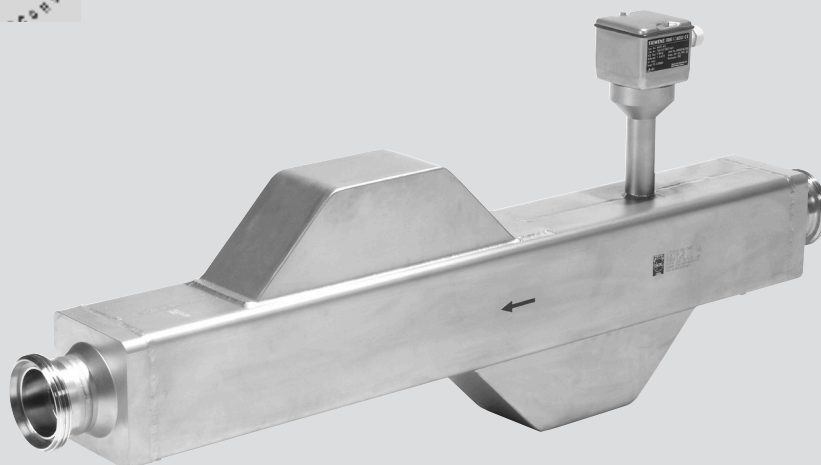


Coriolis flowmeters

SITRANS F C MC2 and MC2 Hygienic

Operating Instructions • 10/2009



SITRANS F

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Flowmeters SITRANS F C MC2

Operating Instructions

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MC2 DN 50-150
MC2 Hygienic (EHEDG) DN 20 - DN 80

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
⚠ WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

These instructions contain all the information you need for using the device.

The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it as well as service and maintenance engineers.

Note

It is the responsibility of the customer that the instructions and directions provided in the manual are read, understood and followed by the relevant personnel before installing the device.

1.1 Items supplied

- MC2 sensor
- Sensorprom
- Calibration report
- Quick Start
- CD-ROM

1.2 History

This document describes:

- SITRANS F C MC2
- SITRANS F C MC2 Hygienic

Documentation history

The contents of these instructions are regularly reviewed and corrections are included in subsequent editions. We welcome all suggestions for improvement.

The following table shows the most important changes in the documentation compared to each previous edition.

Edition	Remarks
10/2009	Updated information on electrical connections
05/2008	First edition of operating instructions for SITRANS F C MC2 and SITRANS F C MC2 Hygienic.
01/2006	Manual supplement for SITRANS F C MC1

1.3 Further Information

The contents of these Operating Instructions shall not become part of or modify any prior or existing agreement, commitment or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract which also contains the complete and solely applicable warranty conditions. Any statements contained herein do not create new warranties or modify the existing warranty.

Product information on the Internet

The Operating Instructions are available on the CD-ROM shipped with the device, and on the Internet on the Siemens homepage, where further information on the range of SITRANS F flowmeters may also be found:

Product information on the internet (<http://www.siemens.com/flowdocumentation>)

Worldwide contact person

If you need more information or have particular problems not covered sufficiently by the operating instructions, please get in touch with your contact person. You can find contact information for your local contact person on the Internet:

Local contact person (<http://www.automation.siemens.com/partner>)

Safety notes

 CAUTION
--

Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance. Only qualified personnel should install or operate this instrument.

Note

Alterations to the product, including opening or improper repairs of the product, are not permitted.

If this requirement is not observed, the CE mark and the manufacturer's warranty will expire.

2.1 Laws and directives

General requirements

Installation of the equipment must comply with national regulations. For example EN 60079-14 for the European Community.

Instrument safety standards

The device has been tested at the factory, based on the safety requirements. In order to maintain this condition over the expected life of the device the requirements described in these Operating Instructions must be observed.

CAUTION

Material compatibility

Siemens Flow Instruments can provide assistance with the selection of wetted sensor parts. However, the full responsibility for the selection rests with the customer and Siemens Flow Instruments can take no responsibility for any failure due to material incompatibility.
--

CE marked equipment

The CE-mark symbolizes the compliance of the device with the following guidelines:

- EMC-guideline 89/336/EWG
- Low voltage guideline 73/23/EWG

2.2 Installation in hazardous location

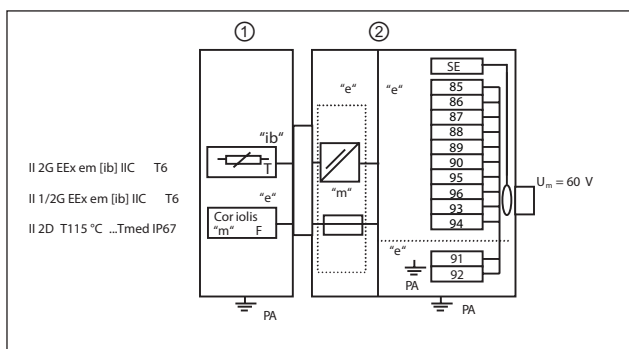
- Pressure equipment directive (PED/DGRL) 93/23/EG
- ATEX Directive 94/9/EG

2.2 Installation in hazardous location

⚠ WARNING
Equipment used in hazardous areas must be Ex-approved and marked accordingly. It is required that the special conditions for safe use provided in the manual and in the Ex certificate are followed!

Ex approvals

DN ≤40 [1½"]	DN ≥50 [2"]
II 2G EEx em [ib] IIC T6	II 1/2 EEx em [ib] IIC T6





- ① Sensor
- ② Terminal box

Figure 2-1 Ex layout

Temperature specifications for Ex use

Temperature class	Ambient temperature [°C]		
	-40...+40	-40...+50	-40...+60
T2	180	-	-
T3	165	140	-
T4	100	100	80
T5	65	65	65
T6	50	50	50

Sensor location

Non-hazardous location	Hazardous location
	

EX requirements

It is required that:

- Electrical connections are in accordance with Elex V (VO in explosion hazardous areas) and EN60079-14 (Installing Electrical Systems in Explosion Hazardous Areas).
- The protective cover over the power supply is properly installed. For intrinsically safe circuits the connection area can be opened.
- Appropriate cable connectors are used for the output circuits: intrinsically safe: blue, non-intrinsically safe: black
- Sensor and transmitter are connected to the potential equalization. For intrinsically safe output circuits potential equalization must be maintained along the entire connection path.
- Sensor insulation thickness is max. 100mm (only insulated sensors).
- EN50281-1-2 is considered for installation in areas with combustible dust.
- When protective earth (PE) is connected, no potential difference between the protective earth (PE) and the potential equalization (PA) can exist, even during a fault condition.

Description

Measurement of liquids and gases

SITRANS F C Coriolis mass flow meters are designed for measurement of a variety of liquids and gases. The meters are multi parameter devices offering accurate measurement of mass flow, volume flow, density, fraction, Brix/Plato, and temperature.

Main applications

The main applications of the Coriolis flow meter can be found in all industries, such as:

- Chemical & Pharma: Detergents, bulk chemicals, pharmaceuticals, acids, alkalis
- Food & Beverage: Dairy products, beer, wine, softdrinks, plato/brix, fruit juices and pulps, bottling, CO₂ dosing, CIP/SIP-liquids
- Automotive: Fuel injection, nozzle & pump testing, filling of AC units, engine consumption, paint robots
- Oil & Gas: Filling of gas bottles, furnace control, CNG-dispensers, test separators
- Water & Waste Water: Dosing of chemicals for water treatment

3.1 Coriolis Mass flow meters

The Coriolis principle of measurement

The flow measuring principle is based on Coriolis law of movement.

The SITRANS F C sensors are energized by an electromechanical driver circuit which oscillates the pipe at its resonant frequency. Two pick-ups, 1 and 2 are placed symmetrically on both sides of the driver. When the media flows through the sensor, Coriolis force will act on the measuring tube and cause a tube deflection which can be measured as a phase shift from pick-up 1 to pick up 2.

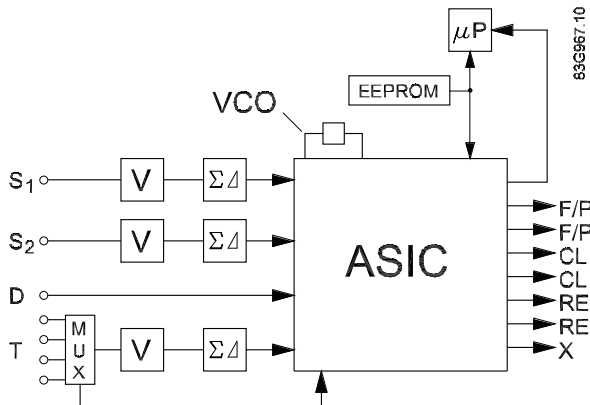
The phase shift is proportional to the mass flow rate. The amplitude of the driver is automatically regulated via a "phase locked loop", to ensure a stable output from the 2 pickups in the region of 80 to 110 mV. The temperature of the sensor is measured by a Pt1000, in a wheatstone configuration (4-wire).

The flow proportional signal from the 2 pick-ups, the temperature measurement and the driver frequency are fed into the transmitter (SITRANS F C MASS 6000 or SIFLOW FC070) for calculations of mass, density, volume, fraction, Brix/Plato, and temperature.

ASIC

The analog to digital conversion takes place in an ultra low noise ASIC with 23 bit signal resolution. The signal transfer function is based on a patented DFT technology (Discrete

Fourier Transformation). The ASIC is constructed as a state machine gate array, which enables fast signal processing and filtering. The ASIC has a built in noise filter, which can be changed and is used to improve the performance of the meter if the installation and application conditions are not ideal. Typically influence from process noise such as pump pulsations, mechanical vibrations, oscillating valves can be filtered out to a large degree through the filter functions.



SENSORPROM

All SITRANS F Coriolis flow meters feature a SENSORPROM® memory unit which stores sensor calibration data and transmitter settings for the lifetime of the product. Factory settings matching the sensor are thus stored in the SENSORPROM® unit and can always be retrieved. At commissioning the flow meter commences measurement without any initial programming. Also customer specified settings are downloaded to the SENSORPROM® unit.



USM

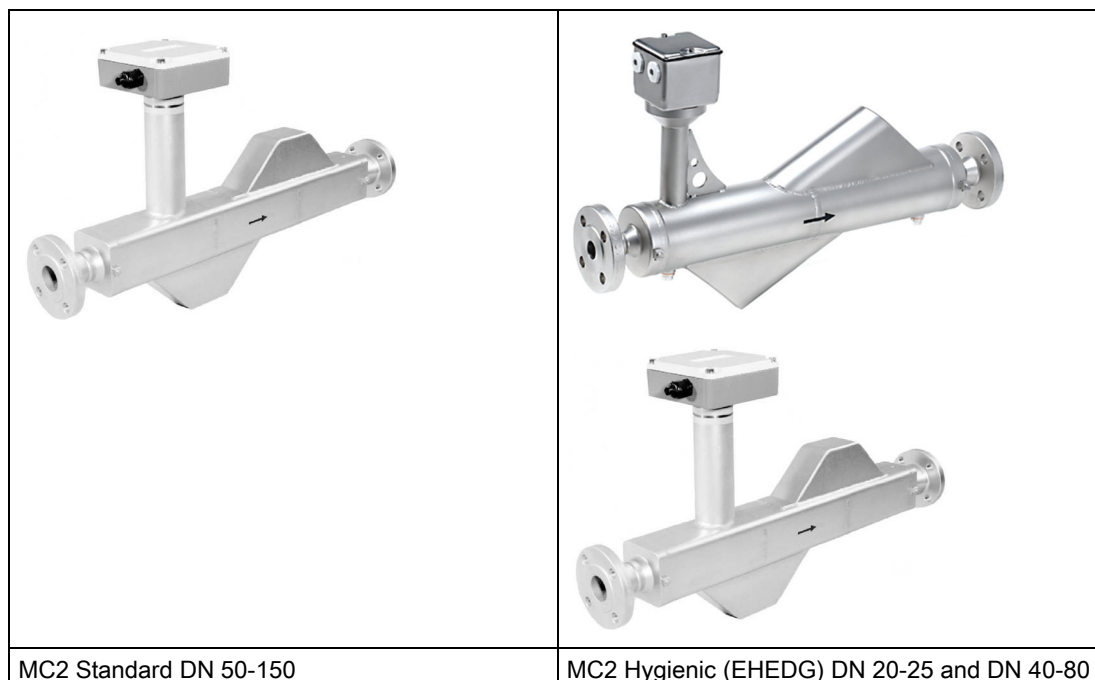
For communication purposes the ASIC has a CAN interface with a Siemens specific protocol. This concept is known as the USM II (Universal Signal Module) concept. The idea is that extra output modules or communication modules can be connected to this bus, making it possible to configure the flow meter for the precise task in hand. When the internal CAN bus detects the installed module, it is automatically programmed to factory settings via the SENSORPROM® memory unit. Currently the USM platform handles the following communication protocols: PROFIBUS DP, PROFIBUS PA, HART, MODBUS, Devicenet, and Foundation Fieldbus.



3.2 MC2 features

Versions

The MC2 is available as a standard and as a hygienic version holding the EHEDG certificate

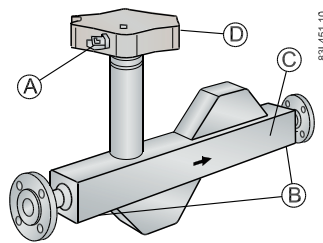


Description

MC2 DN 50 to DN 150 (2" to 6") and MC2 Hygienic (EHEDG certified) from DN 20 to DN 80 (¾" to 3") are suitable for accurate mass flow measurement of a variety of liquids and gases.

The sensors offer superior performance in terms of mass flow accuracy, density accuracy, and turn-down ratio. The very compact sensor construction makes installation and commissioning of even the largest sizes very straight forward and easy.

The sensor delivers true multi parameter measurements i.e.: Mass flow, volume flow, density, fraction flow, Brix/Plato, and temperature.



- A Cable gland
- B Pressure guard
- C Ground terminal
- D Terminal box

Design

The MC2 sensor consists of 2 parallel measuring pipes, welded directly onto a flow splitter at each end to eliminate a direct coupling to the process connectors and significantly reduce effects from external vibrations.

The flow-splitters are welded directly onto a rigid sensor housing which acts as a mechanical low pass filter.

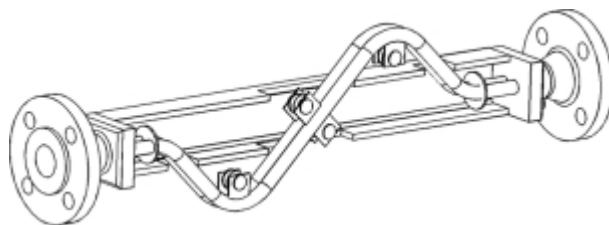
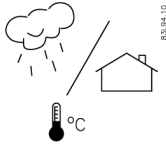


Figure 3-1 MC2 cut open

The wetted parts of the MC2 standard are available in two material configurations, W 1.4571 / AISI 316Ti or Hastelloy C4 with a wide variety of process connections, while MC2 Hygienic is available in W 1.4435. The enclosure is made of stainless steel W 1.4301 / AISI 304 with a grade of encapsulation of IP67/NEMA 4.

Installing / Mounting



SITRANS F flowmeters are suitable for in- and outdoor installations.

- Make sure that pressure and temperature specifications indicated on the device type plate / label will not be exceeded.

! WARNING

Installation in hazardous location

Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous area" (Page 8)

4.1 Use according to specifications

Instrument safety standards

The device meets the safety criteria defined in the Pressure Equipment Directive (PED). It has been tested at the factory, based on the safety requirements. In order to maintain this condition over the expected life of the device the requirements described in these Operating Instructions must be observed.

The device satisfies the EMC-Requirements per EN61326 / NAMUR NE21 and the Low Voltage Directive EN61010-1.

Use according to specifications covers:

- Use within technical limits.
- Consideration of liquid specifications and references.
- Consideration of specifications as to installation, commissioning and maintenance.
- Allowed pressure and temperature must be \leq the pressure and temperature specifications stated on the product label.
- Flow and density must be within the specified limits

Do NOT:

- Use the meter as elastic equalization in pipe systems to compensate for e.g. pipe displacement, pipe vibration, expansion etc.
- Use the meter as footboard for installation purposes.

- Use the meter as support of external loads like pipes etc.
- Change the meter in any way like e.g. decomposition of material in connection with processing, welding and use of accessories and spare parts not approved by Siemens Flow Instruments.

Note

If the meter is not used according to the specifications, the manufacturer cannot be held responsible for any damage occurred.

See also

Technical data (Page 37)

4.2 Determining a location

Note

Do not install the sensor in the vicinity of strong electromagnetic fields, e.g. near motors, pumps, transformers etc. This will destroy the measurement principle.

Upstream / downstream

- The mass flow meter does not require any straight inlet sections
- Avoid long drop lines downstream from the flow meter to prevent the meter tube from draining (min. pressure: 0.2 Bar).
- Avoid installing the sensor immediately upstream of a free discharge in a drop line.

Location in the system

The optimum location in the system depends on the application

- For liquid applications the presence of gas or air bubbles in the fluid may result in erroneous measurements, particularly in the density measurement. Therefore do not install the flow meter at the highest point in the system, where gas / air bubbles will be trapped. For liquids it is advantageous to install the flow meter in low pipeline sections, at the bottom of a U-section in the pipeline.
- For gas applications the presence of oil may result in erroneous measurements. Therefore do not install the flow meter at the lowest point of the system, or install a filter.

4.3 Sensor orientation

Flow direction

The calibrated flow direction is indicated by the arrow on the sensor. Flow in this direction will be indicated as positive (a forward/reverse flow calibration is available as an option).

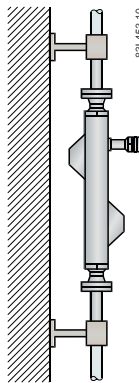
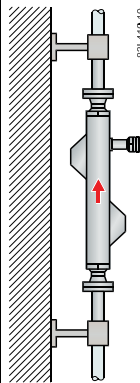
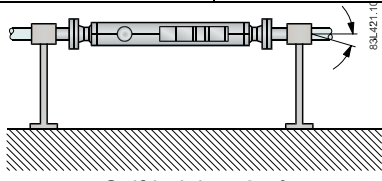
⚠ CAUTION

The sensor must always be completely filled with fluid in order to measure accurately.

Installation orientation

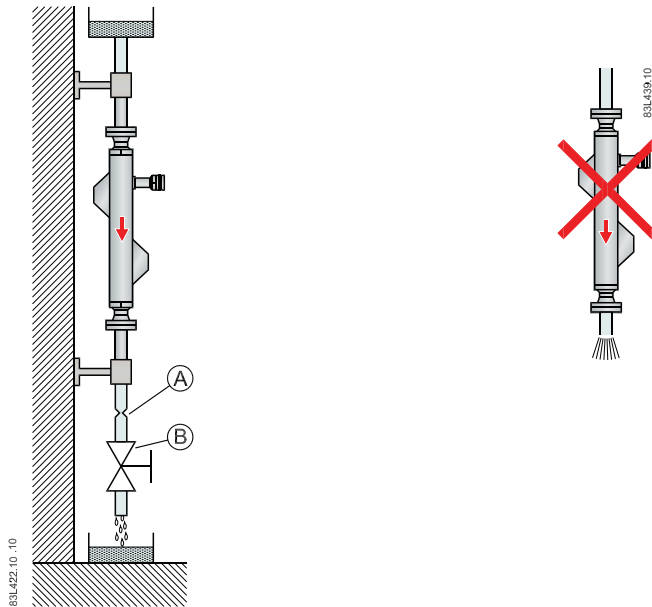
The Sitrans F C MC2 operates in all orientations, but the optimal sensor orientation is a vertical installation with an upward flow. This has the advantage that air and gas bubbles will move upward out of the meter tube. Additionally, it is easy to drain the meter tube. Deposits can thereby be avoided.

Table 4- 1 Sensor orientation

Orientation	GAS	LIQUIDS
Vertical		
Horizontal	 <p style="text-align: center;">Selfdraining: 2-4°</p>	

Installation in a drop line

Table 4-2 Installation in dropline



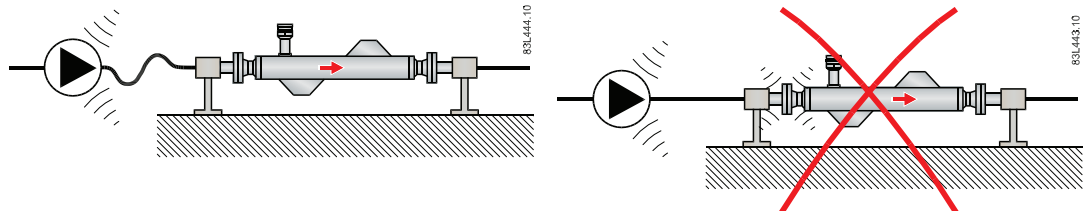
Min. pressure: 0.2 Bar

Installation in a dropline is only possible if a pipeline reduction (A) or orifice (B) with a smaller cross-section can be installed to prevent the sensor from being partially drained during the measurements.

4.4 Vibrations and crosstalk

Avoid vibrations

Use flexible hoses, if vibrations exist in the pipeline.



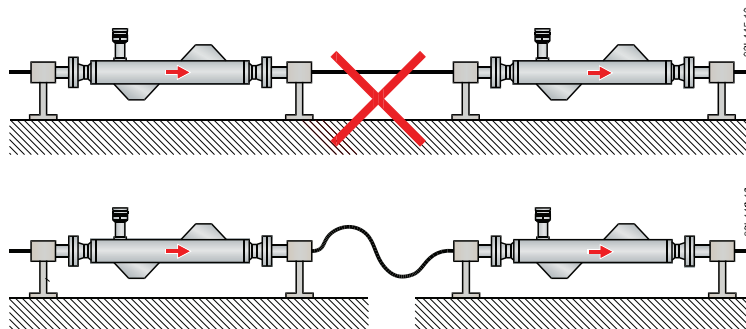
CAUTION

Avoid any direct connection of flexible elements and the sensor:

Install the hoses on the outer side of the shut off devices and the supported flow meter section.

Avoid crosstalk

Mount the sensors on different steelframes, keep distance between the sensors, or decouple the pipelines, if operating more than one meter in one or multiple interconnected pipelines. This will prevent cross talk.



Connecting

The following contains a short description of how to connect the sensor to the transmitter SITRANS F C MASS 6000. For more information, including information about connecting the sensor to SIFLOW FC070, please refer to the operating instructions for the respective transmitters.

 **WARNING**

Only qualified personnel may carry out work on the electrical connections.

 **WARNING**

Use in hazardous locations

- MC2 is not allowed for use with SITRANS F C MASS 6000 Ex d and SIFLOW FC070 Ex.
- MASS 6000 19" and IP67 as well as SIFLOW FC070 have to be remote mounted in the safe area.

Before connecting

- Check that the serial numbers on the sensor and the SENSORPROM® unit are identical.

 **WARNING**

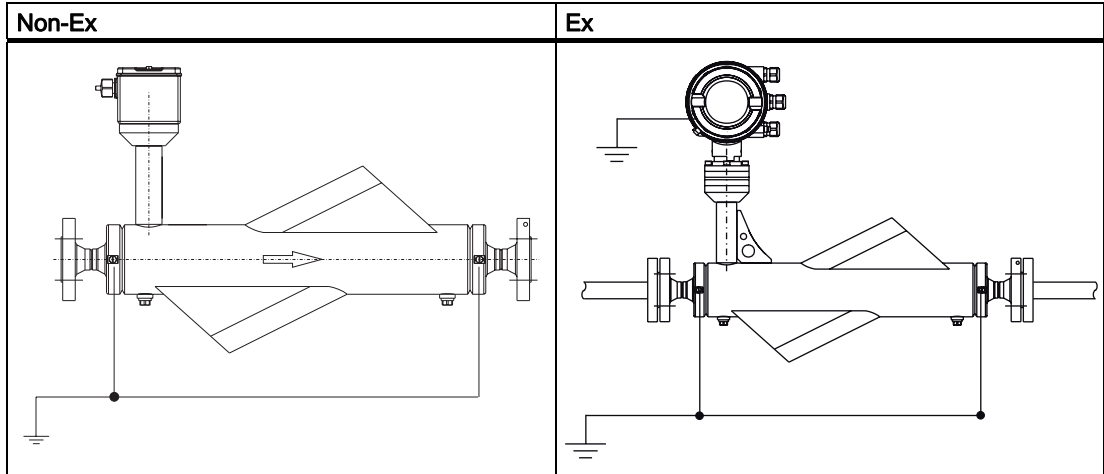
Use in hazardous locations

Before opening the terminal box check that:

- No explosion hazard exists
- A fire department permission certificate has been issued
- All connection leads are potential free

Grounding terminal

Connect grounding terminal (PE) to protective earth



NOTICE

In compliance to the EMC-standard / low voltage guideline, the terminal box, additional to the meter tube of the flow sensor, has to be grounded. To make this connection, make use of the included green/yellow cable:

- Cut the enclosed cable lug to the shortest required length
- Crimp the matching cable lug onto the cable
- Join both ends and make sure both screws are securely fastened

Explosion proof instruments should fundamentally be integrated into equipotential bonding

Electrical connection

WARNING

Use in hazardous locations

Special requirements apply for the power supply, in- and output signals and ground connections.

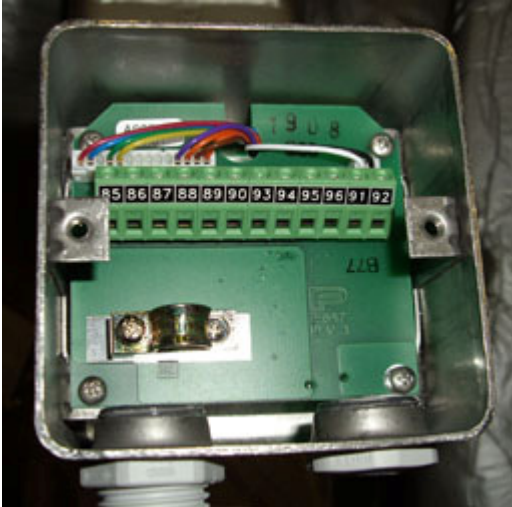
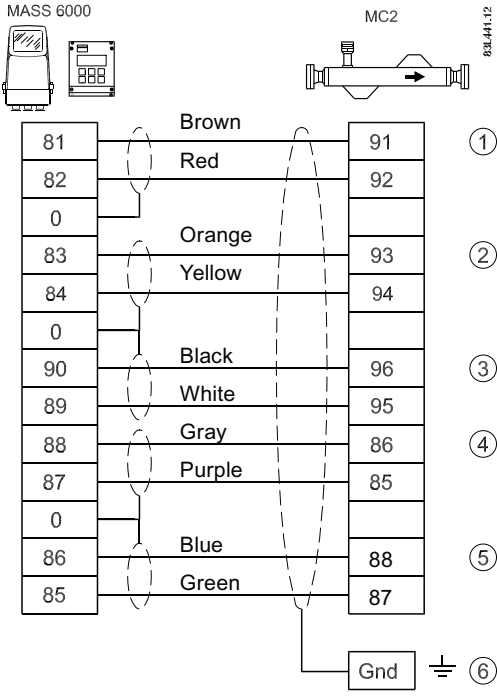


Figure 5-1 Example of sensor connection print (non ex-version)



- ① Driver
- ② Temp. sensor in (PT 100)
- ③ Temp. sensor out (PT 100)
- ④ Pick up 2
- ⑤ Pick up 1
- ⑥ Ground

Figure 5-2 Connection schematics

Connection in hazardous locations

The MC2 sensors are ex certified products (increased safety) up to 60 V.

This means that:

- All secondary circuits/terminals can be considered as limited circuits with non-hazardous voltage of max. 60 V.
- The MASS 6000 and MC2 can be connected with no further approvals.
- Equipment connected to the signal outputs (current, pulse etc) must however obtain the same high degree of isolation from mains supply as the MASS 6000 (Class 2 transformer or Class 1)

See also

For further information on the electrical connection of the sensor to the transmitter, see the operating instructions for the respective transmitters.

Commissioning

6.1 General requirements

Before commissioning it must be checked that:

- The device has been installed and connected in accordance with the guidelines provided in chapter 4 "Installing / Mounting (Page 15)" and 5 "Connecting (Page 21)"
- Device installed in hazardous location meets the requirements described in "Installation in hazardous location (Page 8)"

6.2 Zero point adjustment

Commissioning the device includes performing a zero point adjustment. In the following it is described how to prepare for a zero point adjustment, and how to activate an auto zero point adjustment.

Before zero point adjusting

- Install shut off devices in the pipeline. - When possible, both up- and downstream of the sensor. Otherwise: in horizontal installations at the outlet -in vertical installations at the inlet

CAUTION
In order to avoid damaging the pump and interrupting the process it is recommended to install a bypass line

Auto zero point adjustment

- Acclimate the transmitter (min. 30 min).
- Pump liquid at max. flow through the sensor (min. 2 min) in order to avoid air in the liquid.
- Stop the flow while pumping by shutting off the outlet valve and then the inlet valve. Wait min. 1 min. In this way there will be zero flow but the liquid remain pressurized within the sensor, which hinders de-gassing of the liquid, i.e. the release of air or other gas from the liquid.

Note

The flow must be completely stopped and the sensor completely filled with liquid.

- Perform an auto zero point adjustment:

MASS 6000	SIFLOW FC070
Choose menu entry "Reset mode" -> Zero adjust -> Zero adjust auto	Choose the SIMATIC PDM menu -> Device -> zero adjust

For further information on performing an auto zero point adjustment please refer to the relevant transmitter Operating Instructions.

- After count down (30 s.), the actual zero point is displayed and the meter ready for operation.

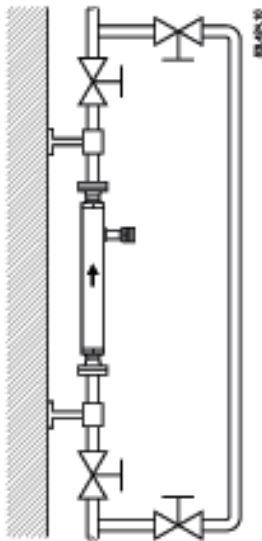


Figure 6-1 Best practise zero adjustment with a by-pass line and two shut-off devices

Maintenance and service

7.1 Maintenance

The device is maintenance-free, however a periodic inspection according pertinent directives and regulations must be carried out.

An inspection can include check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover screws
- Reliability of power supply, lightning protection, and grounds

7.2 Transportation/storage

The sensor is a fragile piece of equipment. Impact and shock can cause measuring inaccuracy. Therefore during transportation it must be placed in the transportation box delivered by Siemens Flow Instruments. If this is not possible, the alternative sensor packaging must be able to withstand the hazards from transportation.



7.3 Recalibration

Siemens Flow Instruments offers to recalibrate the sensor. The following calibrations are offered as standard:

- Standard calibration
- Matched pair calibration
- Customer specified matched pair calibration (up to 10 points)
- Accredited matched pair calibration

Note

For recalibration the memory unit must always be returned with the sensor

7.4 Technical support

CAUTION
Repair and service must be carried out by approved Siemens Flow Instruments personnel only.

Note

Siemens Flow Instrument defines sensors as non-repairable products.

Technical Support

If you have any technical questions about the device described in these Operating Instructions and do not find the right answers, you can contact Technical Support:

- Via the Internet using the **Support Request:**
Support request (<http://www.siemens.com/automation/support-request>)
- Phone: +49 (0) 180 5050 222

Further information about our technical support is available in the Internet at
Technical support (<http://support.automation.siemens.com/WW/view/en/16604318>)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Service and support (<http://www.siemens.com/automation/service&support>)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- A Knowledge Manager to find the right documents for you.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under "Services."

Additional Support

Please contact your local Siemens representative and offices if you have additional questions about the device

Find your contact partner at:

Local contact person (<http://www.automation.siemens.com/partner>)

7.5 Return procedures

Enclose the delivery note, the cover note for return delivery together with the declaration of decontamination form outside of the packing in a well fastened clear document pouch.

Required forms

- **Delivery Note**
- **Cover Note for Return Delivery** with the following information
Return delivery form (<http://support.automation.siemens.com/WW/view/en/16604370>)
 - kind (ordering number)
 - amount of devices or spare parts returned
 - reason for the return
- **Declaration of Decontamination**
Decontamination declaration
(http://pia.khe.siemens.com/efiles/feldg/files/Service/declaration_of_decontamination_en.pdf)

With this declaration you certify "that the returned products/spare parts have been carefully cleaned and are free from any residues."

If the device has been operated together with toxic, caustic, flammable or water-endangering products, you are requested to clean by rinsing or neutralizing, that all cavities are free from such dangerous substances. Afterwards check and ensure the cleaning.

We will not service a device or spare parts unless the declaration of decontamination confirms proper decontamination of the devices or spare part. Shipments without a declaration of decontamination will be cleaned professionally at your expense before further proceeding.

You can find the forms on the Internet and also on the CD delivered with the device.

Troubleshooting / FAQs

8.1 General information

Incorrect and unstable measurements, especially at low flows, are typically a result of an unstable zero point due to:

- Incorrect installation
- Air bubbles in the liquid
- Vibrations/Cross talk
- Solid particles in the liquid

In the following a 4 steps guide to troubleshooting is provided:

Step 1	Preliminary application inspection
Step 2	Zero point adjustment
Step 3	Measurement error calculation
Step 4	Application improvement

The guide will enable you to trace the reason for incorrect measurements and to improve the application.

8.2 Step 1: Inspecting the application

The first step in the troubleshooting procedure is to check for some easily resolved problems.

Check that:

- Sensor and SENSORPROM unit correspond (serial numbers)
- The sensor is properly installed.
- The sensor is located in a vibration-free position. Vibrations can disturb the sensor and therefore cause measurement error.
- The sensor is filled with liquid and liquid only. Air or gas bubbles in the liquid cause instability and can result in measurement errors.

Note

The liquid must be homogeneous in order to measure with high accuracy. If the liquid contains solid particles of greater density than the liquid, then these solids can precipitate, especially at low flow rates, which will cause instability in the sensor and lead to measurement errors.

Resolving step 1 problems

1. Make sure that the serial numbers on the sensor and the SENSORPROM® unit are identical.
2. Make sure that the sensor is installed as described in the installation chapter (Page 15) of the sensor manual.
3. Flush the pipe systems and the sensor for several minutes at maximum flow rate to remove any air bubbles which may be present.

8.3 Step 2: Performing a zero point adjustment

The second step in the troubleshooting procedure is to zero point adjust the device. For further information on zero point adjustment, see the commissioning chapter.

See also

Zero point adjustment (Page 25)

8.4 Step 3: Calculating the measurement error

Calculating the measurement error

The result of the zero point adjustment will show you whether the zero point was set under good and stable conditions. The lower the value of ZERO SIGMA, the lower the measuring error achievable.

For a well-installed flow meter, the ZERO SIGMA value is approximately the same order of magnitude as the specified zero point error for the sensor size. The specified zero point errors are indicated below

Table 8- 1 MC2 zero point error

Sensor size	Zero point error/ ZERO SIGMA value.
DN 20	0.6 kg/h
DN 25	0.96 kg/h
DN 40	2.85 kg/h
DN50	5.5 kg/h
DN65	11.4 kg/h
DN80	14,8 kg/h
DN100	25 kg/h
DN150	66 kg/h

Given the ZERO SIGMA value reading, it is possible to calculate the error which can be expected for different flow rates, without performing time-consuming measurements. So using this formula, one can assess if the application can be used as-is, or whether to use more time improving the installation.

E	=	Z x 100% / Qm
E	=	measurement error in % of flow rate
Z	=	Zero Sigma value in kg/h
Qm	=	current Flow rate in (kg/h)

Example 1: Low flow rate application

- Di 15 sensor. The sensor is specified to max. 5600 kg/h
- Zero point error/ ZERO SIGMA value is specified as 0.2 kg/h
- Flow: Min. 10 kg/h - Max. 100 kg/h

After the zero point adjustment, the ZERO SIGMA value 'Z' is read as 1 kg/h, i.e. a 5 times greater than that specified for the sensor.

The error for a flow rate of 10 kg/h is estimated as:

- $E = 1 \text{ kg/h} \times 100\% / 10 \text{ kg/h} = 10\%$.

For a flow rate of 100 kg/h the error is estimated as:

- $E = 1 \text{ kg/h} \times 100\% / 100 \text{ kg/h} = 1\%$

For this application it is necessary to investigate more closely what the cause of the relatively high ZERO SIGMA value is, in order to establish what needs to be done to improve the measurement accuracy.

Example 2 : High flow rate application

- Di 15 sensor. The sensor flow rate is specified as max. 5600 kg/h
- The zero point error/ZERO SIGMA value is specified as 0.2 kg/h
- Flow rate: Min. 1000 kg/h - Max. 3000 kg/h

After the zero point adjustment, the ZERO SIGMA value 'Z' is read as 1 kg/h, i.e. a 5 times greater value than that specified for the sensor !

The error at a flow rate of 1000 kg/h is estimated as:

- $E = 1 \text{ kg/h} \times 100\% / 1000 \text{ kg/h} = 0.1\%$

At a flow rate of 3000 kg/h the error is estimated to be:

- $E = 1 \text{ kg/h} \times 100\% / 3000 \text{ kg/h} = 0.03\%$
Plus the linearity error of 0.1 %

As can be seen, in this case it is not so important that the zero point, i.e. Zero Sigma Value is 1kg/h. The error due to the zero point is only 0.1 % for a flow rate of 1000 kg/h, and even less for a higher flow rate.

So for this installation with the given flow rate and zero point error (ZERO SIGMA value), you should typically choose not to spend more time finding ways to improve the application.

8.5 Step 4: Improving the application

It is not always worth while investing time and money in improving the installation and thus the measurement accuracy. However, it should always be checked where the zero point error (ZERO SIGMA value) originates from.

In the following it is described how to find the causes of a high ZERO SIGMA value and how to improve the installation.

Setting "low flow cut-off"

In order to see if the zero point becomes more stable when making changes / adjustments, the low flow cut-off must be set to 0,0%.

This is done from the transmitter:

MASS 6000	SIFLOW FC070
Choose menu entry "Basic settings"	Choose PDM table
-> Low flow cut-off	Choose input

When "low flow cut-off" has been set, it is possible to see the instability directly from the mass flow in kg/h in the transmitter display or the online window ("View->Display")

This information can be used to troubleshoot. For example, tightening the brackets which hold the sensor, or turning off the pump to check if vibrations from the pump are disturbing the sensor, etc.

Incorrect installation of the sensor

- Has the sensor been correctly installed, i.e. fastened to the floor / wall or frame with good mounting brackets as shown in the Instructions?

Especially for low flow rates, i.e. flow rates less than 10% of the maximum capacity of the flow meter, it is important that the sensor is correctly and stably installed.

If the sensor is not correctly fixed in place, the zero point of the sensor will move, leading to measuring errors.

Try to tighten up the sensor brackets to see whether the flow instability is reduced and now more stable.

Vibrations and cross talk

Vibrations in the pipe system are normally generated by pumps.

Typically, cross talk is generated by two sensors positioned in close proximity in the same pipe, or installed upon the same rail or frame.

Vibrations / cross talk have a greater or lesser effect upon the zero point stability and therefore also the measurement accuracy.

1. Check whether there are vibrations.

Turn off the pump and check whether the zero point stability improves, i.e. if the flow rate fluctuation in kg/h is reduced.

If the sensor is disturbed by vibration from the pump, the installation should be improved or the pump should be exchanged, e.g. to another type.

2. Check for cross talk.

Turn off the power to the other flow meter(s) and wait approximately 2 minutes, so the vibrating tubes in the sensor have stopped vibrating. Then check if the zero point stability has improved, i.e. that the fluctuation in kg/h has been reduced. If this is the case, the sensors disturb one another and the installation should be improved.

Air in the liquid

When air is present in the liquid, the zero point becomes unstable, which leads to a poorer measurement accuracy.

Checking for air:

- Check the Driver Current

MASS 6000	SIFLOW FC070
Menu entry	Online menu:
Service mode ->	View ->
Special information	Device status

- Check if the "Driver current" varies more than ± 1 mA. If this is the case, it is usually due to the presence of air or gas bubbles in the liquid.
- Increase the pressure in the sensor, creating a larger back pressure upon the sensor by reducing the opening of the outlet valve or by increasing the pump pressure. Thereby the size of air bubbles inside the sensor will be minimized. If the value or stability of "Driver current" falls, it is proof that the liquid contains air or gas bubbles.

Typical causes of air in the liquid

- The entry pipe and sensor have not been properly filled with liquid. The pump cavitates, the rotary speed of the pump is too high in relation to the supply of liquid to the pump.
- The flow rate in the pipe is too high, so components sitting in front of the flowmeter can cause cavitation.
- If there is a filter installed before the flow meter, it may be close to blocking, which also can cause cavitation.

Solid particles in the liquid

If the solid particles in a liquid have a density higher than that of the liquid, they can precipitate inside the sensor and cause instability which leads to a measurement error.

If solid particles are present in the liquid, they must be homogeneously distributed and have the same density as the liquid. Otherwise they can cause relatively large measurement errors.

It is important that the sensor is installed such that solid particles can easily run out of the sensor.

8.5 Step 4: Improving the application

- For MASS 2100 sensors this is achieved by a nearly horizontal installation with the entry highest and the outlet lowest.
 - For MC2 sensors it is achieved by a vertical installation or by a nearly horizontal installation with the entry highest and the outlet lowest.
1. Check if solid particles are present in the liquid:
Take a sample of the liquid, fill a glass and see if the solids precipitate.

Technical data

Versions	Mm	20	25	40	50	65	80	100	150
	Inch	¾	1	1½	2	2½	3	4	6
Number of measuring pipes		2							
Inside pipe diameter	2 x mm	8.0	10.0	16.0	22.0	29.0	34.0	43.1	76.1
Pipe wall thickness	Mm	1	1	1	1.5	1.5	2.0	2.6	3.2
Mass flow measuring range at pressure drop of 2 bar at 1 g/cm ³	Kg/h	4600	7360	21850	42600	87000	113400	192000	510000
Density	Kg/dm ³	0.5-3.5							
Fraction e.g. Brix	Brix	0-100							
Temperature	Standard	-50 to +180 °C							
	Ex	-20 to +180 °C							
Liquid pressure measuring pipe	PN	100	100	100	100	100	100	40	40
Stainless steel (DIN 2413, 20 °C)									
Materials, Wetted parts	Standard	SS 1.4571 or Hastelloy C4							
	Hygienic	SS 1.4435 (316L)							
Enclosure		IP67							
Enclosure material / connection box		1.4301 / aluminium							
Process connections		See Dimensions (Page 43)							
Electrical connections		Screw terminals, M20							
Cable length	m	Max. 300							
Cable connection		5 x 2 x 0.35 mm ² twisted and screened in pairs, ext. Ø 12mm							
Ex-version		II 2G EEx em [ib] IIC T6 (≤ DN 40 [1½"])							
ATEX 1443X		II 1/2 EEx em [ib] II C T6 (> DN 50 [2"])							
Weight approx	kg	13	14	18	34	47	58	91	260

Output

Table 9- 1 Display / frequency and pulse output MC2 sensors

	5%	50%	100%
DN 20	150 kg/h	3000 kg/h	4600 kg/h

9.1 Pressure / temperature range

DN 25	240 kg/h	4800 kg/h	7360 kg/h
DN 40	712,5 kg/h	14250 kg/h	21850 kg/h
DN 50	2130 kg/h	21.300 kg/h	42600 kg/h
DN 65	4350 kg/h	43500 kg/h	87000 kg/h
DN 80	5670 kg/h	56700 kg/h	113400 kg/h
DN 100	9600 kg/h	96000 kg/h	192000 kg/h
DN 150	25500 kg/h	255000 kg/h	510000 kg/h

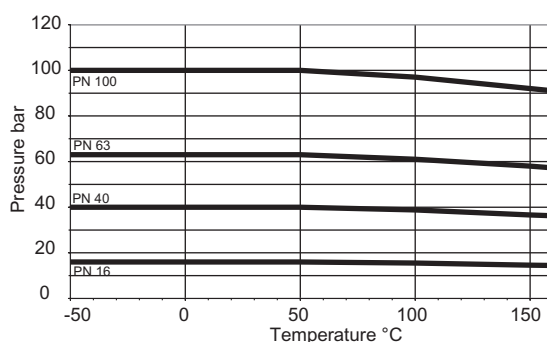
Reference conditions

Table 9- 2 Reference conditions (ISO 9104 and DIN/EN 29104)

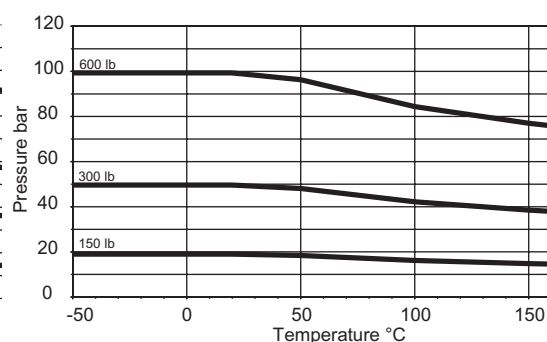
Flow conditions	Fully developed flow profile
Temperature of medium	20°C ± 2K
Ambient temperature	20°C ±2 K
Liquid pressure	2 ± 1 bar
Density	0.997 g/cm3
Brix	40 °Brix
Supply voltage	Un ±1%
Warming-up time	30 min.
Cable length	5 m between transmitter and sensor

9.1 Pressure / temperature range

Table 9- 3 Material load curves for flanged flowmeters



DIN Flanges SS 1.4571/316Ti to DN 100 (4")



ASME Flanges SS 1.4571/316Ti to DN 100 (4")

Table 9- 4 Material strength for process connections

Process connections	Size		PS _{max} 20°C	TS _{max}	TS _{min}
	DN	Inch	bar (psi g)	°C (°F)	°C (°F)
Thread acc. DIN 11851	15 ... 40	½ ... 1½	40 (580)	140 (284)	-40 (-40)
	50 ... 1000	2 ... 4	25 (363)	140 (284)	-40 (-40)
Tri-Clamp acc. DIN 32676	15 ... 50	½ ... 2	16 (232)	120 (248)	-40 (-40)
	65 ... 1000	2½ ... 4	10 (145)	120 (248)	-40 (-40)

9.2 Pressure drop

Calculation of pressure drop

The pressure drop through the instrument is a function of the properties of the fluid and the flow rate. The online Sizing Program can be used to calculate the pressure drop.

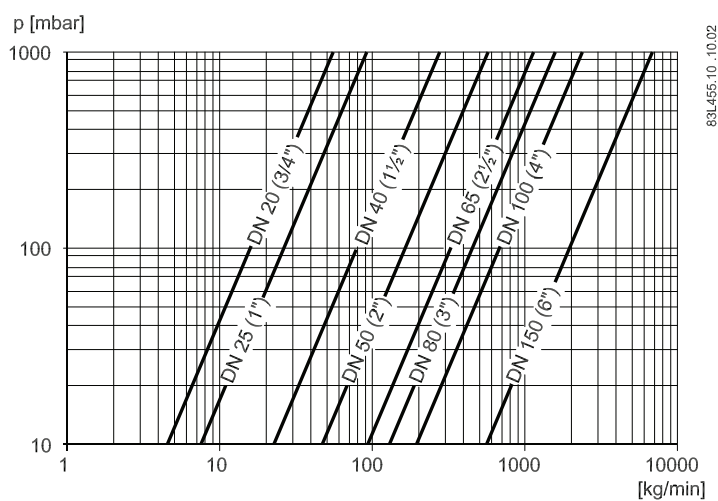


Figure 9-1 Pressure drop

See also

Online Sizing program for Coriolis sensors
(<http://pia.khe.siemens.com/index.aspx?nr=11381>)

9.3 Accuracy

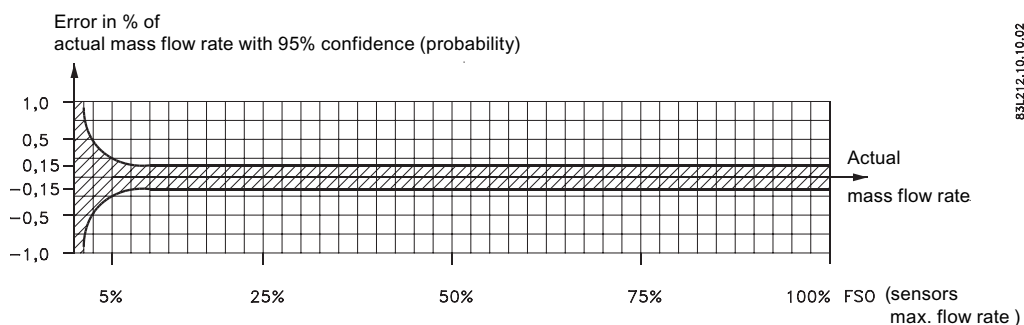


Figure 9-2 Standard calibration curve.

E current

$$E = \pm \sqrt{(0,10)^2 + \left(\frac{z \times 100}{qm}\right)^2}$$

- E = Error [%]
- Z = Zero point error [kg/h]
- qm = Mass flow [kg/h]

Qmax. at 2.0 bar pressure loss at 1 g/cm³

Measuring type accuracy

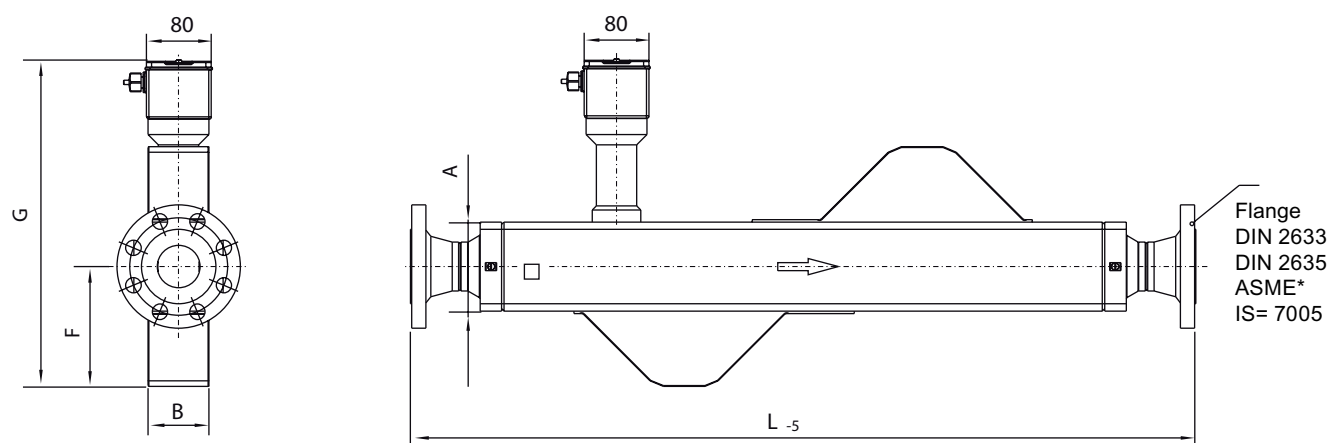
Version		DN 20	DN 25	DN 40	DN 50	DN 65	DN 80	DN 100	DN 150
Mass flow:	Linearity error % of rate	±0.15							
	Repeatability error % of rate	±0.1							
	Max. zero point error [kg/h]	±0.6	±0.96	±2.85	±5.52	±11.34	±14.76	±24.96	±66.00
Density error: (Standard)	[kg/l]	±0.005							
Density error (Extended)	[g/cm ³]	±0.001							N/A
Range	[g/cm ³]	0-3.5							
Repeatability error	[g/cm ³]	±0.0001							
Temperature error	[°C]	±1.0							
Brix error	[°Brix]	±0.2							N/A

N/A = Not available

Dimensions

10.1 Dimensions of MC2

Remote design, flanged construction, DIN/ANSI



Meter size	Process connection size		L [mm (inch)]						G1 [mm (inch)]	F [mm (inch)]	B [mm (inch)]	A [mm (inch)]	Weight
	Inch	D N	DIN 11864-2 form A	DIN 2635 PN 40	DIN 2637 PN 100	ANSI CL 150	ANSI CL 300	ANSI CL 600					
50 (2)	2	50	918 (36.14)	940 (37.01)	979 (38.54)	970 (38.19)	980 (38.58)	1001 (39.41)	403 (15.87)	148 (5.83)	80 (3.15)	110 (4.33)	34
	2½	65	1081 (42.56)	1100 (43.31)	1148 (45.20)	1218 (47.95)	1228 (48.35)	1248 (49.13)					38
65 (2½)	2	50	1197 (47.13)	1220 (48.03)	1259 (49.57)	1250 (49.21)	1260 (49.61)	1281 (50.43)	429 (16.89)	164 (6.64)	97 (3.82)	130 (5.12)	43
	2½	65	1081 (42.56)	1100 (43.31)	1148 (45.20)	1218 (47.95)	1228 (48.35)	1249 (49.17)					47
	3	80	1200 (47.24)	1220 (48.03)	1260 (49.61)	1240 (48.82)	1260 (49.61)	1282 (50.47)					50
80 (3)	2½	65	1310 (51.57)	1330 (52.36)	1378 (54.25)	1365 (53.74)	1375 (54.13)	1396 (54.96)	456 (17.95)	186 (7.32)	108 (4.25)	140 (5.51)	56
	3	80	1200 (47.24)	1220 (48.03)	1260 (49.61)	1240 (48.82)	1260 (49.61)	1282 (50.47)					58
	4	100	1463 (57.60)	1480 (58.27)	1530 (60.24)	1500 (59.06)	1520 (59.84)	1568 (61.73)					69

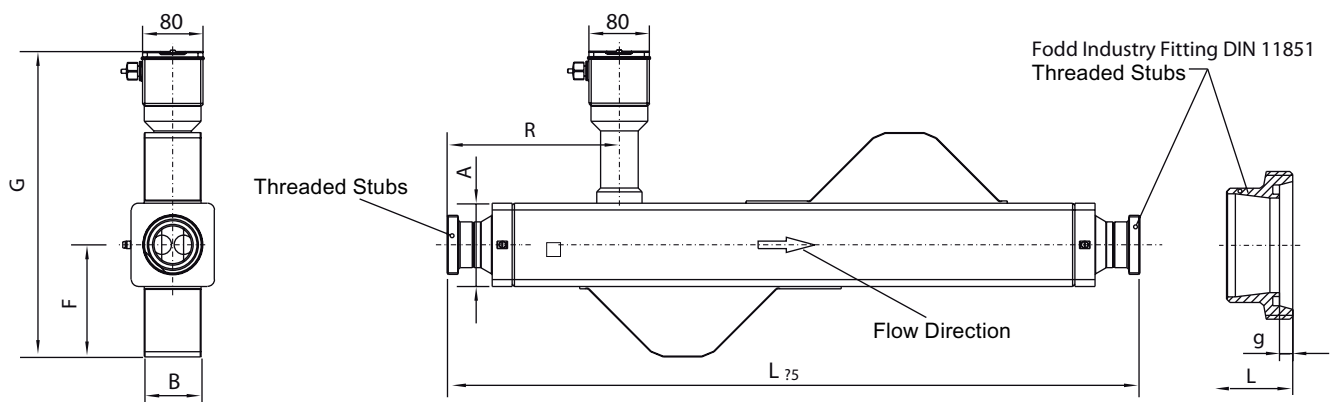
Dimensions

10.1 Dimensions of MC2

100 (4)	3	80	1618 (63.70)	1640 (64.57)	1680 (66.14)	1660 (65.35)	1680 (66.14)	1702 (67.01)	500 (19.69)	215 (8.46)	131 (5.16)	170 (6.69)	84
	4	100	1463 (57.60)	1480 (58.27)	1530 (60.24)	1500 (59.06)	1520 (59.84)	1568 (61.73)					91
	6	150	N/A	1778 (69.92)	N/A	1806 (71.10)	1826 (71.89)	N/A					120
150 (6)	6	150	N/A	2040 (80.31)	N/A	2070 (81.50)	2090 (82.28)	N/A	613 (24.13)	285 (11.22)	190 (7.84)	260 (9.84)	260

1) For Ex add 54 mm.

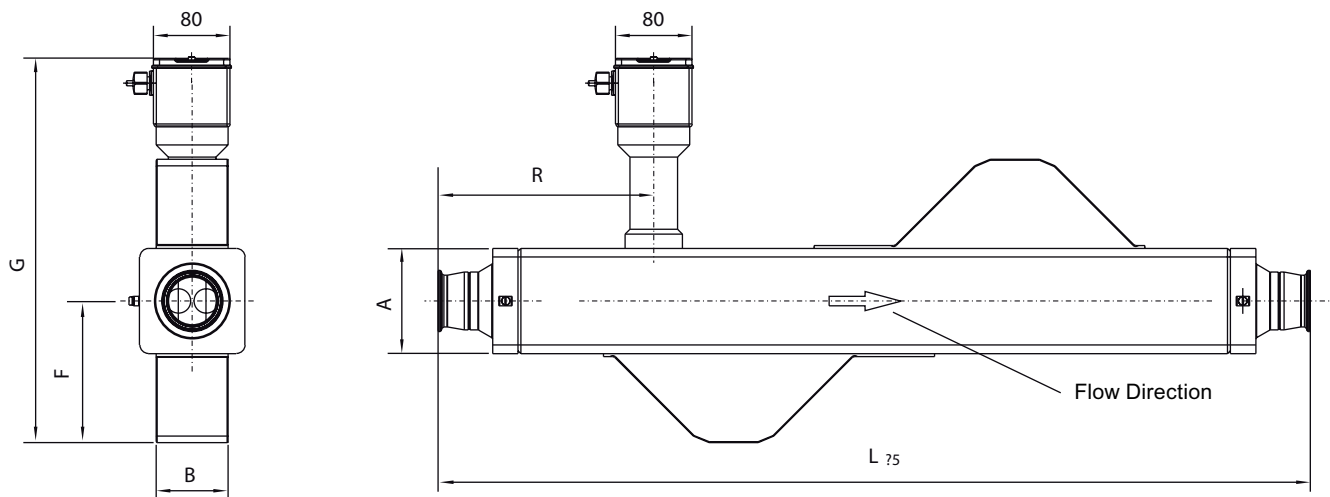
Remote design, food industry fittings, DIN 11851



Meter size	Process connection size			L	G	G1	F	B	A	R	Weight
DN (Inch)	Inch	DN		mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg
50 (2)	2	50	Rd 78 x 1/6	918 (36.14)	7 (0.28)	403 (15.87)	148 (5.83)	80 (3.15)	110 (4.33)	177 (6.97)	30
	2½	65	Rd 95 x 1/6	1081 (42.56)	8 (0.31)					254 (10.00)	34
65 (2½)	2	50	Rd 78 x 1/6	1197 (47.13)	7 (0.28)	429 (16.89)	164 (6.46)	97 (3.82)	130 (5.12)	291 (11.46)	40
	2½	65	Rd 95 x 1/6	1081 (42.56)	8 (0.31)					227 (10.91)	44
	3	80	Rd 110 x 1/6	1200 (47.24)	8 (0.31)					281 (11.06)	47
80 (3)	2½	65	Rd 95 x 1/6	1310 (51.57)	8 (0.31)	456 (17.95)	186 (7.32)	108 (4.25)	140 (5.51)	319 (12.56)	54
	3	80	Rd 110 x 1/6	1200 (47.24)	8 (0.31)					258 (10.16)	56
	4	100	Rd 110 x 1/6	1463 (57.60)	10 (0.39)					381 (15.00)	62

100 (4)	3	80	Rd 110 x 1/6	1618 (63.70)	8 (0.31)	500 (19.69)	215 (8.46)	131 (5.16)	170 (6.69)	401 (15.79)	82
	4	100	Rd 130 x 1/4	1463 (57.60)	10 (0.39)					314 (12.36)	86

Remote design, Tri-clamp DIN 32676 (ISO 2852)



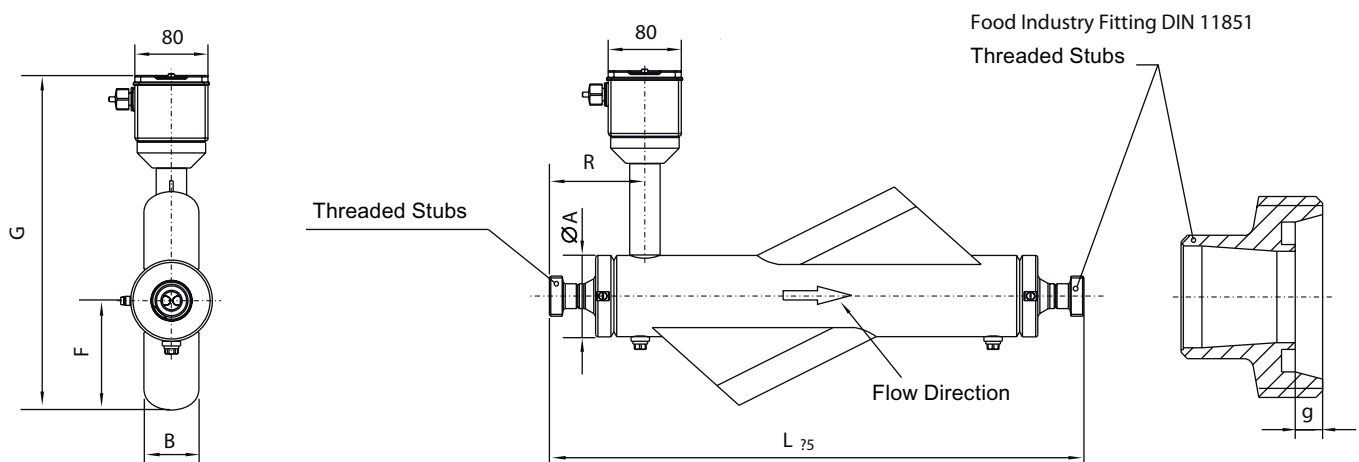
Meter size		Process connection size		L	G1)	F	B	A	R	Weight
Inc h	DN	Inch	DN	mm (inch) ± 3	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg
2	50	2	50	913 (35.94)	403 (15.87)	148 (5.83)	80 (3.15)	110 (4.33)	225 (8.86)	26
		2½	65	1073 (42.24)					305 (12.01)	27
2½	65	2	50	1192 (46.93)	429 (16.89)	164 (6.46)	97 (3.82)	130 (5.12)	335 (13.19)	36
		2½	65	1073 (42.24)					275 (10.83)	37
		3	80	1180 (46.46)					328 (12.91)	38
3	80	2½	65	1302 (51.26)	456 (17.95)	186 (7.32)	108 (4.25)	140 (5.51)	378 (14.88)	45
		3	80	1180 (46.46)					296 (11.65)	44
		4	100	1448 (57.01)					430 (16.93)	46
4	100	3	80	1598 (62.91)	500 (19.69)	215 (8.46)	131 (5.16)	170 (6.69)	440 (17.32)	71
		4	100	1448 (57.01)					365 (14.37)	69

10.2 Dimensions of MC2 Hygienic



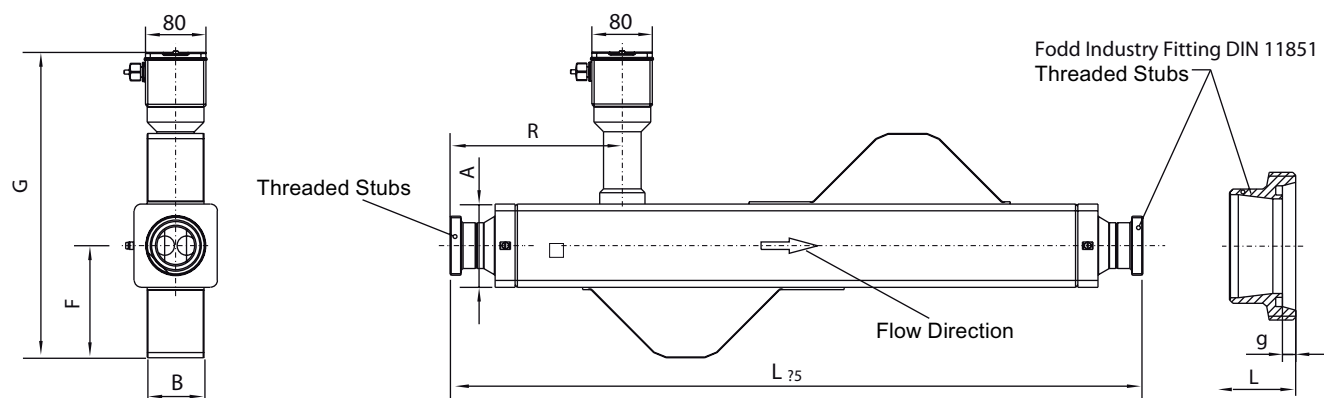
Figure 10-1 EHEDG certified

Remote design, Food Industry Fitting, DIN 11851, DN 20-25



Meter size		Process connection size			L	g	G1)	F	B	A	R	Weight
Inch	DN	Inch	DN		mm (inch)	mm (inch)	mm (inch)	mm (inch)]	mm (inch)	mm (inch)	mm (inch)	kg
¾	20	½	15	Rd34 x 1/8	672 (26.46)	4 (0.16)	358 (14.94)	127 (5.00)	66 (2.60)	89 (3.50)	152 (5.98)	13
		¾	20	Rd44 x 1/6	583 (22.95)	6 (0.24)					102 (4.02)	
		1	25	Rd52 x 1/6	683 (26.89)	7 (0.28)					152 (5.98)	
1	25	2½	65	Rd44 x 1/6	743 (29.25)	6 (0.24)	358 (14.94)	127 (5.00)	66 (2.60)	89 (3.50)	162 (6.38)	14
		3	80	Rd52 x 1/6	643 (25.31)	7 (0.28)					112 (4.11)	
		4	100	Rd65 x 1/6	786 (30.94)	7 (0.28)					185 (7.28)	

Remote design, Food Industry Fitting, DIN 11851, DN 40-80

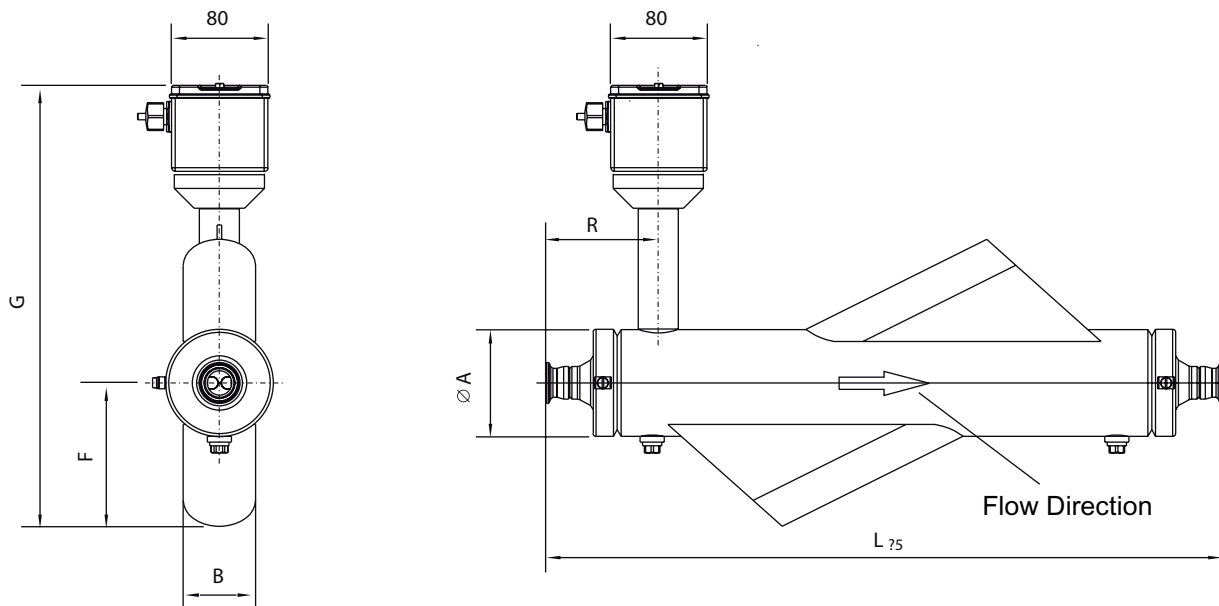


Meter size		Process connection size			L	g	G1)	F	B	A	R	Weight
Inch	DN	Inch	DN		mm (inch)	mm (inch)	mm (inch)	mm (inch)]	mm (inch)	mm (inch)	mm (inch)	kg
1½	40	1	25	Rd52 x 1/6	864 (34.02)	7 (0.28)	374 (14.72)	129 (5.08)	64 (2.52)	90 (3.54)	218 (8.58)	16
		1½	40	Rd65 x 1/6	761 (29.96)	7 (0.28)					164 (6.46)	18
		2	50	Rd78 x 1/6	918 (36.14)	7 (0.28)					241 (9.49)	19
2	50	1½	40	Rd65 x 1/6	1025 (40.35)	7 (0.28)	403 (15.87)	148 (5.83)	80 (3.15)	110 (4.33)	233 (9.17)	28
		2	50	Rd78 x 1/6	918 (36.14)	7 (0.28)					177 (6.97)	30
		2½	65	Rd95 x 1/6	1081 (42.56)	8 (0.31)					254 (10.00)	34
2½	65	2	50	Rd78 x 1/6	1197 (47.13)	7 (0.28)	429 (16.89)	164 (6.46)	97 (3.82)	130 (5.12)	291 (11.46)	40
		2½	65	Rd95 x 1/6	1081 (42.56)	8 (0.31)					227 (8.94)	44
		3	80	Rd110 x 1/4	1200 (47.24)	8 (0.31)					281 (11.06)	47
3	80	2½	65	Rd95 x 1/6	1310 (51.57)	8 (0.31)	456 (17.95)	186 (7.32)	108 (4.25)	140 (5.51)	319 (12.56)	54
		3	80	Rd110 x 1/4	1200 (47.24)	8 (0.31)					258 (10.16)	56
		4	100	Rd130 x 1/4	1463 (57.60)	10 (0.39)					381 (15.00)	60
4	100	3	80	Rd110 x 1/4	1618 (63.70)	8 (0.31)	500 (19.68)	215 (8.46)	131 (5.16)	170 (6.69)	401 (15.79)	82
		4	100	100 4" Rd130 x 1/4	1463 (57.60)	10 (0.39)					314 (12.36)	86

Dimensions

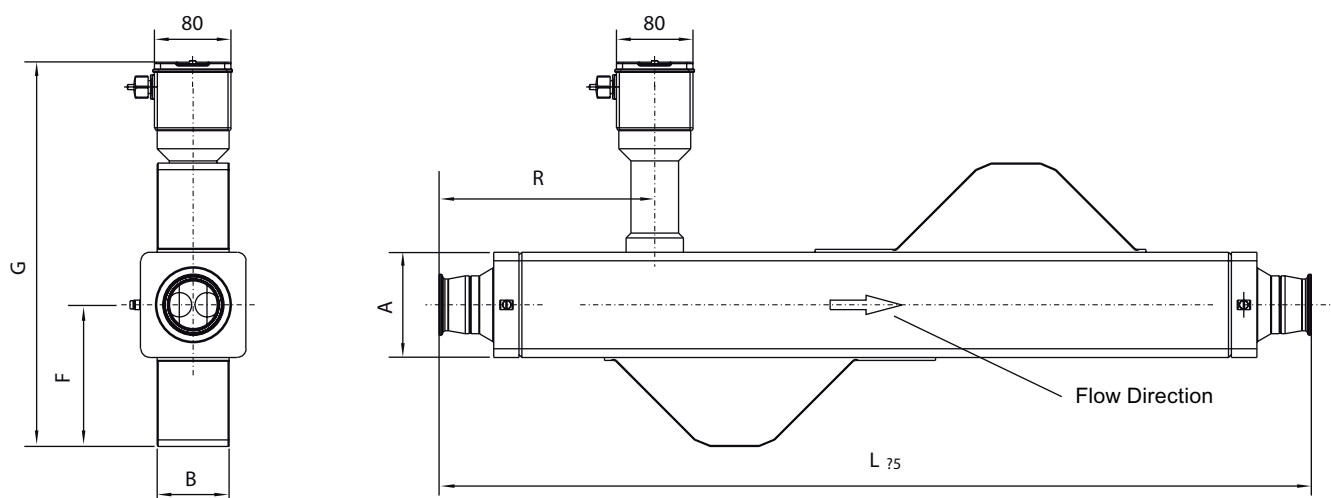
10.2 Dimensions of MC2 Hygienic

Remote design Tri-clamp DIN 32676, DN 20-25



Meter size		Process connections		L-5	G	F	B	øA	R	Weight
Inch	DN	DN	Inch	Mm (Inch)	Mm (inch)	Mm (inch)	Mm (inch)	Mm (inch)	Mm (inch)	kg
¾	20	15	½	656 (25.83)	358 (14.09)	127 (5.00)	66 (2.60)	89 (3.50)	140 (5.51)	12
		20	¾	561 (22.09)					92 (3.62)	
		25	1	661 (26.02)					142 (5.59)	
1	25	20	¾	721 (28.39)	358 (14.09)	127 (5.00)	66 (2.60)	89 (3.50)	152 (5.98)	13
		25	1	621 (24.45)					102 (4.02)	
		40	1½	773 (30.43)					180 (7.09)	

Remote design Tri-clamp DIN 32676, DN 40-80



Meter size		Process connections		L-5	G	F	B	øA	R	Weight
Inch	DN	DN	Inch	Mm (Inch)	Mm (inch)	Mm (inch)	Mm (inch)	Mm (inch)	Mm (inch)	kg
1½	40	25	1	842 (33.15)	374 (14.72)	129 (5.08)	64 (2.52)	90 (3.54)	242 (9.53)	17
		40	1½	748 (29.45)					195 (7.68)	17
		50	2	913 (35.94)					278 (10.94)	18
2	50	40	1½	1012 (39.84)	403 (15.87)	148 (5.83)	80 (3.15)	110 (4.33)	275 (10.83)	27
		50	2	913 (35.94)					225 (8.86)	26
		65	2½	1073 (42.24)					305 (12.01)	27
2½	65	50	2	1192 (46.93)	429 (16.89)	164 (6.46)	97 (3.82)	130 (5.12)	335 (13.19)	36
		65	2½	1073 (42.24)					275 (10.83)	37
		80	3	1180 (46.46)					328 (12.91)	38
3	80	65	2½	1302 (51.26)	456 (17.95)	186 (7.32)	108 (4.25)	140 (5.51)	378 (14.88)	45
		80	3	1180 (46.46)					296 (11.65)	44
		100	4	1448 (57.01)					430 (16.93)	46

Dimensions

10.2 Dimensions of MC2 Hygienic

4	100	80	3	1598 (62.91)	500 (19.68)	215 (8.46)	131 (5.16)	170 (6.69)	440 (17.32)	71
		100	4	1448 (57.01)					365 (14.37)	69

If this connection is supplied with an EHEDG-certified device, the device nominal sizes must correspond with the connection

A

Appendix

All certificates are posted on the Internet. Additionally, the CE Declaration of Conformity as well as EX approvals are available on the Sitrans F literature CD-ROM Certificates on the Internet (<http://support.automation.siemens.com/WW/view/en/10806951/134200>)

A.1 Accessories and spare parts

In order to ensure that the ordering data you are using is not outdated, the latest ordering data is always available on the Internet: Process instrumentation catalog (<http://www.siemens.com/processinstrumentation/catalogs>)

Glossary

ASIC

Application-Specific Integrated Circuit is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use.

BRIX

Degrees Brix (symbol °Bx) is a measurement of the mass ratio of dissolved sugar to water in a liquid. A 25 °Bx solution is 25% (w/w), with 25 grams of sugar per 100 grams of solution.

CAN

Controller Area Network. CAN is the leading serial bus system for embedded control. CAN is a mainstream network and was internationally standardized (ISO 11898–1) in 1993.

Coriolis

The Coriolis effect is an apparent deflection of moving objects from a straight path when they are viewed from a rotating frame of reference. The effect is named after Gaspard-Gustave Coriolis, a French scientist who described it in 1835. The Coriolis effect is caused by the Coriolis force, which appears in the equation of motion of an object in a rotating frame of reference.

DFT

The discrete Fourier transform (DFT) is one of the specific forms of Fourier analysis. As such, it transforms one function into another, which is called the frequency domain representation, or simply the DFT, of the original function (which is often a function in the time domain). The DFT evaluates enough frequency components to reconstruct the finite segment that was analyzed. The DFT is thus a transform for Fourier analysis of finite-domain discrete-time functions.

EMC

Electromagnetic compatibility (EMC) is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects (Electromagnetic Interference, or EMI) that such energy may induce. The goal of EMC is the correct operation, in the same electromagnetic environment, of different equipment which use electromagnetic phenomena, and the avoidance of any interference effects.

Fraction

Fraction designates a proportional relation between an object part and the object whole. For example, the fraction $\frac{3}{4}$ represents three equal parts of a whole object, divided into four equal parts.

HART

HART Communication is a bi-directional industrial field communication protocol used to communicate between intelligent field instruments and host systems. HART is the global standard for smart process instrumentation and the majority of smart field devices installed in plants worldwide are HART-enabled. HART technology is easy to use and very reliable

IP

An IP (Ingress Protection) number is used to specify the environmental protection of enclosures around electronic equipment. These ratings are determined by specific tests. The IP number is composed of two numbers, the first referring to the protection against solid objects and the second against liquids. The higher the number, the better the protection. For example, in IP67 the first Number (6) means that the device is totally protected against dust, and the second (7) that it is protected against the effect of immersion between 15cm and 1m

MODBUS

MODBUS is a serial communications protocol intended for use with programmable logic controllers (PLCs). MODBUS allows for communication between many devices connected to the same network, for example a system that measures temperature and humidity and communicates the results to a computer. MODBUS is often used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition systems.

NAMUR

Normenarbeitsgemeinschaft für Meß- und Regeltechnik in der Chemischen Industrie (NAMUR). NAMUR is a group representing the interests of the chemical industry which create standards for instrumentation and electrical devices used in industrial plants.

PED

The Pressure Equipment Directive (97/23/EC) is the legislative framework on European level for equipment subject to a pressure hazard. It was adopted by the European Parliament and the European Council in May 1997 and has been obligatory throughout the European Union since May 2002.

Plato

Plato is a measure of the weight of the solids dissolved in water. It is expressed in %.

PROFIBUS

PROFIBUS (Process Field Bus) is a vendor-independent, open bus system standardized in the German DIN 19 245. It is a standard for field bus communication in automation technology and should not be confused with the PROFINET standard for industrial Ethernet. PROFIBUS-PA (Process Automation) is one of three PROFIBUS variants that are compatible with each other. PROFIBUS-DP (Decentralized Periphery)

SENSORPROM

All sensor related settings/data saved on an EPROM. SENSORPROM technology automatically configures the transmitter at start up providing calibration data, pipe size, sensor type, and output settings. The SENSORPROM automatically stores values or settings changed by users, and automatically re-programs any new transmitter without loss of accuracy.

Turndown ratio

'Turndown ratio' is a flow measurement term indicating the range a specific flow meter, or meter type, is able to measure with acceptable accuracy. It is also known as rangeability. If a gas flow to be measured is expected to vary between 100,000 m³ per day and 1,000,000 m³ per day, the specific application has a turndown ratio of at 10:1. Therefore the meter requires a turndown ratio of at least 10:1.

USM

USM II is a Communication Platform. The Siemens USM II concept enables fitting of add-on bus modules without loss of functionality:

1. All modules can be fitted as true "plug & play"
2. Module and transmitter are automatically configured through the SENSORPROM

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For more information

www.siemens.com/flow

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