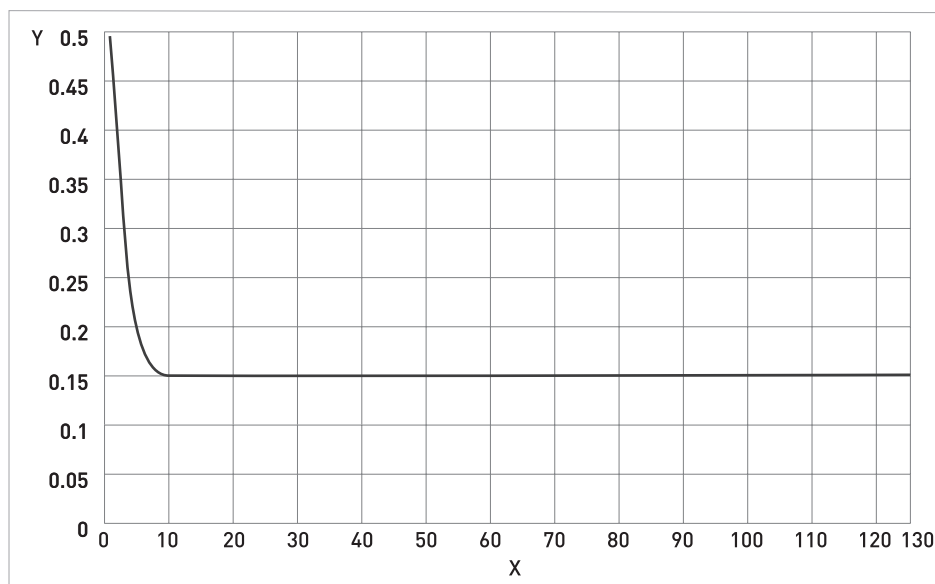
Configuration

Function	MODBUS connection for programming and configuration of full process parameters using software supplied
	Note: MODBUS and pulse / frequency output can not be used simultaneously
Type	RS485 Modbus RTU

Approvals

Mechanical	
Electromagnetic compatibility (EMC) acc. to CE	Namur NE 21/5.95
	2004/108/EC (EMC)
	2006/95/EC (Low Voltage Directive)
Hygienic	3A 28-03
	ASME BPE 2005
	Conforms with FDA guidelines
	EHEDG
Vibration	IEC 60068-2-6

7.3 Measuring accuracy



X Flow rate [%]

Y Measuring error [%]

Measuring error

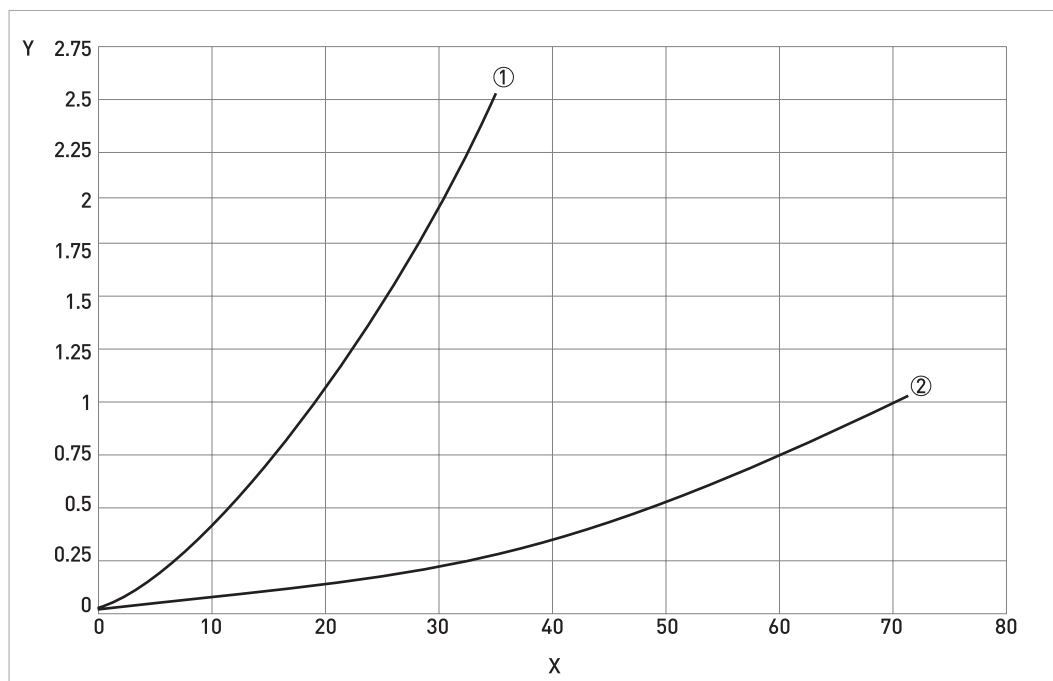
The measuring error is obtained from the combined effects of accuracy and zero stability.

Reference conditions

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

7.4 Pressure drop

Metric



X Mass flow [kg / min]

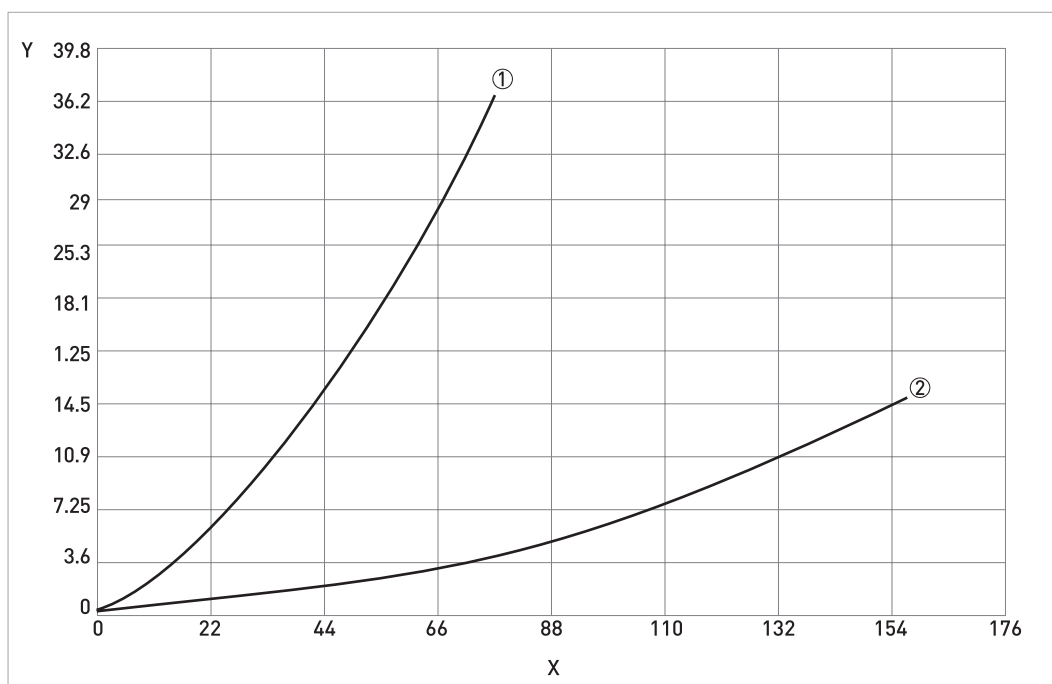
Y Pressure [barg]

① S10

② S15

Reference conditions

Meter	Product	Temperature
OPTIBATCH S10	Water	20°C
OPTIBATCH S15	Water	20°C

Imperial

X Mass flow [lb / min]

Y Pressure [psig]

① S10

② S15

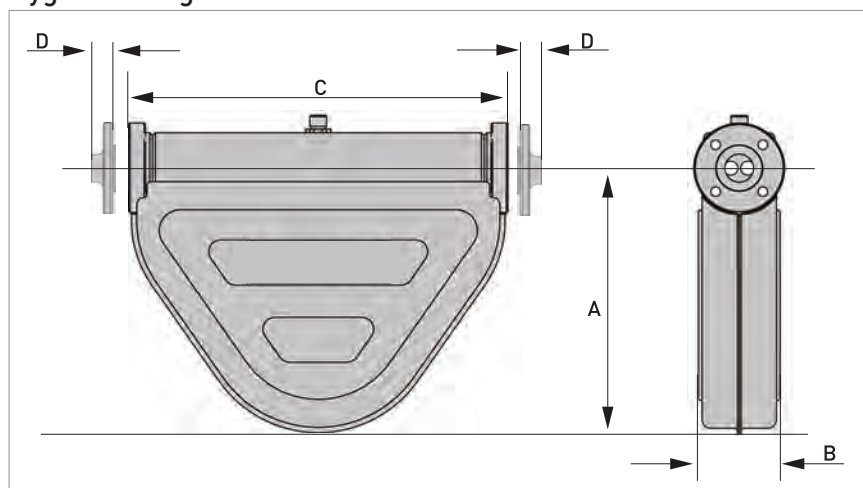
Reference conditions

Meter	Product	Temperature
OPTIBATCH S10	Water	68°F
OPTIBATCH S15	Water	68°F

7.5 Dimensions and weights

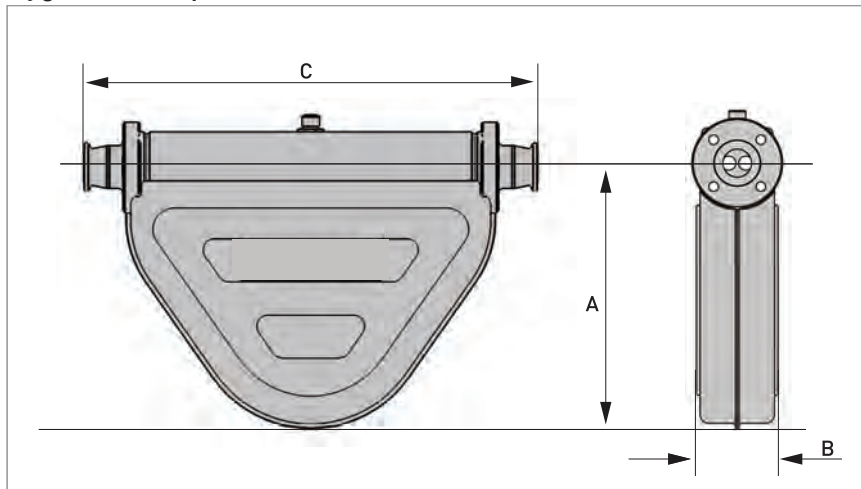
7.5.1 Dimensions

Hygienic flange



Meter	S10		S15	
Connection	DN20 DIN11864-2		DN20 DIN11864-2	
	[mm]	[inches]	[mm]	[inches]
A	189	7.44	189	7.44
B	59.5	2.34	59.5	2.34
C	270	10.6	270	10.6
D	15	0.59	15	0.59

Hygienic clamp



Meter	S10				S15								
Connection	DN10 Clamp DIN32676	DN15 Clamp DIN32676	DN10 IDF Clamp (A type)	DN15 Tri-Clover	DN15 Clamp DIN32676	DN20 Clamp DIN32676	DN25 Clamp DIN32676	DN15 IDF Clamp (A type)	DN20 Tri-Clover	DN25 Tri-Clover	DN25 Clamp ISO2852	DN25 RJT	DN25 SMS
[mm]													
A	189				189								
B	59.5				59.5								
C	333				333								
[inches]													
A	7.44				7.44								
B	2.34				2.34								
C	13.1				13.1								

7.5.2 Weights

Meter	S10		S15	
	[kg]	[lb]	[kg]	[lb]
	2.9	6.38	2.9	6.38



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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