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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

Before installing the EMF, read these operating instructions carefully. Failure to observe the instructions contained herein, in particular the safety instructions, may result in hazards to people, the environment, the device and the system.

The EMF corresponds to the current state of the art. This applies to the accuracy, functionality and safe operation of the equipment.

In order to ensure safe operation, competent and safety-conscious behaviour of the operators is required.

Bopp & Reuther Messtechnik provides assistance for the application of the products either personally or through appropriate literature. The customer checks the applicability of the product on the basis of our technical information. In customer and application specific tests the customer checks the suitability of the product for his intended use. With this test, risk and danger are transferred to our customer; our warranty expires.

1. The existing national regulations for accident prevention and safety at work must be observed for all work. Existing internal regulations of the

operator must be observed, even if they are not mentioned in these instructions.

2. Protection class according to DIN EN 60529:  
Ensure that the ambient conditions at the place of use do not exceed the requirements of the specified protection class ( § 9 "Technical Data").
3. Prevent the medium in the device from freezing by taking appropriate measures.
4. Use the EMF only when in perfect condition. Damaged or faulty devices must be checked immediately and replaced if necessary.
5. Use only suitable tools for assembly, connection and disassembly.
6. Nameplates or other notices on the device must neither be removed nor made unrecognisable, otherwise all guarantee and manufacturer's responsibility becomes void.
7. Special safety instructions:  
Crystallizing liquids:  
Liquids that crystallize as they dry out can cause the EMF to malfunction.
8. Ensure sure that the EMF is not run dry.
9. Prevent the liquid in the device from crystallizing by taking appropriate precautions.
10. Further warnings, which refer specifically to individual functional sequences or activities, can be found in front of the corresponding points in these operating instructions.



## Warning!

Failure to heed the warning may result in personal injury or a safety hazard.



## **Attention!**

Non-observance can lead to faulty operation or to destruction of the device.

### **v. Qualified personnel**

The personnel charged with commissioning and operating the EMF must be suitably qualified. This can be done by training or appropriate instruction.

The personnel must be familiar with the contents of these operating instructions and must have access to them at all times.

The electrical connection may only be carried out by a qualified electrician.

### **v. Disclaimer**

No liability is accepted for damage and operating faults resulting from installation errors, improper use or non-observance of these operating instructions

## 1. Identification

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

Product type Electromagnetic flowmeter

Product name Series MID-EMF

Versions no. A-EN-09003-EMF Rev.A

## 2. Area of application

The flow sensor series EMF is without moving parts. The measurement is made by magnetic induction.

The EMF is used for measuring or dosing water and electrically conductive liquids. Due to the compact design and the almost complete independence of the inlet and outlet sections, the EMF can be used in many applications.

The operational safety of the delivered device is only guaranteed if it is used as intended. The specified limit values ( § 9 "Technical Data") must never be exceeded.

Before installation, check whether the wetted materials of the instrument are suitable for the medium used ( § 9.2 "Materials table").

### Measuring tube empty (partially filled). / conductivity too low:

If the measuring tube of the EMF is empty or partially filled or the conductivity of the liquid used is too low, the green LED may flash irregularly. Random pulses occur at the output, but these do not correspond to a flow rate.

Make sure that the measuring tube of the EMF is always completely filled ( § 4.1 "Installation Instructions").

Make sure that the liquid used has a conductivity of at least 20  $\mu\text{S}/\text{cm}$ .

**Versions:**

The EMF is available in various nominal sizes from DN3 to DN25.

**Nameplate:**

The type plate is located on the back of the EMF. It contains the most important technical data.

### 3. Principle of Operation and System Design

#### 3.1 Measuring principle

The magnetic inductive flow sensor operates according to the induction principle, i.e. a DC voltage is generated by the movement of a conductor in a magnetic field:

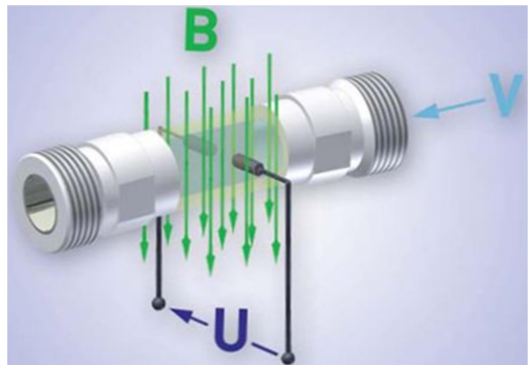
The measuring tube of the EMF is located in a magnetic field (B).

An electrically conductive liquid (V) flows through the measuring tube. The positive and negative charge carriers are deflected in opposite directions.

A voltage (U) is generated perpendicular to the magnetic field, which is picked up by the two electrodes.

The induced voltage is proportional to the average flow velocity of the liquid.

The electronics of the EMF converts the induced voltage into a frequency signal proportional to the flow rate.



## 3.2 System design

Components:

① Housing:

The housing is made of plastic and has protection class IP65.

② Electrical connection:

The electrical connection is via a 4-pin plug M12x1.

③ LED for operation / flow rate indication.

④ Nameplate with flow direction (imprint)

⑤ Process connection:

The process connections are available in different sizes.



Aufbau:

The measuring tube with the grounding sleeves and the electrodes runs through the housing and forms the process connections of the EMF on the outside.

The magnetic field for the measurement is generated inside the housing. The measuring and evaluation electronics are also located there.

The two stainless steel electrodes are located in the middle of the measuring tube between the grounding sleeves.

The EMF requires no moving parts for the measuring process. The inside of the measuring tube is completely free. The liquid can flow through the measuring tube without any obstacles



## 4. Input

### 4.1 Measured variable

Volume

## 5. Output

### 5.1 Pulse pick-up, analog output

There are different variants available.

Pulse output 24 VDC

4-20mA

0-10V

## 6. Characteristic Parameters

### 6.1 Reference conditions

The calibration of electromagnetic flowmeters is carried out on test benches with the following reference conditions:

Pressure: approx. 2 bar, Temp: 25°C

warm-up time: 30min

Liquid: water without gas inclusions

### 6.2 Tolerated deviation

$\pm 0.7\%$  of measured value;  $\pm 0.3\%$  of full scale

$\pm 1\%$  repeatability

## 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 disassembling the device, **depressurize** and **cool down the system**.

##### 7.1.1.1 General information

- Only trained and qualified personnel authorized by the plant operator may perform mounting, electrical installation, commissioning, maintenance and operation. They must have read and understood the operating instructions and must strictly follow them.
- The parameters specified on the nameplate are maximum values and must not be exceeded.
- Install electromagnetic flowmeters in such a way that they remain completely filled with liquid even when not in use
- To avoid measurement errors due to gas inclusions or contamination etc., the user must take appropriate precautions.
- Measuring instruments that are to be used for liquid foodstuffs and luxury foods must be thoroughly cleaned before commissioning (see Maintenance and Cleaning).

### 7.1.1.2 Installation

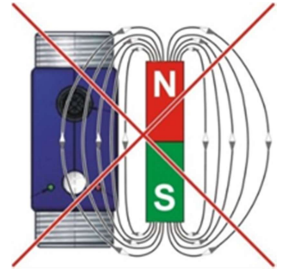
- Clear the pipeline of foreign bodies. Flush the pipe.
- Use only suitable gaskets during installation.
- Do not remove the protective caps on the inlet and outlet nozzles of the electromagnetic flow meter until immediately before installation. The ingress of impurities must be prevented during installation.
- Flow direction any, if necessary observe the arrow on the housing.
- Install the electromagnetic flowmeter stress-free in the pipeline
- For the best possible measuring accuracy, the vertical installation position with rising flow is preferred (no dirt deposits).
- **CAUTION! Material damage!** Maximum torque 5 Nm.
- When tightening, only hold the EMF by hand!
- If you use an open-ended spanner or pipe wrench, the EMF may be damaged.
- Tighten the two union nuts with a maximum torque of 5 Nm.



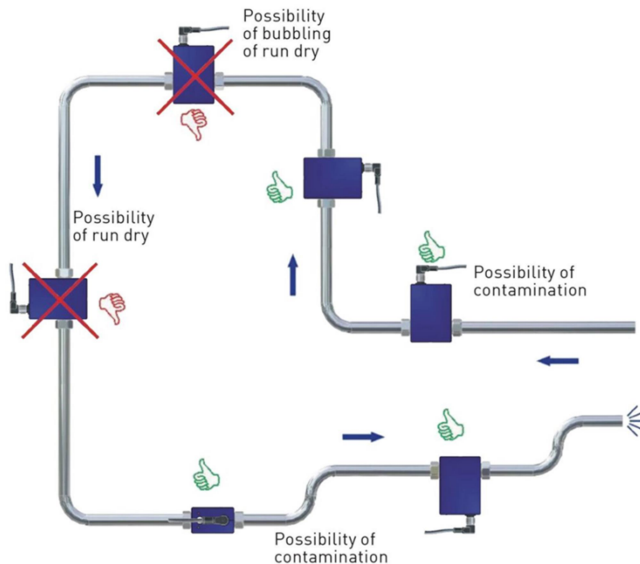
**Attention! Malfunction due to external fields!**

External magnetic fields in the immediate vicinity of the device can lead to malfunctions and must be prevented.

☞ Make sure that there are no external magnetic fields at the installation location of the EMF.



- In principle, the EMF can be installed at any point in the pipeline. Straight pipe sections are preferable.



- The installation can be carried out in horizontal as well as in vertical pipelines. The flow sensor is only suitable for use in completely filled pipes.
- In principle, magnetic inductive flow sensors are largely independent of the flow profile. A calming section is not absolutely necessary.
- However, in order to achieve the highest possible measuring accuracy, straight inlet and outlet sections of the corresponding nominal width (DN) should be used. The inlet pipe should be at least 10 x DN, the outlet pipe 5 x DN long.

- The inlet and outlet sections, as well as the seals, must have the same or a slightly larger inside diameter than the measuring tube to achieve the specified accuracy.
- If several EMFs are operated side by side, a lateral distance of at least 2.5 cm is required.
- With smaller distances, mutual interference of the devices is possible.



### 7.1.1.3 Measuring mode

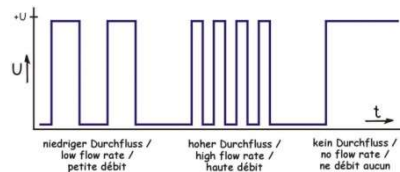
In measuring mode the green LED flashes proportionally to the measured flow rate.



For the human eye, the flashing is no longer visible from a frequency of  $\sim 30 \dots 40$  Hz. The green LED then seems to light up permanently.

#### **EMF with frequency output:**

Depending on the version, the EMF supplies a flow proportional NPN / PNP or push-pull square wave signal. The frequency changes according to the flow rate.



#### **EMF with analog output:**

Depending on the configuration of the EMF, the analog output provides a voltage or current signal.

This is proportional to the measured flow rate. You will find the scaling of the analog output on the type plate.

## **7.2 Ambient conditions**

### **7.2.1 Ambient temperature**

5 to +60°C

### **7.2.2 Storage temperature**

-15 to +60°C

### **7.2.3 Degree of protection**

IP 65 according to IEC 529 / EN 60529

### **7.2.4 Electromagnetic compatibility**

According to EMC directive 2014/30/EU

## **7.3 Process conditions**

### **7.3.1 State of aggregation**

Suitable for liquid media

### **7.3.2 Flow rate limit**

depending on nominal diameter

### **7.3.3 Liquid temperature limit**

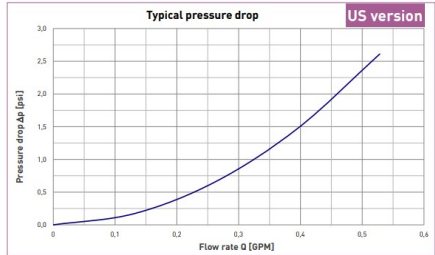
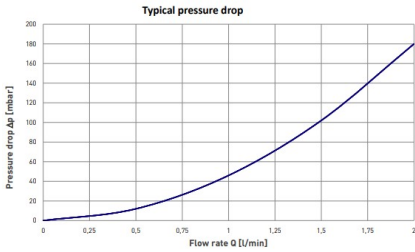
5 bis +60°C

### **7.3.4 Liquid pressure limit**

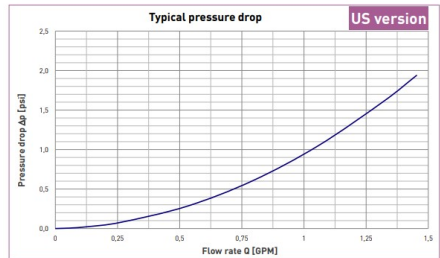
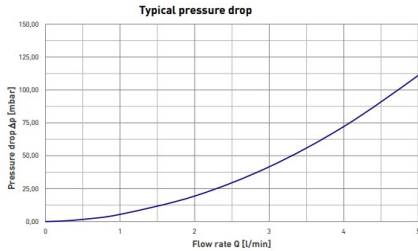
10 bar at 20°C, 8 bar at 40°C, 6 bar at 60°C

### 7.3.5 Pressure loss

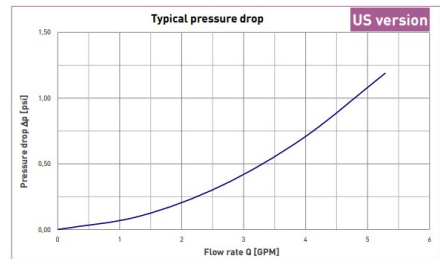
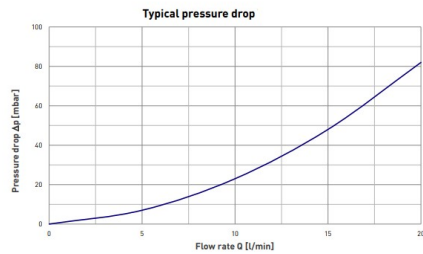
#### DN3



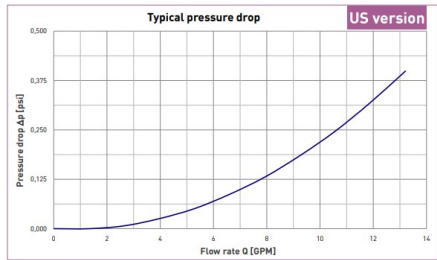
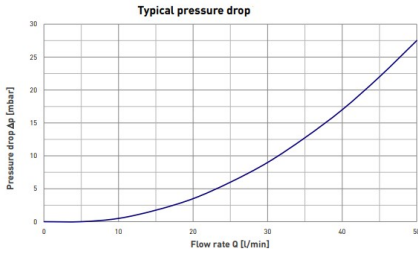
#### DN6



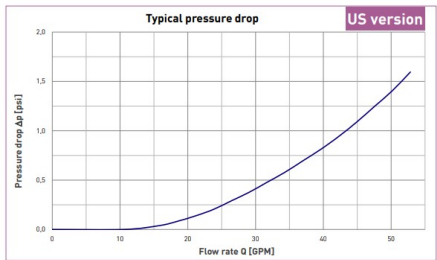
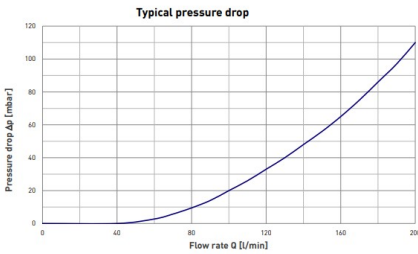
#### DN8



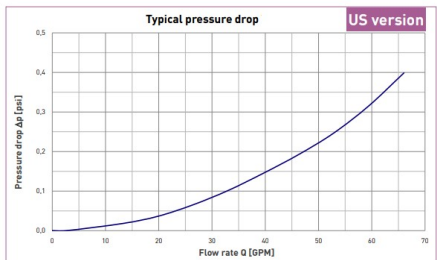
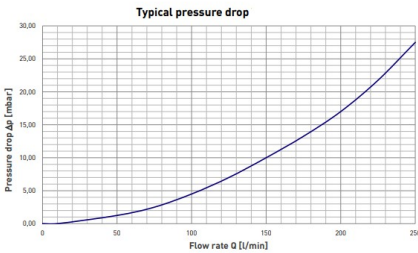
### DN15



### DN20

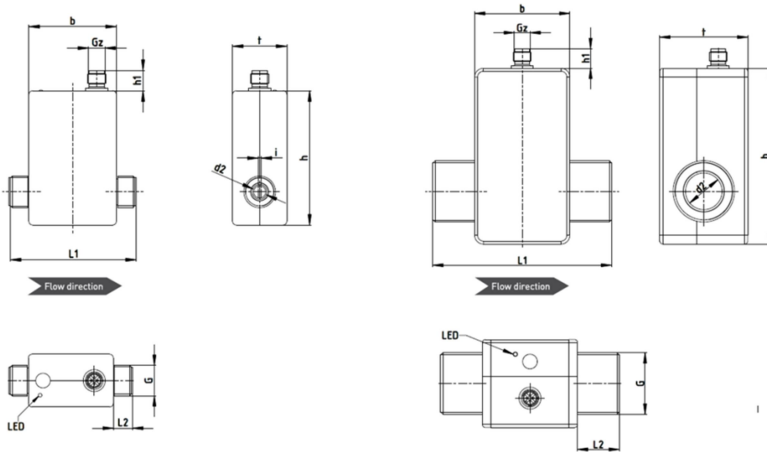


### DN25



## 8. Constructive Design

### 8.1 Model / Dimensions



MID-EMF		DN 3	DN 6	DN 8	DN 15	DN 20	DN 25
Dimensions (mm)	L1	85	85	85	90	90	122
	L2	13	13	13	16	16	28,5
	G	G½B	G½B	G½B	G¾B	G1B	G1¼B
	d2	Ø3	Ø8	Ø8	Ø14	Ø18	Ø25
	b	58	58	58	58	58	58
	Gz	M12x1	M12x1	M12x1	M12x1	M12x1	M12x1
	h	89	89	89	89	89	89
	h1	13,5	13,5	13,5	13,5	13,5	13,5
	t	36	36	36	36	36	36
	i		2				

Weight (kg)	3,5	3,5	3,5	8,1	8,1	8,1
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### 8.2 Materials

Housing:	ABS
Electrodes and grounding rings:	stainless steel 1.4404
Measuring tube and process connections:	PVDF
O-rings:	EPDM

### 8.3 Process connection

G<sup>3</sup>/<sub>8</sub>B - G1<sup>1</sup>/<sub>4</sub>B  
 Others on request

### 8.4 Electrical connection

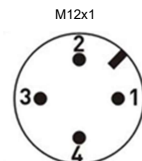
Electrical characteristics	
Supply voltage	12...24 V <sub>DC</sub> (±10 %)**
Power consumption	Max. 3,6 W
Electrical protective features	short-circuit proof - reverse polarity protected
Electrical connection	4-Pin-plug M12x1
Protection class (DIN EN 60529)	IP 65 (only with plugged on coupling socket)

Pin assignment:

The pin assignment differs depending on the selected configuration of the device.

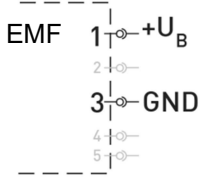
Pin assignment:

- Pin 1: +UB
- Pin 2: d. n. c. (not connected) / Analog U/I
- Pin 3: GND
- Pin 4: Frequency



- ✎ Wire the connection cables according to their design and the pin assignment on the nameplate.

### Supply voltage



### EMF with frequency output

Push-Pull :	NPN Open Collector:	PNP Open Collector:
<p>*1: Push-Pull Switching outputs of several EMF must not be connected in parallel.                      *2: Recommendation Pull-Up / Pull-Down resistor <math>R_L \sim 2,5 \text{ k}\Omega</math> (12 V) or <math>\sim 5 \text{ k}\Omega</math> (24 V).                      Make sure that the maximum signal current of 25 mA is not exceeded.</p>		

### Use of frequency and analog output

Push-Pull:	NPN Open Collector:	PNP Open Collector:
<p>Recommendation for resistor <math>R_L \sim 2,5 \text{ k}\Omega</math> (12 V) or <math>\sim 5 \text{ k}\Omega</math> (24 V).                      Make sure that the maximum signal current of 25 mA is not exceeded.</p>		

### Switching on and off:

The EMF has no switch and cannot be switched on or off independently. It is switched on and off via the connected supply voltage.

### Switch on the supply voltage.

The green LED lights up. The EMF is ready for operation and goes into measuring mode.

## 9. Pulse rate, K-factor, flow

Type	EMF03	EMF06	EMF08	EMF15	EMF20	EMF25
<b>Frequency output:</b>						
- Pulse rate/ K-Faktor [Pulse/l]	50.000	25.000	10.000	5000	2500	1200
- Auflösung [ml/Pulse]	0,02	0,04	0,1	0,2	0,4	0,83
- Signal form	square wave signal - duty cycle 50:50 Push-Pull - NPN open collector - PNP open collector					
- Signal current	≤ 100 mA					

DN	Flow rate Q <sub>max</sub> [l/min]	v=0,5 m/s	v=1,0 m/s	v=2,5 m/s	...	v=10 m/s
		[ml/s]	[ml/s]	[ml/s]		[ml/s]
3	2	4,2	8,4	21		84
6	5	13,9	28	70		280
8	20	21	42	105	...	420
15	50	88	176	440		1760
20	200	157	314	785		314
25	250	245	490	1225		4900

Recommended flow velocity 1m/s

## Appendix

### A. Troubleshooting

The electromagnetic flowmeter operates maintenance-free. If a malfunction occurs, or if there is a suspicion of incorrect measurement, check the installation conditions according to chapter 7



#### **Warnung!**

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

#### **General:**

**If the error of the device cannot be found, the service of Bopp & Reuther Messtechnik must be called in or the device must be sent to Bopp & Reuther Messtechnik for repair (see appendix B2).**

## **B Maintenance, Cleaning, Repair, Hazardous substances**

### **B.1 Maintenance, Cleaning**

Maintenance:

The EMF is maintenance-free and cannot be repaired by the user. In case of a defect, the device must be replaced or returned to the manufacturer for repair.

#### **ATTENTION! Material damage!**

Opening the device can damage important parts or components.

**Never open the device and never carry out repairs yourself.**

#### **Cleaning:**

Clean the EMF with a dry or slightly moistened, lint-free cloth. Do not use sharp objects or aggressive cleaning agents when cleaning.

### **B.2 Repairs, hazardous substances**

For reasons of the legal regulations for environmental protection and occupational safety and to maintain the health and safety of our employees, all devices returned to Bopp & Reuther Messtechnik for repair must be free of toxic and hazardous substances. This also applies to cavities of the devices. If necessary, the customer has to neutralize or rinse the device before returning it to Bopp & Reuther Messtechnik.

Costs arising from inadequate cleaning of the device (disposal or personal injury) will be charged to the operator.

#### **WARNING! Risk of injury if cleaning is inadequate!**

**The operator is liable for all damages of any kind, in particular for personal injuries (e.g. burns or poisoning), decontamination measures, disposal, etc., which are due to inadequate cleaning of the measuring instrument.**

Please observe the following instructions before returning the device.

The following measures must be taken before you send the device to Bopp & Reuther Messtechnik for repair:

- Clean the device thoroughly. This is particularly important if the medium used is hazardous to health (e.g. corrosive, toxic, carcinogenic, radioactive, etc.).
- Please note that the adhering medium residues must also be removed from all gaps, sealing grooves and cavities of the housing.
- Enclose a fault report with the device. Describe the application and the chemical-physical properties of the medium.
- Observe the notes on the safety certificate on our website (The following measures must be taken before sending the instrument to Bopp & Reuther Messtechnik for repair:
- Clean the instrument thoroughly. This is particularly important if the medium used is hazardous to health (e.g. corrosive, toxic, carcinogenic, radioactive, etc.).
- Please note that the adhering medium residues must also be removed from all gaps, sealing grooves and cavities of the housing.
- Enclose a fault report with the device. Describe the application and the chemical-physical properties of the medium.
- The customer must confirm that the measures have been carried out by completing the clearance certificate, which can be downloaded from our website resp. see page 27
- Please name a contact person for questions from our service department.

Please contact our customer service department in the event of malfunctions:

Bopp & Reuther Messtechnik GmbH, Service, Am Neuen Rheinhafen 4, 67346 Speyer / Germany, Phone: +49 6232 657-420, Fax: +49 6232 657-561, eMail: [service@burmt.de](mailto:service@burmt.de)

## B.3 Disassembly and disposal

### **ATTENTION! Danger of injury!**

Never remove the device from a system in operation.  
Ensure that the system is switched off properly.

### **Before disassembly:**

Before disassembly, check that

- the system is switched off and is in a safe and de-energized state.
- the plant is depressurised and cooled down.

### **Disassembly:**

- Remove the electrical connections.
- Remove the EMF with suitable tools.

### **Disposal:**

According to the 2011/65/EU (RoHS) and 2012/19/EU (WEEE)\* directives, the device must be disposed of separately as electrical and electronic waste.



### **NO HOUSEHOLD GARBAG!**

The EMF consists of different materials. It must not be disposed of together with household waste.

- Send the EMF to local recycling

or

- send the EMF back to your supplier or Bopp & Reuther Messtechnik for disposal.

## C. Certificates

### C.1 Certificate of non-objection for contractor

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](mailto:service@burmt.de)

Web: [www.bopp-reuther.de](http://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: \_\_\_\_\_

## D. 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 entraine la perte de validité de cette déclaration de conformité

<b>Hersteller</b> Manufacturer Fabricant	Bopp & Reuther Messtechnik GmbH Am Neuen Rheinhafen 4 D-67346 Speyer
<b>Bezeichnung</b> Description Description	<b>Magnetisch Induktiver Durchflussmesser</b> Electromagnetic Flowmeter Débitmètre électromagnétique
<b>Typ, Modell</b> Type, model Type, Modèle	MID-EMF

<b>Richtlinie</b> Directive Directive	2014/30/EU /UE Elektromagnetische Verträglichkeit Electromagnetic interference Compatibilité électromagnétique	L 96/79
<b>Normen und normative Dokumente</b> Standards and normative documents Normes et documents normatifs	EN 61000-6-2:2005 EN 61000-6-3:2011	

<b>Richtlinie</b> Directive Directive	2011/65/EU /UE Beschränkung gefährlicher Stoffe Restriction of hazardous substances Limitation de substances dangereuses	L 174/88
<b>Normen und normative Dokumente</b> Standards and normative documents Normes et documents normatifs	EN 50581:2012	

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

Speyer, 2020-04-21

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

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

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