OPTIGAS 4010C Handbook

Sensor for gas dispenser applications

Software revision:
V2.3.xx

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

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1.1 Intended use

This flowmeter has been specifically designed for measuring Compressed Natural Gas (CNG) in retail dispensers.

1.2 Associated documents

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

- hazardous areas
- communications
- concentration
- corrosion

1.3 Safety instructions from the manufacturer

1.3.1 Copyright and data protection

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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.

1.3.3 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.

1.3.4 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.

1.3.5 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.

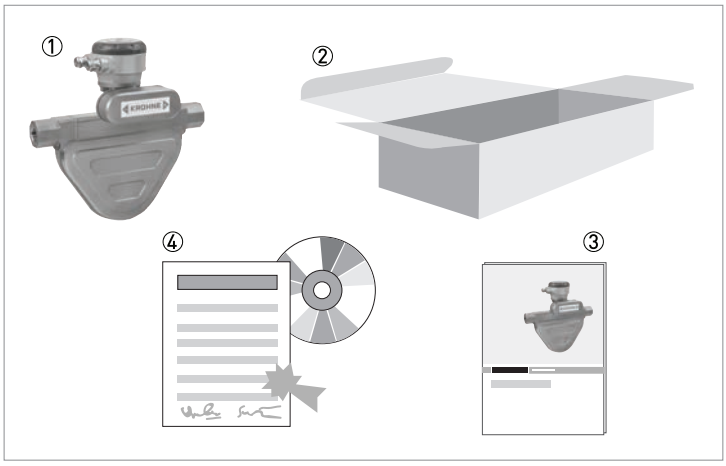
- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

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

1.4 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 measurement of Compressed Natural Gas (CNG) in CNG dispensers.

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 General notes on installation

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

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

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.

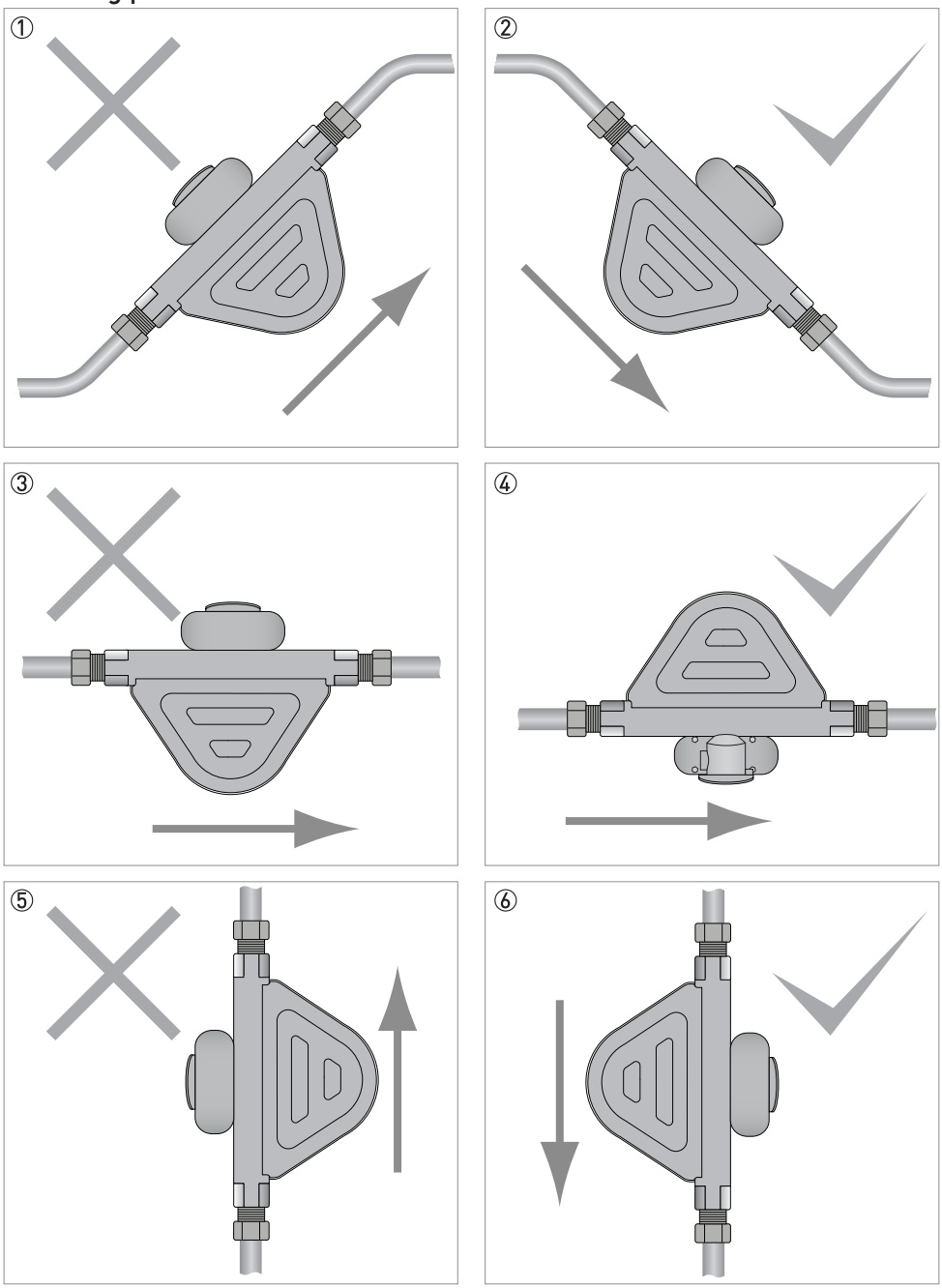
3.3 Mounting restrictions

3.3.1 General installation principles

There are no special installation requirements but you should note the following points:

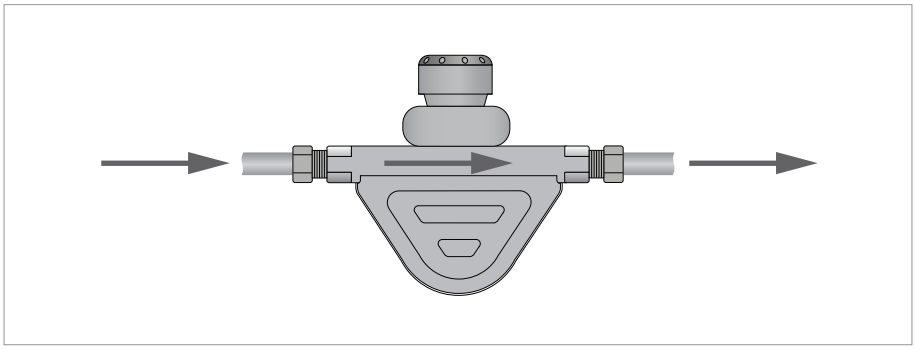
- Support the weight of the meter as close to the meter body as possible.
- Mount the meter in such a way to avoid the build up of liquid in the measuring tube.
- Straight runs either side of the meter are not required.
- The use of reducers and other fittings at flanges, including flexible hoses, is allowed but you should take care to avoid cavitation.
- Avoid extreme pipe size reductions.
- Meters are not affected by crosstalk and can be mounted in series or in parallel.
- Avoid mounting the meter at the lowest point in the pipeline where liquid can collect.

Mounting positions



① Avoid mounting the meter with the flow running uphill because it can cause liquid to build up on the supply side of the meter.
② Mount the meter with the flow running downhill. This will allow any build up of liquid to drain from the meter.
③ Avoid mounting the meter with the connection box above the meter. This can cause liquid to collect in the measuring tubes at their lowest point in the meter.
④ Mount the meter with the junction box underneath the meter. This will prevent liquid from collecting in the measuring tubes.
⑤ The meter can be mounted vertically but DO NOT mount it so that the flow is uphill. This can cause fluid to build up on the supply side of the meter.
⑥ If you are mounting the meter vertically, mount it so that the flow is downhill. This will allow any build up of fluid to drain from the meter.

3.3.2 Flow direction



With the orientation of the meter as shown in the illustration, the factory set flow direction is left to right.

If the meter has been intalled with the process flow running from right to left, the flow direction can be changed through the supplied software **Toolbox**. Please see the **START-UP** section.

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 Electrical and I/O connections

For information regarding electrical and I/O connections, please refer to the handbook for the relevant signal converter.

5.1 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 subject to wear and tear under normal operating conditions.

5.2 Availability of services

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

INFORMATION!
For more precise information, please contact your local sales office.

5.3 Fault finding

The status of the meter and possible problems, can be checked using the diagnostic functions available in the Toolbox software supplied with the meter, or Modbus RS485 communication. There are no serviceable components in the meter. If the Toolbox diagnostics show a fault, the meter should be replaced.

The following diagnostic functions are available (please refer to the relevant converter Handbook for register values):

Temperature:

This displays the temperature in either °C or °F. The temperature shown should be stable and the same as the actual process temperature.

Frequency:

This displays the vibration frequency of the measuring tubes and should be stable to the first decimal point. For example, the display might show 230.1xxx Hz. Variations in the first digit after the decimal point indicates a fluctuation in gas density. This fluctuation can be caused by changes in pressure / temperature or moisture in the gas.

Drive energy:

The typical value of the drive energy for gas with no moisture content is: 1...5%.

Sensor A and B:

The display should show values for sensors A and B of 80% and should be within 2% of each other.

5.4 Returning the device to the manufacturer

5.4.1 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 neutralising, 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.*

5.4.2 Form (for copying) to accompany a returned device

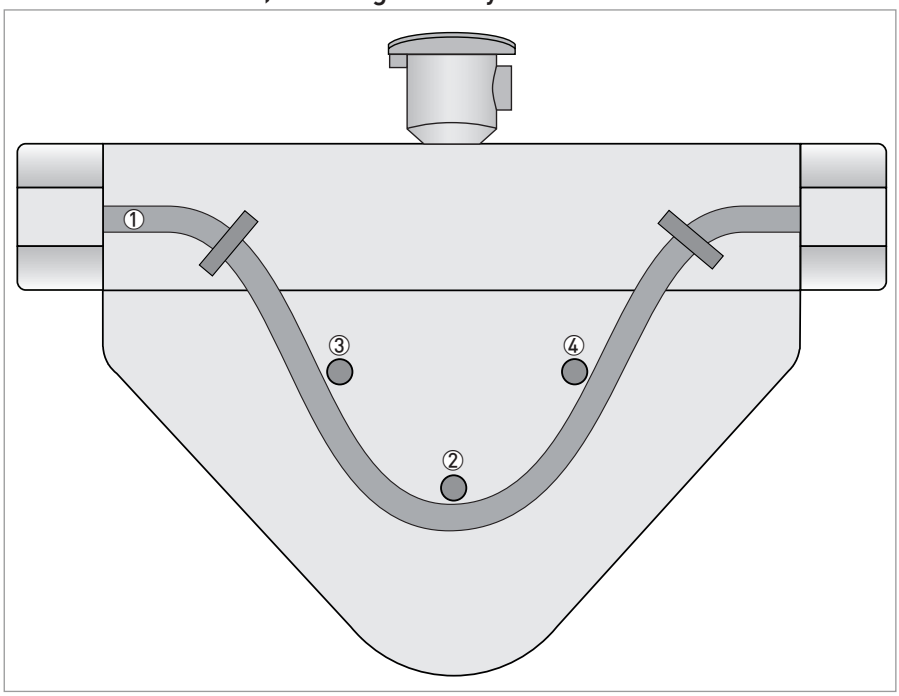
Company:		Address:
Department:		Name:
Tel. no.:		Fax no.:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:	☐	water-hazardous
	☐	toxic
	☐	caustic
	☐	flammable
	☐	We checked that all cavities in the device are free from such substances.
	☐	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:		

5.5 Disposal

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

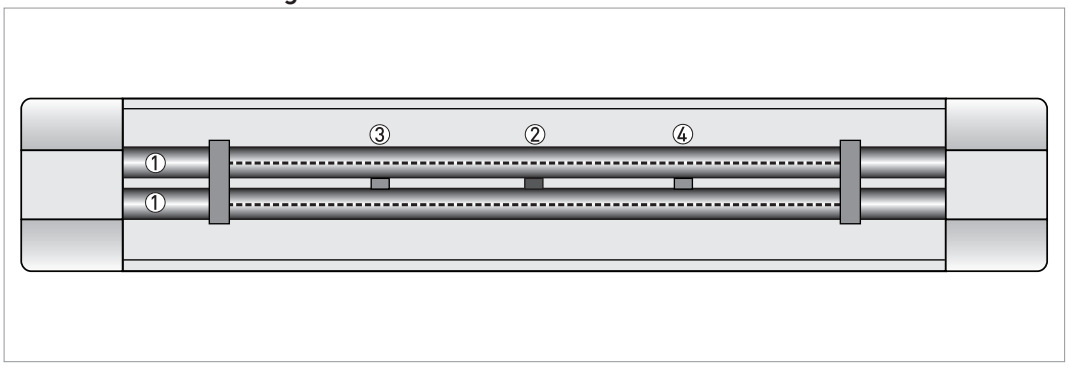
6.1 Measuring principle

Meter from the side, showing tube layout



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

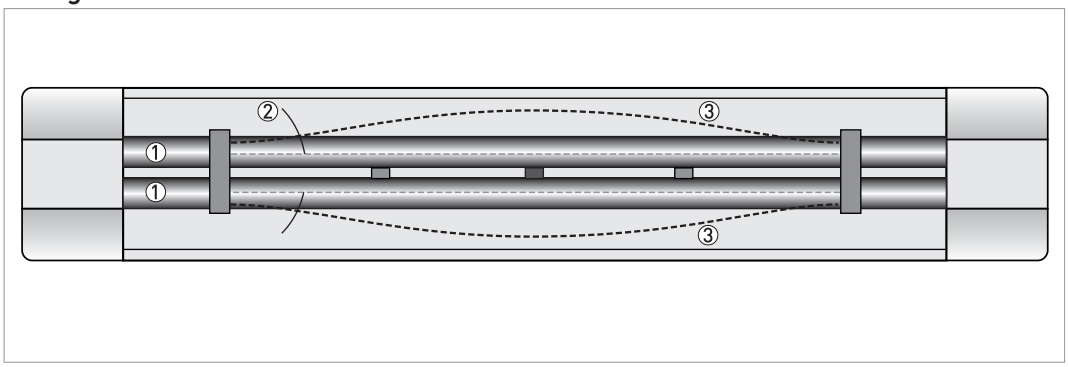
Static meter not energised and with no flow



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.

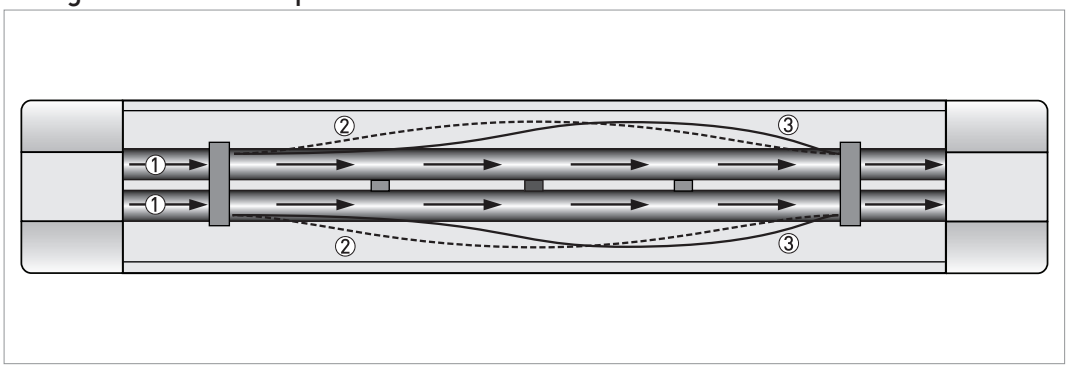
Energised meter



① Measuring tubes
② Direction of oscilation
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.

Temperature measurement is made using a Pt500 sensor.

6.2 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 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	Measurement of Compressed Natural Gas (CNG)
Measured values	Mass, temperature

Design

Basic	System consists of a measuring sensor with integral MFC010 converter to process the output signal.
Features	Fully welded maintenance- free sensor with twin U-shaped measuring tube

Application conditions

Fluid	Compressed Natural Gas (CNG) with operating pressure typically > 100 barg / 1450 psig
Flow range capacity	1...70 kg/min / 2.2...155 lbs/min
Accuracy	±0.5% of total batch (where minimum actual flow rate is 1 kg/min / 2.2 lbs/min)
Repeatability	±0.3% of actual flow rate + zero stability (for a batch size > 1 kg . 2.2lbs)
Zero stability	±0.015% of flow range capacity
Pressure rating	
Static	350 barg / 5076 psig
Cycling	300 barg / 4351 psig
Process fluid temperature	-40...+93°C / -40...+200°F
Ambient temperature	-40...+55°C / -40...+131°F

Mechanical

Process connections	¾" NPT female (adaptor options are available)
Materials	
Measuring tube	Stainless Steel 316L (1.4404)
Outer casing	
Electronics housing	
Junction box	Die cast Aluminium (polyurethane coating)

Electrical

Power supply	12 VDC via Ex approved barrier (11.4...12.6 VDC)
Programming	Via Modbus. ①
Outputs	Modbus RTU over RS485
Diagnostics	

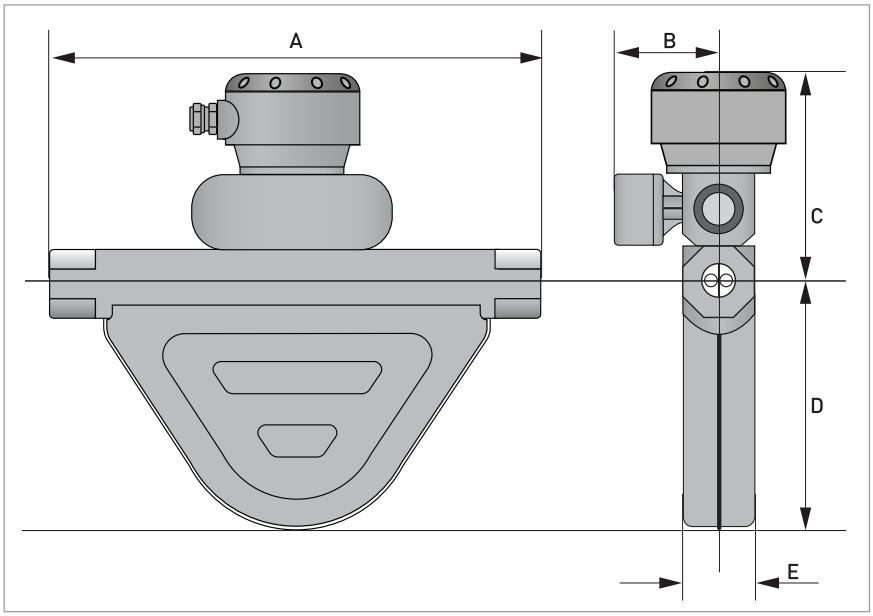
Interface cable	2 x screened twisted pairs with a minimum 20 AWG conductors. Total C ≤ 50nF, total L ≤ 200µH
Cable glands	M20 X 1.5 Stainless Steel suitable for cable diameter 6.5...9.5 mm

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

① Toolbox software is available from the manufacturer but it requires a compatible Modbus to PC adapter with approved barrier. Please call for more information.

6.3 Dimensions and weights



	[mm]	[inches]
A	359 ±2	14.1 ±0.08
B	97	3.8
C	162	6.4
D	194	7.6
E	50	1.97

KROHNE product overview

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

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.:+49 (0)203 301 0
Fax:+49 (0)203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com

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