



Coriolis Dosing Mass Flow Meter

Series FMD

Operating Manual



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Foreword

I. Transport, Delivery, Storage

Always protect devices against humidity, soiling, impacts and damages.

Delivery Inspection:

Check the delivery for completeness upon receipt. Compare the device data with the data on the delivery note and in the order records.

Report any in-transit damage immediately. Damage reported at a later date shall not be recognized.

II. Warranty

Please refer the contractual terms and conditions relating to delivery for the scope and period of warranty. Warranty claims shall be conditional to correct installation and commissioning in accordance with the operating instructions of the device. The necessary installation, commissioning and maintenance work should only be carried out by qualified and authorized personnel.

III. General Safety Instructions

1. Dosing flowmeters are reliable and high accurate measuring devices. They should only be used for their intended purpose. Always observe the pressure and temperature limits stated on the type plate, as well as all other technical data and safety information during device installation, start-up and operation.
2. Always observe national and international regulations concerning the operation of devices and systems under pressure.
3. Prior to installation, the operator has to ensure that the pressure bearing parts have not been damaged during transportation.
4. The devices have to be installed, operated and serviced by qualified personnel. The operator has the responsibility to ensure that the personnel have received sufficient and appropriate training. In cause of doubt, please contact the manufacturer.
5. Only the measurement of liquids that provide for integrity of the materials used is allowed.
6. Symbols used



Warning!

Failure to observe this warning can lead to injury of persons or a security risk.



Attention:

Non-compliance can lead to faulty operation or damage to the device.

1. Identification

Manufacturer: Bopp & Reuther Messtechnik GmbH
Am Neuen Rheinhafen 4
67346 Speyer
Phone: +49 6232 657-0
Fax: +49 6232 657-505

Product type: Direct mass flowmeter (Coriolis mass flowmeter)

Product name: FMD-Series Dosing Flowmeter

Version No. A-EN-05809-00Rev.A

2. Area of Application

The area of application of all the FMD dosing flowmeters is the measurement and the dosing of liquid flows. They are used to dispense liquids with different properties. The focus is on the measurement of non-conductive liquids with a low content of gas or solids. This equipment is also designed for the purposes of measurement of oil, distilled water, or alkanes. As a result, they complete the range of dosing flowmeters manufactured by Bopp & Reuther Messtechnik GmbH along with magnetic inductive flowmeters and dosing oval gear flowmeters.

Due to the measuring principle, direct measurement of the mass of dosage is possible.

Coriolis Dosing Mass Flow Meter Series FMD provides the highest quality of dosing due to their highly accurate measurement even at very short intervals of dosing.

The Series FMD is manufactured with nominal sizes DN10 and DN15. Depending on the type of process connection, they can be used up to PN 40; the maximum operating temperature is 90 °C. For cleaning and sterilization the devices can be subjected to SIP processes up to 140 °C.

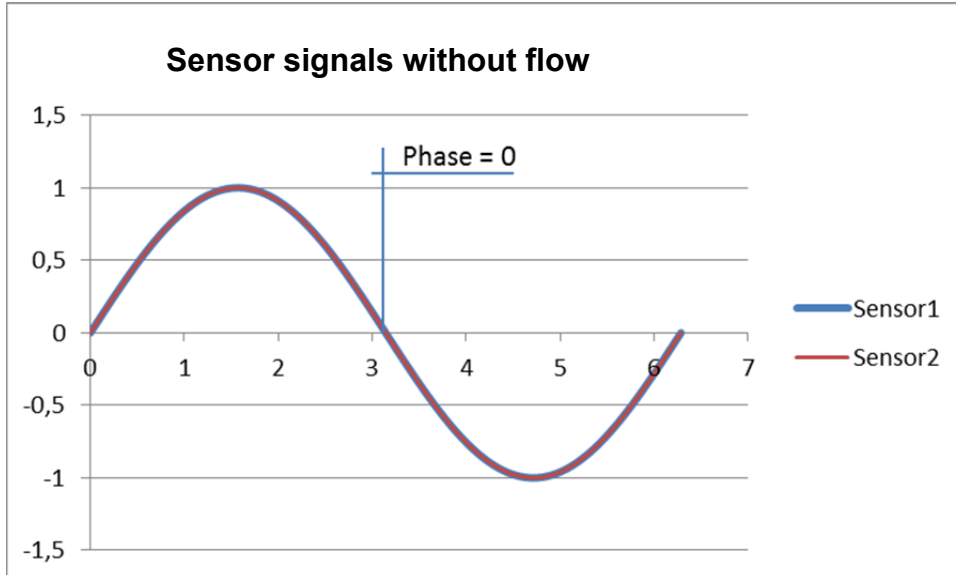
As an accessory for the Coriolis Mass Flow Meter there is a compact controller with touch screen and integrated PLC. So can be operated independently 4 dosing points.
With the help of such a compact controller, small filling and dosing systems can easily and conveniently be put together.

3. Principle of Operation and System Design

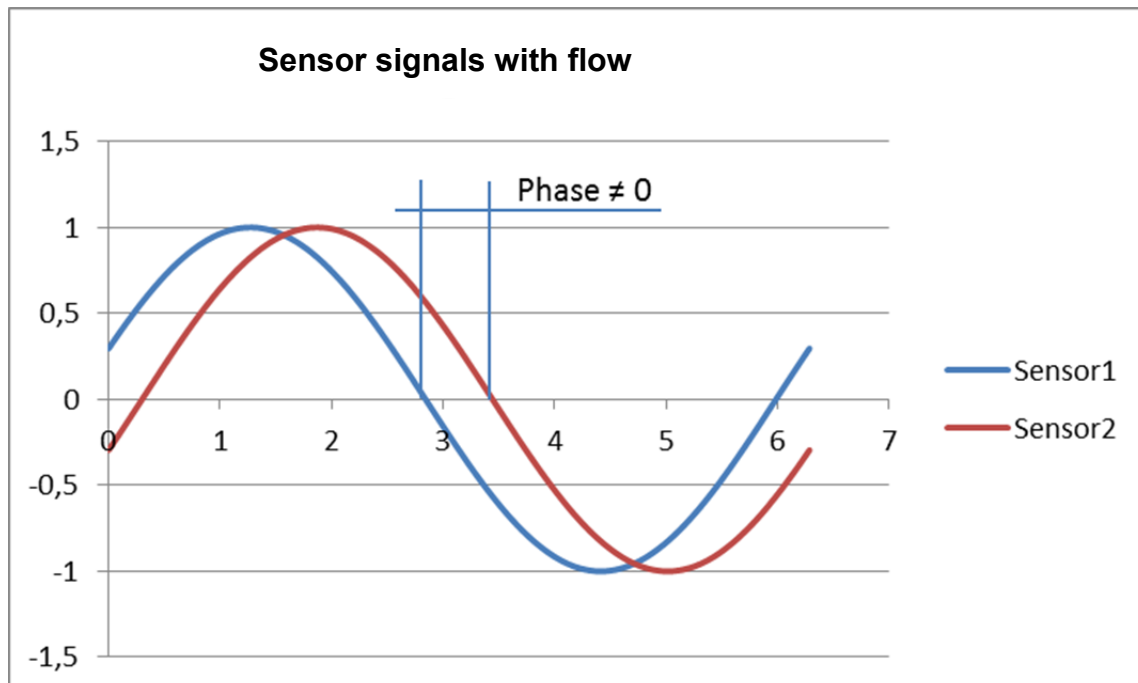
3.1 Measuring Principle

Dosing flowmeters that use the Coriolis principle are classified as direct mass flowmeters. They consist of two U-shaped measuring tubes, an actuator, and two sensors.

In operation, the two measuring tubes are stimulated to an antiphase oscillation. Without flow, both sides of the measuring tubes vibrate equally and the sensors deliver in-phase signals.



When liquid flows through the measurement tubes, the inlet end of the tube decelerates and the outlet end of the tube accelerates by the occurring Coriolis effect. As a result a phase difference in the two sensor signals is generated, which is proportional to the mass flow.



3.2 Design

The Coriolis Dosing Mass Flow Meter Series FMD has a compact design and consists of the following components:

Sensor:

The sensor consists essentially of two parallel measuring tubes. Sensors are mounted to these tubes on the inlet side and the outlet side. Excitation leads to vibration of the measuring tubes. Additionally a temperature sensor is installed. At the inlet and the outlet flow dividers are installed that distribute the measured medium between the measuring tubes.

Transducer electronic:

The transducer electronic is connected to the sensor. The electronic receives the signals sent by the sensor and calculates the measuring values. Pulses are generated in accordance with the flow and sent to the control unit. The electronic expect a status signal of the control unit (see § 4.3).

4. Input

4.1 Measured Value

Mass flow

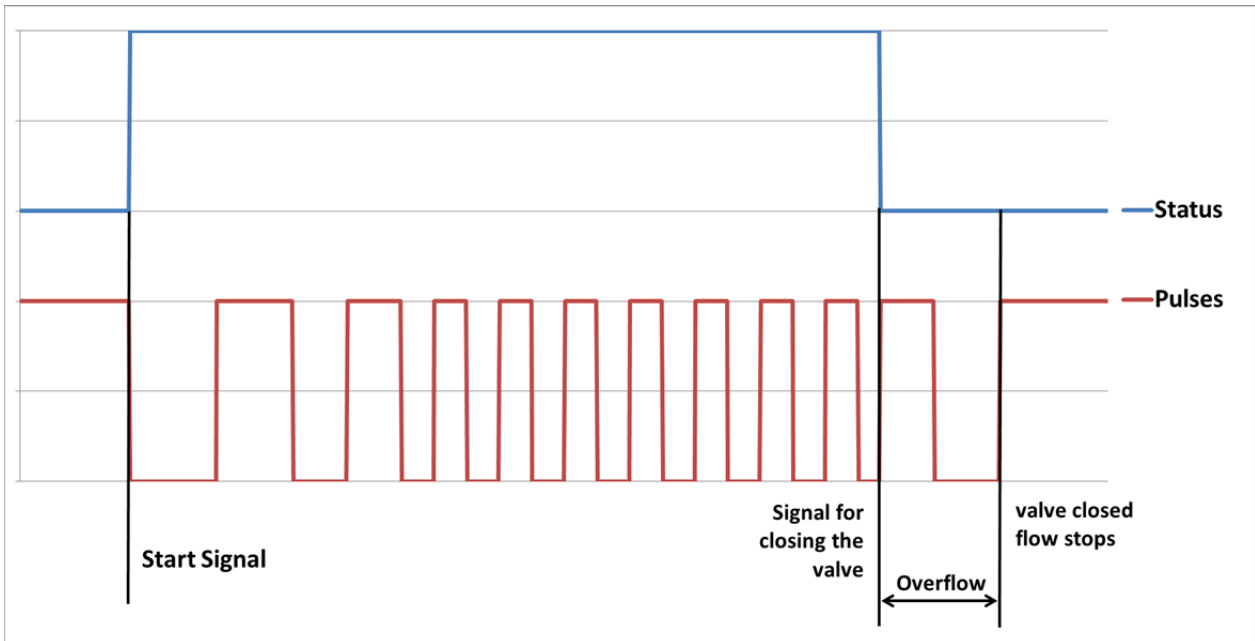
4.2 Measurement Range

Type	Nominal Diameter	Nominal Flow [kg / min]	Pulse factor [Imp/g]
FMD06	10	1 - 25	63,660
FMD08	15	2 - 45	28,293

The sensors are designed in such a way that at nominal flow (with water at 20 °C) a pressure drop of approximately 1 bar occurs. The devices can easily be operated at higher flow rates. But it is important to ensure that cavitation does not occur.

4.3 Status Signal

The dosing flowmeter requires a valve status signal from the control unit.



Pulses are generated only after the status signal is switched on/active. Even after the signal to close the valve was given, pulses are generated until the flow completely stops. Pulses arriving after the signal to close the valve are so-called overflow (trailing volume). This depends on the used valve and can be accounted in the control unit to achieve precisely the required initial set.

5. Output

5.1 Output Signal

A pulse output is available for transmitting of the measured mass flow. The output pulses are active, i.e., they don't require an external power supply. Only an external pull-down resistor is necessary, which, however, is already included in the input circuit of the majority of control units.

The pulse output Idle High.

The pulse-pause ratio is 1:1.

Pulse voltage corresponds to the supply voltage.

The maximum load of the output is 20 mA.

6. Characteristic parameter

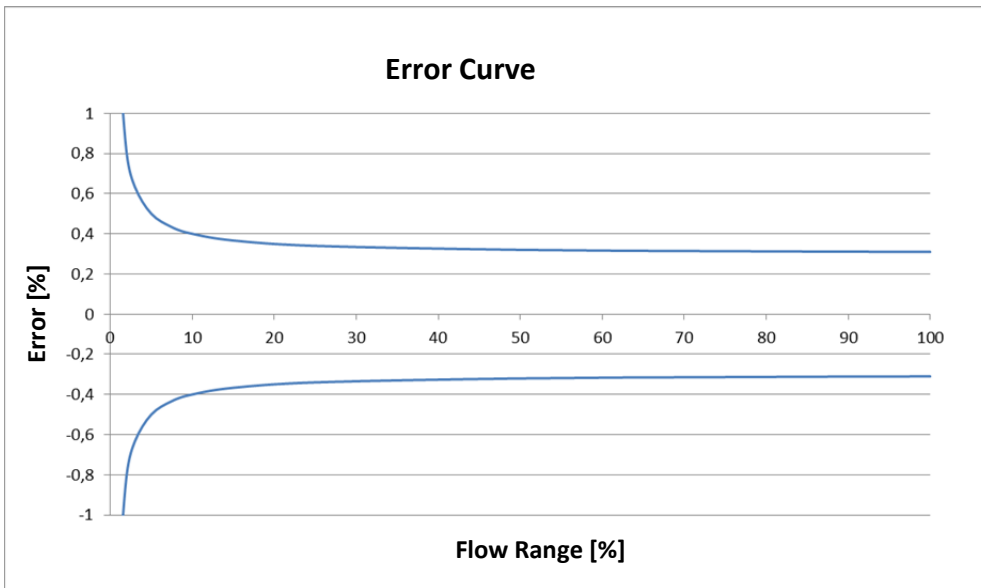
6.1 Reference conditions

The dosing flowmeters are calibrated in accordance to the standard method of calibration with the use of water.

Pressure: 1 bar, Temperature: 20-30 °C

6.2 Measurement error

The measuring accuracy was determined under reference conditions. Measuring times ≥ 10 s.
 $\pm 0.3\% \pm (0.01\% \cdot \text{Nominal flow rate} / \text{instantaneous flow rate})$



6.3 Repeatability

Repeatability as a function of dosing time

Dosing time [s]	Standard deviation [%]
>5	0,05
>3	0,07
>1,5	0,1
>0,5	0,2
>0,25	0,5

7. Operating Conditions

7.1 Installation conditions

7.1.1 Installation instructions



Warning!

Before mounting and operating the device, carefully read and observe the installation instructions.

Before mounting or assembling the device, **depressurize** and **cool down the system**.

7.1.1.1 General information

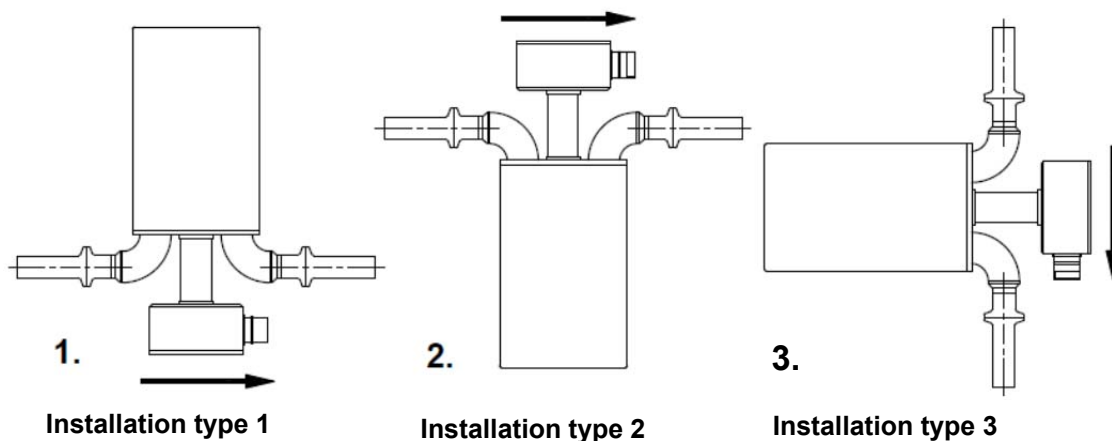
- Only trained personnel who have been authorized by the system operator are allowed to perform assembly, electrical installations, commissioning, maintenance and operation. You must have read and understood the instructions and follow their instructions strictly.
- The dosing flowmeters manufactured by Bopp & Reuter are precision mass flow meters and require careful maintenance.
- It is necessary to comply with the specified operating parameters, the order confirmation and the configuration data sheet. If you want to use the device under differing operating conditions, consult Bopp & Reuther Messtechnik GmbH indicating the factory number.
- Installation of the dosing flowmeter must be implemented so that it is completely filled with liquid even at rest.
- To avoid measuring inaccuracies due to gas bubbles or contamination, preventive measures must be taken.

7.1.1.2 Installation

No inlet and outlet piping lines are required. The equipment must be installed in a way to prevent accumulation of gases and solid particles inside.

1. For the liquids with solids of a greater density than the fluid, in a horizontal line.
2. For the liquids with gases or solids of a lower density than the fluid, in a horizontal line.
3. For all liquids in a vertical line.

The devices can be installed horizontally or vertically (see the drawing). It is necessary to ensure that the measuring tubes are completely filled during operation. Vertical installation may require a cross-sectional constriction in order to prevent spontaneous draining of the device during dosing.



7.2 Ambient Conditions

7.2.1. Ambient temperature

0 °C up to +50 °C

7.2.2 Storage temperature

-20 °C up to +70 °C (preferred temperature: 20 °C)

7.2.3 Degree of protection

IP67 IEC 529 / EN 60529

7.3 Process conditions

7.3.1 Media temperature

0 °C up to 90 °C

SIP up to 140 °C

7.3.2 State of aggregation

suitable for liquid media

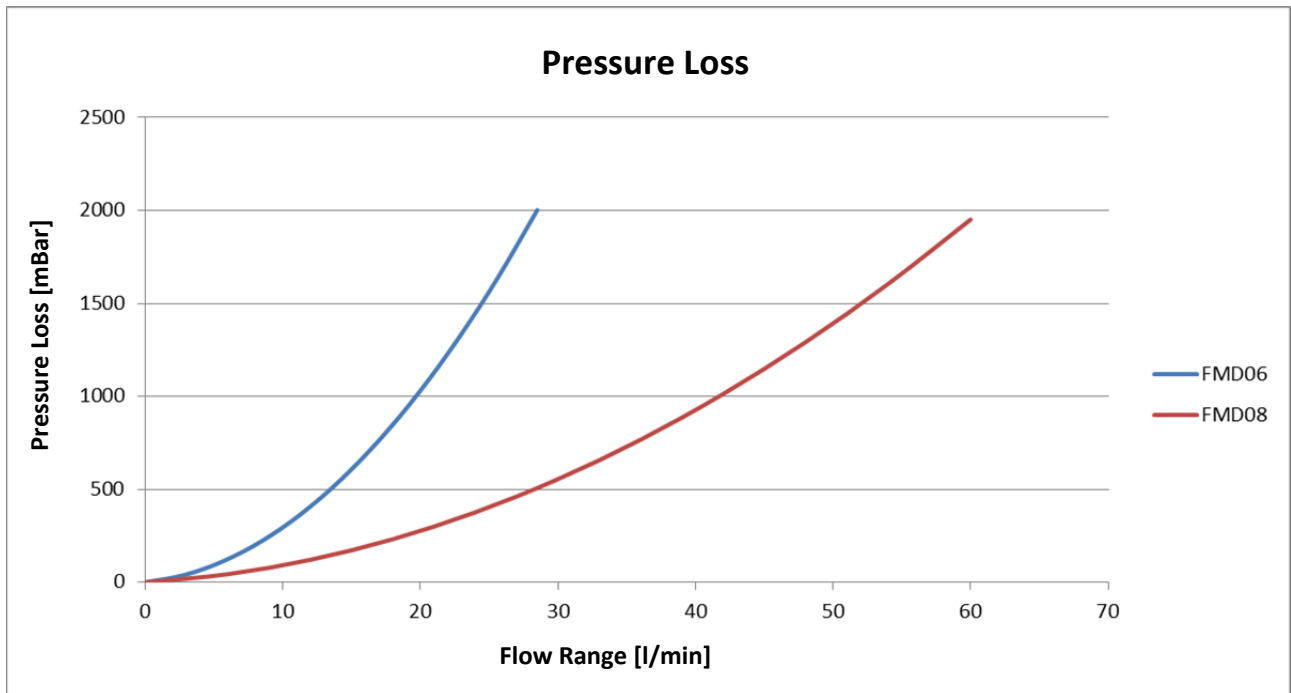
7.3.3 Media pressure limit

depending on the process connections

7.3.4 Flow rate limit

FMD 06	FMD 08
25 kg / min	45 kg / min

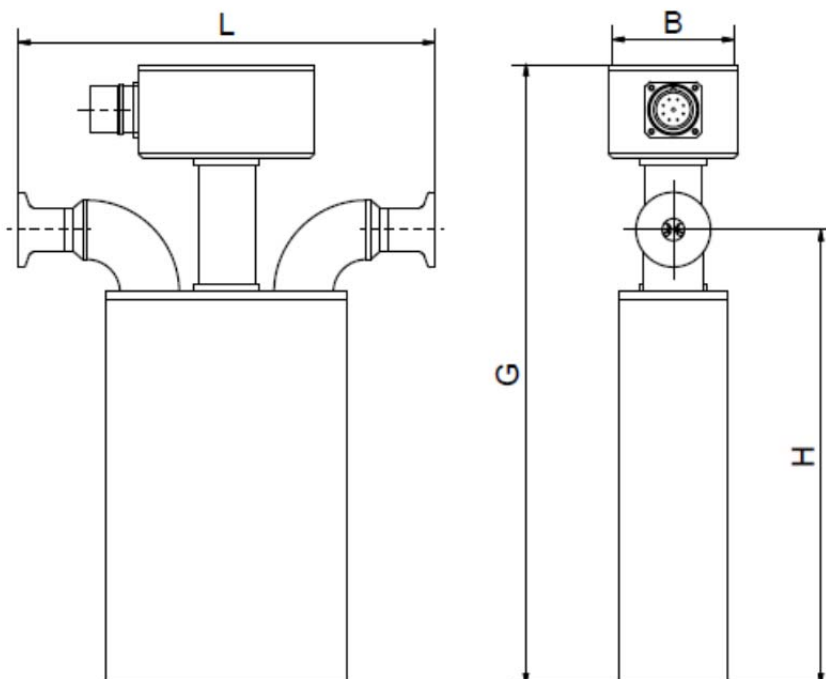
7.3.5 Pressure Loss



1 bar at nominal water flow 20°C

8. Construction details

8.1 Design / Dimensions



	G [mm]	H, Height [mm]	B, Width [mm]	L, Length [mm]
FMD06	275	205	60	*
FMD08	320	240	60	*

* Depends on the respective technological connection

DIN 32767 Tri-Clamp		
	L, Length [mm]	Weight [kg]
FMD06	190	2
FMD08	220	3

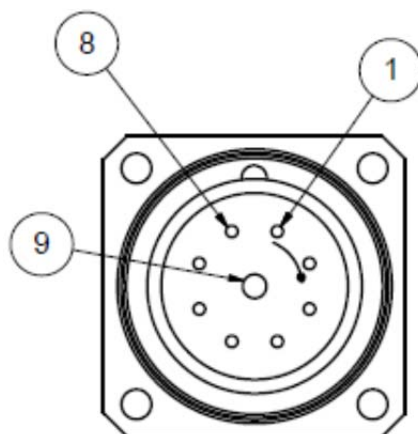
DIN EN 1092 Flange		
	Length [mm]	Weight [kg]
FMD06		
FMD08	265	5.5

8.2 Material

	Material / Material No. / ASTM
Sensor case	X5CrNi18-10 / 1.4301 / 304
Measuring tube	X6CrNiMoTi17-12-2 / 1.4571 / 316Ti
Flow divider	X6CrNiMoTi17-12-2 / 1.4571 / 316Ti
Process connection	X6CrNiMoTi17-12-2 / 1.4571 / 316Ti
Case of the transducer electronic	AlMgSi1 / 3.2315 / -

8.3 Electrical Connection

The dosing flowmeter is equipped with a plug connector (type: RC-09 Phoenix Contact). The appropriate interconnect cable is supplied (2-81-25826-005).



Plug connector

PIN	Function	Cable Color
3	Pulse	White
5	Valve Status	Brown
6	Power +	Red
7	Power -	Blue
other	Do not connect	Do not short-circuit

Power Supply Voltage

Rated voltage of 24V DC (12V DC - 36V DC)

Power Consumption

1.5W ~ 60 mA @ 24V DC

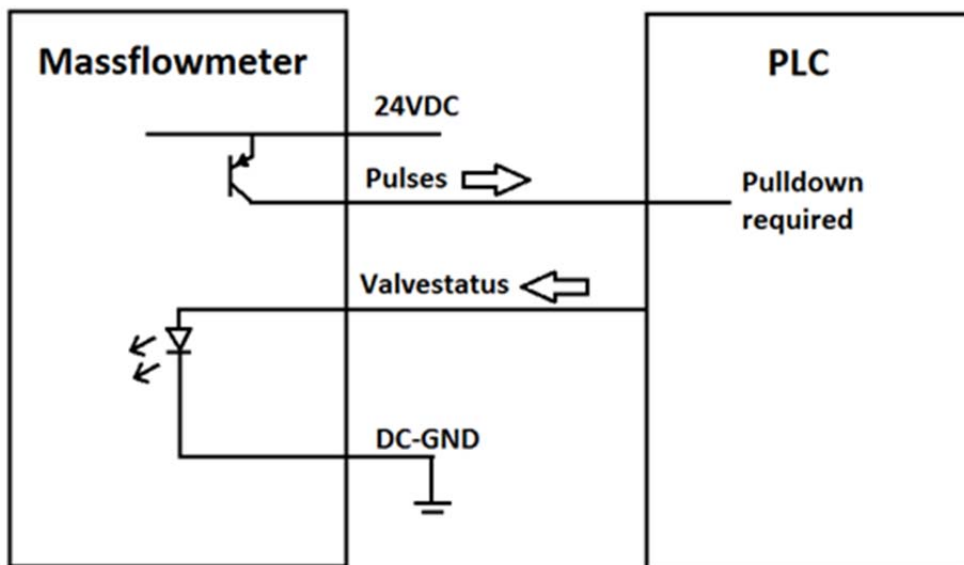
Inrush current: 0.5 A (<5 ms)

Pulse

Active pulse output (max. 20 mA; an external pull down resistor is required)

Valve Status

Valve status signal: 24 V DC / 2 mA (12V DC - 36V DC)

**9. Calculation pulse frequency**

Example for the FM06:

Flow rate: 9 kg/min = 150 g/s

Pulse factor: 63,330 Imp/g

Pulse frequency = flow x pulse factor

Pulse frequency = 150 g/s x 63,660 Imp/g = 9549 Imp/s (Hz)

10. Certificates and approvals

CE mark:

The measuring system fulfills the legal requirements of the EC Directives 2014/30/EU and 2011/65/EU including the amendments and supplements published to date. Bopp & Reuther Messtechnik GmbH confirms the successful testing of the device by affixing the CE mark.

DIN EN ISO 9001 certified

Directive 2014/30/EU (EMC)

Electromagnetic compatibility according to DIN EN 61000-6-2, DIN EN 61000-6-3
EN 61326-1:2013-07 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General requirements

EN 60529 Degrees of protection provided by enclosures (IP code)

Directive 2011/65/EU Restriction of Hazardous Substances

Appendix

A. Error diagnostics and fault rectification

The dosing mass flow meter is maintenance-free. If a malfunction should occur or if a wrong measurement is suspected, please contact Bopp & Reuther Messtechnik GmbH.



Warning!

When working on the electrical connections, the local regulations and all safety instructions in this operating manual must be observed.

B. Maintenance, Cleaning



Warning!

The operating instructions must be read and observed before installation and commissioning. The system must be **drained, depressurized and cooled down** before mounting or dismounting the device.



Warning!

Make sure that you remove hazardous media from the meter properly!

B.1 Maintenance, Cleaning



Attention!

When cleaning the meter, make sure that the cleaning agent used does not attack the meter.

The maximum permissible medium temperature for the measuring instrument must be observed..

If the dosing mass flow meter is to be taken out of operation for a longer period of time, it must be thoroughly cleaned.

B.2 Repairs, hazardous materials

The following measures must be taken before you repair the mass flow meter. Bopp & Reuther einsenden:

- In any case, please enclose the **Declaration on contamination of products and components** with the description of the fault, the application and the chemical-physical properties of the measuring medium (see appendix D for form)
- Remove all adhering residues of the medium. This is particularly important if the medium is hazardous to health, e.g. corrosive, toxic, carcinogenic, radioactive, etc.
- We must ask you to refrain from returning the goods if it is not possible for you to completely remove hazardous substances with absolute certainty.

The user will be invoiced for any costs incurred as a result of inadequate cleaning of the device for possible disposal or personal injury (caustic burns, etc.).

In case of malfunctions of the dosing mass flow meter, please contact our customer service:

Bopp & Reuther
Messtechnik GmbH
Service
Am Neuen Rheinhafen 4
67346 Speyer / Germany
Phone : +49 6232 657-420
Fax: +49 6232 657-561

C. Removal

The device must also be removed properly and disposed of.



Warning!

The operating instructions must be read and observed before installation and commissioning. The system must be **drained**, **depressurized** and **cooled down** before mounting or dismounting the device.



Warning!

Make sure that you professionally remove media that are hazardous to health from the meter and dispose of them properly!

Please note the relevant regulations:

- the nationally valid regulations
- material separation and recycling of equipment components

D. Forms

D.1 Declaration on contamination of products and components for contractor

You can fill out the form online on our homepage, or copy this page:

Bopp Reuther Messtechnik GmbH
Am Neuen Rheinhafen 4

67346 Speyer

Germany

BOPP & REUTHER
MESSTECHNIK 

Telefon: +49 (0) 6232 657 420

Fax: +49 (0) 6232 657 561

Mail: service@burmt.de

Web: www.bopp-reuther.de

DECLARATION ON CONTAMINATION OF PRODUCTS AND COMPONENTS

Please complete this form and return in advance by Fax to +49 (0) 6232 / 657 561 in order to receive an equipment return authorisation (ERA) number. No action to repair or examine the product will be done, until a valid declaration of contamination has been received.

ERA number: _____

Contact information

Company name + address	Contact person
_____	Name: _____
_____	Phone: _____
_____	E-Mail: _____









Product information

Type: _____ Id. no.: _____ Serial no.: _____

Reason for return (e.g. calibration, repair). Please describe in detail.

Contamination information

The product was contaminated with: _____

<input type="checkbox"/> poisonous 	<input type="checkbox"/> corrosive, irritant 	<input type="checkbox"/> flammable 
<input type="checkbox"/> hazardous 	<input type="checkbox"/> oxidizing 	<input type="checkbox"/> cancer-causing, health hazard 
<input type="checkbox"/> explosive 	<input type="checkbox"/> environmental hazardous 	<input type="checkbox"/> other: _____

The product was cleaned with: _____

Packaging and shipping Instructions

- remove any cables, connectors, separate filters and mounting materials
- double bag each item in suitable protective foil (sealed)
- transport in suitable shipping container (e.g. original B & R shipping container) and include a copy of this declaration form at the shipping documents to the outside

By signing this form you are accepting full responsibility for its contents and confirming that any decontamination has taken place in accordance with legal regulations.

Print name: _____ Date: _____

Legally valid signature: _____

E. Certificates

E.1 EU - Declaration of conformity

BOPP & REUTHER
MESSTECHNIK 

EU - Konformitätserklärung EU - Declaration of conformity UE - Déclaration de conformité

Hiermit erklärt der Hersteller in alleiniger Verantwortung, dass die nachfolgend bezeichnete Baueinheit den Anforderungen der zutreffenden EU-Richtlinien entspricht. Bei nicht mit uns abgestimmten Änderungen verliert diese Erklärung ihre Gültigkeit.

The manufacturer herewith declares under sole responsibility that the unit mentioned below complies with the requirements of the relevant EU directives. This declaration is no longer valid if the unit is modified without our agreement.


Par la présente, le fabricant déclare que les appareils décrits ci-dessous, correspondent aux exigences de la réglementation UE qui les concerne. Toute modification des appareils sans notre accord entraîne la perte de validité de cette déclaration de conformité

Hersteller <i>Manufacture</i> Fabricant	Bopp & Reuther Messtechnik GmbH Am Neuen Rheinhafen 4 D-67346 Speyer	
Bezeichnung <i>Description</i> Description	Coriolis-Massedurchflussmesser <i>Coriolis mass flow meter</i> Système de mesure de débit massique	
Typ, Modell <i>Type, model</i> Type, modèle	FMD – Serie <i>series</i> série	
Richtlinie <i>Directive</i> Directive	2014/30/EU /UE Elektromagnetische Verträglichkeit <i>Electromagnetic interference</i> Compatibilité électromagnétique	L 96/79
Normen und normative Dokumente <i>Standards and normative documents</i> Normes et documents normatifs	EN 61326-1:2013-07	
Richtlinie <i>Directive</i> Directive	2011/65/EU /UE Beschränkung gefährlicher Stoffe <i>Restriction of hazardous substances</i> Limitation de substances dangereuses	L 174/88
Normen und normative Dokumente <i>Standards and normative documents</i> Normes et documents normatifs	EN 50581:2012	

Ort, Datum / Place, Date / Lieu, Date:

Speyer, 2018-07-04


Dr. J. Ph. Herzog
Geschäftsführer / Managing director / Gérant


i. A. B. Bähr
QS Leiter / QA Manager / Responsable qualité

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