



FLEXMAG 4050 C Handbook

Single use electromagnetic flowmeter

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1	Safety instructions	5
1.1	Software history	5
1.2	Intended use	6
1.3	Certification	6
1.4	Safety instructions from the manufacturer	7
1.4.1	Copyright and data protection	7
1.4.2	Disclaimer	7
1.4.3	Product liability and warranty	8
1.4.4	Information concerning the documentation	8
1.4.5	Warnings and symbols used	9
1.5	Safety instructions for the operator	9
2	Device description	10
2.1	Scope of delivery	10
2.2	Device description	11
2.2.1	Transmitter	12
2.2.2	Disposable flow tube	12
2.2.3	Flow rate values	12
2.3	Nameplate (examples)	13
3	Installation	14
3.1	General notes on installation	14
3.1.1	Storage	14
3.1.2	Transport	14
3.1.3	General requirements	15
3.1.4	Vibration	15
3.1.5	Magnetic field	15
3.1.6	Installation conditions	16
3.1.7	Control valve	16
3.1.8	Pump	17
3.1.9	Open feed or discharge	17
3.1.10	Mounting position	18
3.1.11	Configuration of control system	19
3.1.12	Design of the single use assembly	19
3.1.13	Positioning flow tube in the single-use kit assembly	20
3.1.14	Installation and removal of the flow tube	21
4	Electrical connections	22
4.1	Safety instructions	22
4.2	M12-8 pin connector	22
4.3	Grounding and electrical connection	23
4.4	Connection diagrams	24
4.4.1	Current output active	24
4.4.2	Pulse/frequency output active	25

5 Start-up	26
5.1 Configuration of the transmitter	26
5.2 Calculation of flow rate in the control system.....	26
5.3 Parameters to set when installing the transmitter	27
5.4 Parameters to set at each change of the flow tube.....	27
6 Service	28
6.1 Cleaning	28
6.2 Verification kit.....	28
6.3 Spare parts availability	28
6.4 Availability of services	28
6.5 Returning the device to the manufacturer.....	29
6.5.1 General information.....	29
6.5.2 Form (for copying) to accompany a returned device.....	30
6.6 Disposal	30
6.7 Disassembly and recycling.....	31
7 Technical data	35
7.1 Measuring principle.....	35
7.2 Technical data.....	36
7.3 Measurement accuracy	40
7.4 Dimensions and weights	41
8 Notes	43

1.1 Software history

The "Electronic Revision" (ER) is consulted to document the revision status of electronic equipment according to NE 53 for all GDC devices. It is easy to see from the ER whether troubleshooting or larger changes in the electronic equipment have taken place and how that has affected the compatibility.

Changes and effect on compatibility

1	Downwards compatible changes and fault repair with no effect on operation (e.g. spelling mistakes on display)	
3- _	Downwards compatible hardware and/or software change of inputs and outputs:	
	P	Pulse output
	S	Status output
	X	All inputs and outputs
4	Downwards compatible changes with new functions	
5	Incompatible changes, i.e. electronic equipment must be changed.	

Release date	Electronic revision	Changes and compatibility	Documentation
2016	ER 1.0.4 (SW. REV. 3.1.1_)	Initial software version	MA FLEXMAG 4050C R01
2018	ER 1.0.4 (SW. REV. 3.1.1_)	no changes	MA FLEXMAG 4050C R02
2019	ER 1.0.5 (SW. REV. 3.2.1_)	4	MA FLEXMAG 4050C R03

1.2 Intended use

**CAUTION!**

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

**INFORMATION!**

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The FLEXMAG 4050 C electromagnetic transmitter is designed exclusively to measure the flow of electrically conductive, liquid media for the pharmaceutical/bio-technology industry and is not a medical device.

**WARNING!**

If the device is not used according to the operating conditions (refer to chapter Technical data), the intended protection could be affected.

1.3 Certification

CE marking



The manufacturer certifies successful testing of the product by applying the CE marking.

This device fulfils the statutory requirements of the relevant EU directives.

For full information of the EU directives and standards and the approved certifications, please refer to the EU Declaration of Conformity or the website of the manufacturer.

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

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

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

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

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

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

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

1.4.2 Disclaimer

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

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

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

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

1.4.3 Product liability and warranty

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

1.4.4 Information concerning the documentation

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

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

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

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



DANGER!

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



DANGER!

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



DANGER!

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



DANGER!

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



WARNING!

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



CAUTION!

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



INFORMATION!

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



LEGAL NOTICE!

This note contains information on statutory directives and standards.



• **HANDLING**

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

➡ **RESULT**

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

1.5 Safety instructions for the operator



WARNING!

*In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.*

2.1 Scope of delivery


INFORMATION!

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


INFORMATION!

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


INFORMATION!

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

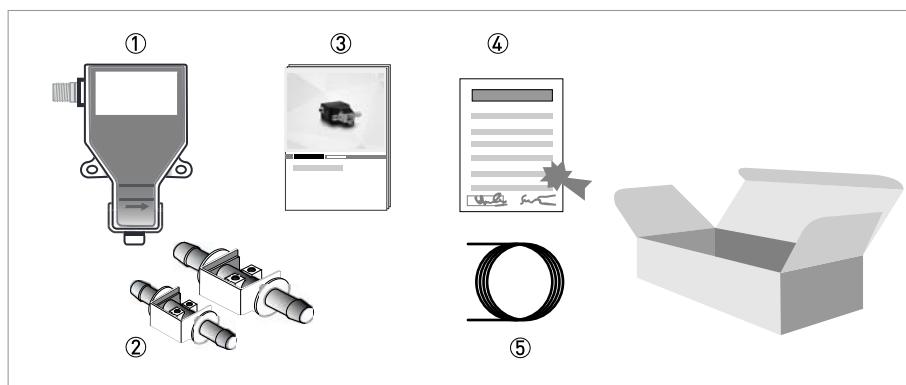


Figure 2-1: Scope of delivery

- ① Transmitter in ordered size
- ② Option: flow tube in ordered size
- ③ Product documentation (on request)
- ④ Product certificate and/or calibration report
- ⑤ Optional: connection cable (unshielded)

Accessories

- Disposable flow tube ID 1/4...1" in a pack of 10; individually packed in double sealed pouches (depending on the ordered size).
- M12 Connection cable for FLEXMAG 4050 C (2 meter/6.56 ft).


INFORMATION!

Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

2.2 Device description

The transmitter is not a stand-alone instrument, it is meant to be integrated in a system, or to be connected with a display and is designed to measure the flow of electrically conductive, liquid media.

The FLEXMAG 4050 C consists of 2 parts, the transmitter and the flow tube.

The following transmitter versions are available:

- Small version; for a flow tube size ID ¼"
- Medium version; for a flow tube size ID 3/8" and ½"
- Large version; for a flow tube size 3/4" and 1"

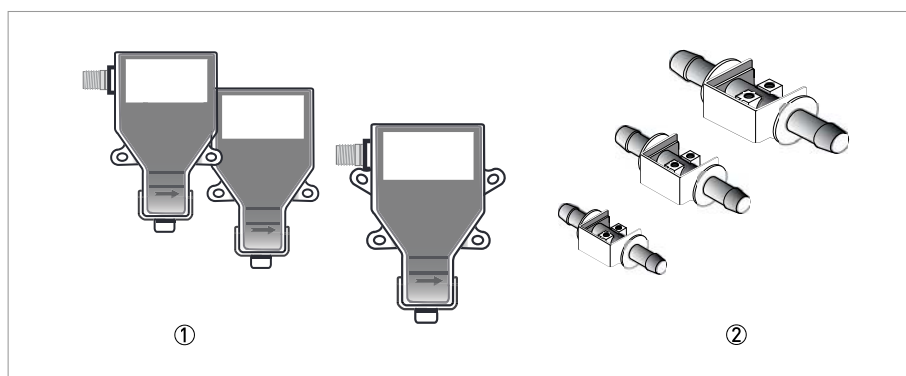


Figure 2-2: Device version

- ① Device versions: Small, Medium and Large size
② Flow tubes: ID ¼...1"

For the exact dimensions, refer to *Dimensions and weights* on page 41

2.2.1 Transmitter

The FLEXMAG 4050 C:

- Small version 1/4" is compatible with a tube of size ID 1/4"
- Medium version 3/8"-1/2" is compatible with tubes of size ID 3/8" and 1/2"
- Large version 3/4"-1" is compatible with tubes of size ID 3/4" and 1"

The transmitter is the source of the magnetic field and signals conversion and includes the holder for the disposable flow tube. The medium and large transmitters fits two different flow tubes sizes, providing the flexibility of two different flow ranges by a simple exchange of tube.

The transmitter is pre-set with standard or customized maximum flow rates, which are corresponding to maximum value of the pulse or analog output. The maximum flow rate has to be integrated into the control system of your machine at construction (refer to *Start-up* on page 26).



INFORMATION!

Please note that the maximum flow rate that can be chosen is limited by the maximum velocity that can be measured by the transmitter. This maximum velocity is set to 6 m/s.

For information about standard and maximum flow rates; refer to Configuration of the transmitter on page 26 or accuracy of the device refer to Measurement accuracy on page 40.

2.2.2 Disposable flow tube

The disposable flow tube is produced and packed in an ISO 13485 certified site with a controlled ISO 7 clean room. Each tube is individually packed within a double packing of PA/PE pouches. The flow tube is provided with a specific pre-determined calibration factor, which is determined by batching calibration. The precision manufacturing of the flow tubes eliminates the need for individual calibration.

The flow tube is meant to be installed in a single use assembly that can be Gamma Sterilized outside of the original pouch. It is compatible with bio-pharmaceutical flexible hoses, braided or non-braided, of the correct nominal inner diameter of the respective flow tube. The hoses are secured with standard bio-pharmaceutical tube clamps. When the assembly is installed into the machine, the flow tube is inserted into the transmitter.

2.2.3 Flow rate values

The transmitter is equipped with a pulse or analogue output. The output signals generated are translated into a flow rate using a calculation formula. This calculation formula (which is depending on Q max and k factor of the tube) has to be integrated into the control system refer to *Calculation of flow rate in the control system* on page 26.

The maximum flow rate is set 1 time in the control system. The k factor is entered at each time the tube is exchanged.

2.3 Nameplate (examples)



INFORMATION!

Check the device nameplate to ensure that the device is delivered according to your order. Additional information (e.g. correct supply voltage), can be found in the documentation of the signal converter.

Nameplate transmitter

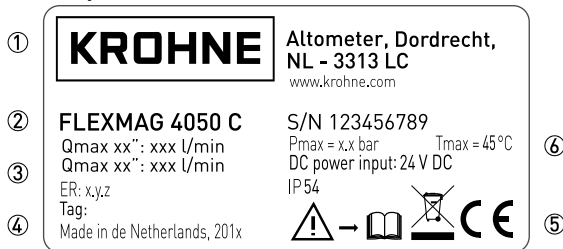


Figure 2-3: Example of nameplate

- ① Name and address of the manufacturer
- ② Type designation of the flowmeter
- ③ Calibration and device data
- ④ Date and place of manufacturing
- ⑤ WEEE and CE sign with number(s) of notified body
- ⑥ Serial number, P&T data and protection category

Nameplate flow tube

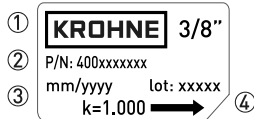


Figure 2-4: Example of nameplate

- ① Manufacturer and flow tube size
- ② Part number of the flow tube
- ③ Date of manufacturing
- ④ k-factor (calibration factor tube) and batch number

3.1 General notes on installation

**INFORMATION!**

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

**INFORMATION!**

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

**INFORMATION!**

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

3.1.1 Storage

- Store the device in a dry and dust-free location
- Avoid lasting direct exposure to the sun
- Before assembling store the device in its original packaging
- Storage temperature: -40...+60°C / -40...+140°F

3.1.2 Transport

- No special requirements

3.1.3 General requirements

**INFORMATION!**

The following precautions must be taken to ensure a reliable installation.

- *Make sure that there is adequate space to the sides*
- *Signal converters installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *To avoid meter malfunction, do not use mechanical and/or lateral forces on the tube when mounting.*
- *Do not expose the signal converter to intense vibration. The transmitter is tested for a vibration level in accordance with IEC 60721-3-3 Class 3M5.*

3.1.4 Vibration

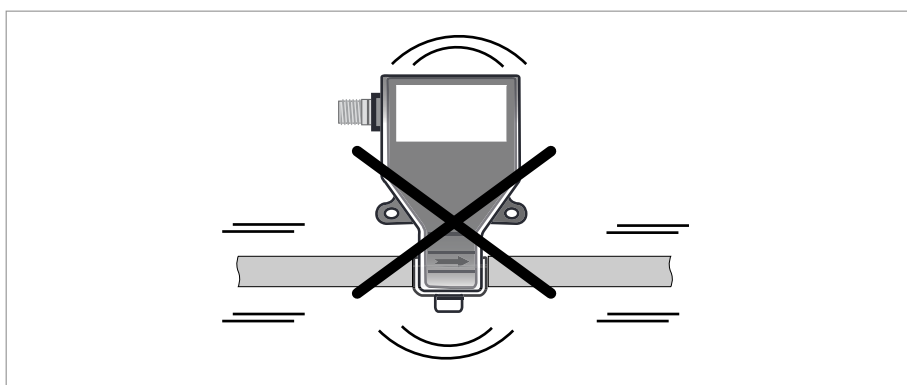


Figure 3-1: Avoid vibration

3.1.5 Magnetic field

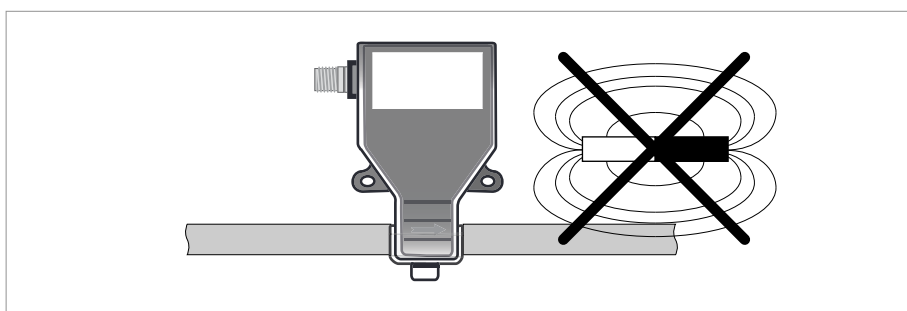


Figure 3-2: Avoid magnetic fields

3.1.6 Installation conditions

**CAUTION!**

To avoid meter malfunction make sure that minimal mechanical stress and no lateral force is applied to the flow tube (e.g. during installation and/or attaching the hoses).

When attaching the hoses, make sure that the hoses are attached in axis to the flow tube and that they are properly supported to avoid any lateral forces to the meter.

**INFORMATION!**

Please comply with the following recommendations:

3.1.7 Control valve

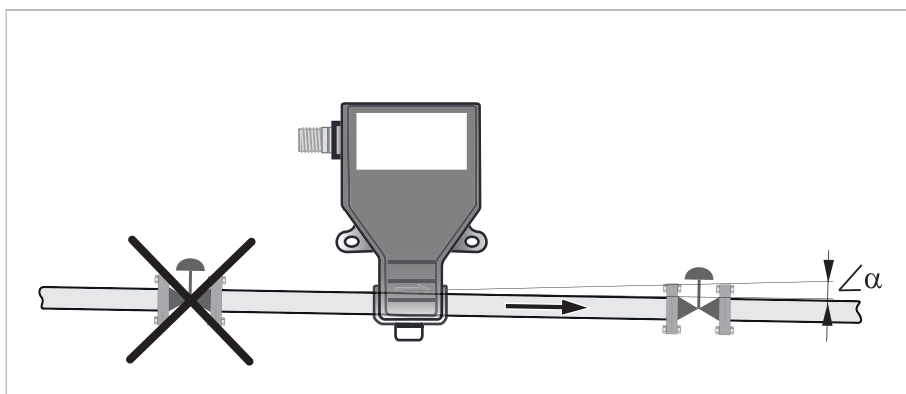


Figure 3-3: Installation in front of a control valve

$$\angle \alpha > 2^\circ$$

3.1.8 Pump

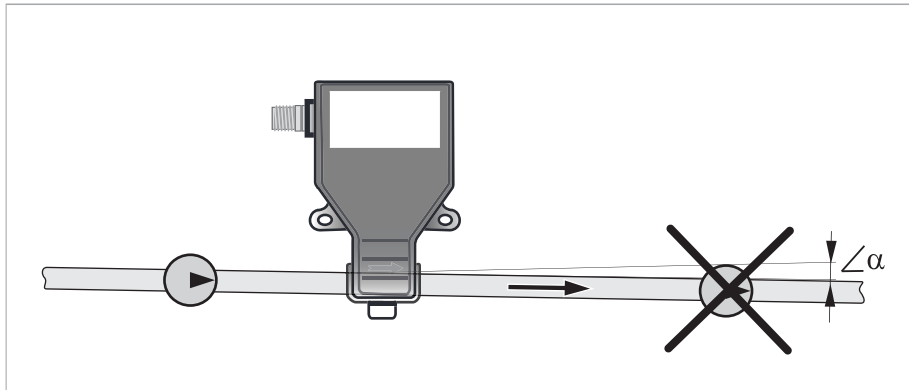


Figure 3-4: Installation behind a pump

$$\angle \alpha > 2^\circ$$

3.1.9 Open feed or discharge

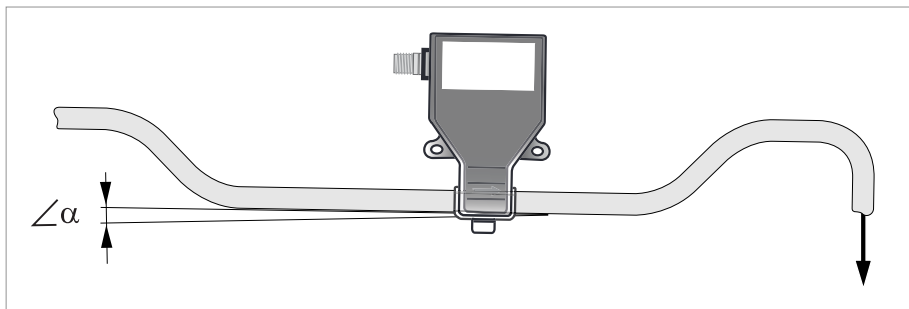


Figure 3-5: Installation in front of an open discharge

$$\angle \alpha > 2^\circ$$

3.1.10 Mounting position

The FLEXMAG 4050 C transmitter can be installed in every position.

**CAUTION!**

Do not use (or apply) forces above 1.5 Nm when mounting the transmitter on a surface.

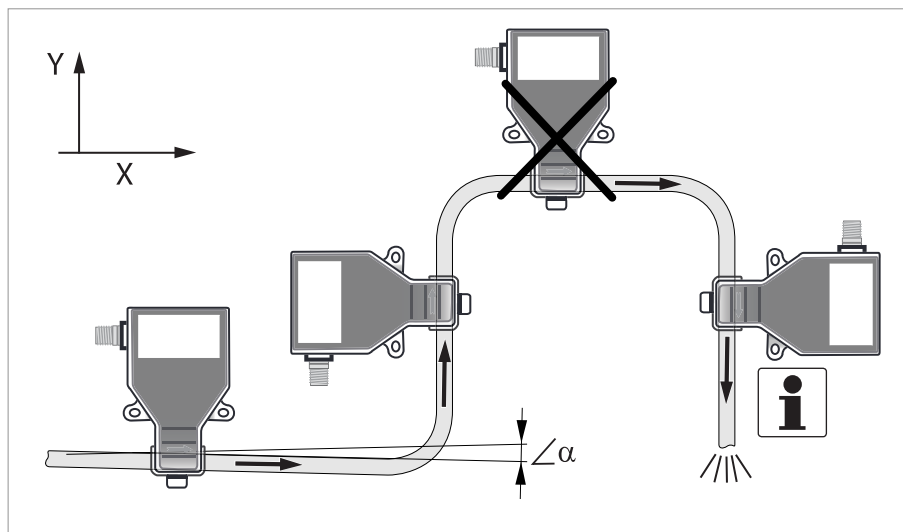


Figure 3-6: Installation in bending pipes

$$\angle \alpha > 2^\circ$$

**INFORMATION!**

Vertical down position only in conjunction with a control valve.

**CAUTION!**

Install in a slightly descending pipe section, to prevent air from collecting and to avoid faulty measurements (meter can drain).

**CAUTION!**

To ensure a correct measurement, avoid draining or partial filling of the flow sensor during operation.

3.1.11 Configuration of control system

After installation of the transmitter, the configuration of the control system has to be carried out.



- First, enter the flow rate calculation formula into the control system.
- Then enter the settings (see the nameplate on the device) into the control system.

For more information refer to *Configuration of the transmitter* on page 26 and refer to *Calculation of flow rate in the control system* on page 26.

3.1.12 Design of the single use assembly



CAUTION!

When designing the single use assembly related to the machine, make sure that minimal mechanical force is applied to the flow tube to avoid meter malfunction. When attaching the hoses, make sure that the hoses are attached in axis to the flow tube and that they are properly supported to avoid any lateral forces to the meter.



CAUTION!

The flow tube holder of the transmitter is designed specifically to fit the flow tube in only one way. During the assembling, make sure that the positioning of the tube is correct.

The flow tubes are compatible with bio-pharmaceutical (braided or non-braided) flexible hoses and are attached with clamps. Be sure to use the correct nominal inner diameter related to the inner diameter of the applicable flow tube.

Examples of suitable hoses and clamps:

Hoses

- Advantapure APSH silicone hose
- C-Flex (CFB)
- SaniTech STHT-R silicone hose

Clamps

- Optiker StepLess ear clamp

3.1.13 Positioning flow tube in the single-use kit assembly

**INFORMATION!**

The flow tubes are designed for single use and are manufactured in a clean room ISO 7 environment. Each tube is individually packed in a double layer PA/PE pouch. Special handling is required to keep the flow tube free of contamination. Please refer to your local procedures for the handling of single-use parts.

**INFORMATION!**

Inspect carefully the flow tube pouches for signs of damage or holes. Report damage to the carrier and to the local office of the manufacturer and do not use flow tubes from damaged pouches.

**INFORMATION!**

To avoid contamination of the tubes it is recommended to wear gloves during the complete procedure.

The storage, packing, sterilization, (or another handling) of the FLEXMAG flow tube has to comply with the applicable specifications.

3.1.14 Installation and removal of the flow tube

To install or exchange the flow tubes from the transmitter, please follow up the necessary steps:



- Move the tube ① in a horizontal direction into the transmitter ③ until the tube is flush with the front side of the transmitter.
- Push the clamp ② downward until the tube is locked (until the "click"). By moving the clamp downwards, the tube is guided to its proper position.
- Enter the diameter and the k factor of the new tube in place into the control system (For more information refer to *Configuration of the transmitter* on page 26).

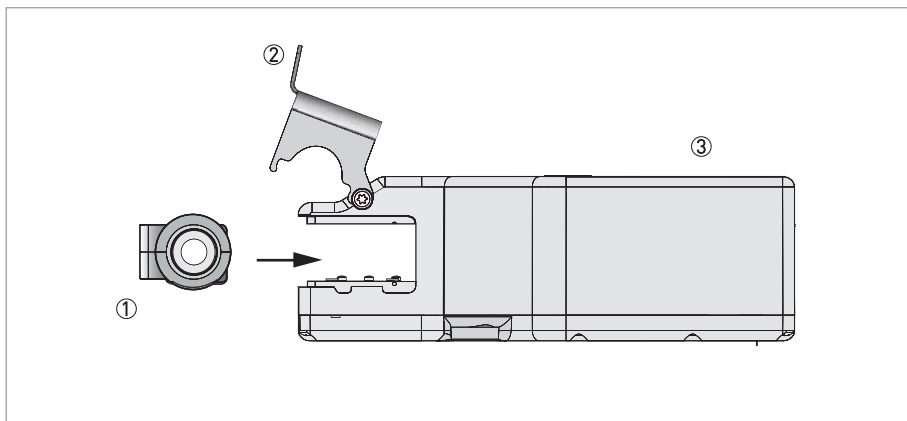


Figure 3-7: Insertion of flow tube



CAUTION!

When the flow tube is removed from the transmitter, the electrical contacts do not carry any harmful electrical load. However, in order to avoid corrosion or static discharge of those contacts avoid touching them with your hands.



CAUTION!

Make sure that the information (Q max., k factor and diameter) are the correct ones that are related to the installed tube.

4.1 Safety instructions



DANGER!

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



DANGER!

Observe the national regulations for electrical installations!



WARNING!

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



INFORMATION!

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

4.2 M12-8 pin connector

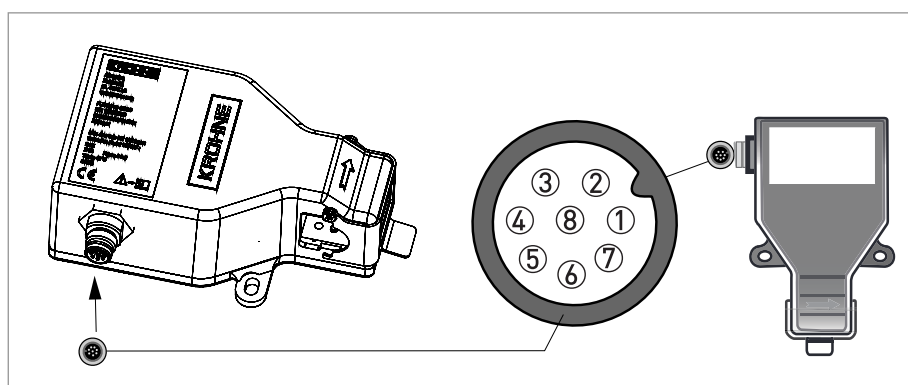


Figure 4-1: Pin location and layout

Use one of the following plug types to connect the flowmeter:

- moulded plug, straight or angle-entry form
- integrally extruded plug with cable in various lengths



INFORMATION!

For the connection diagrams refer to Connection diagrams on page 24.

4.3 Grounding and electrical connection


INFORMATION!

Make sure to use a galvanically isolated power source.


CAUTION!

The transmitter is working with the pulse or mA output. Do not connect both outputs at the same time. The cable of the output which is not used, should be cut short or placed in a connector with open ends.


WARNING!

Avoid any electrostatic discharge, to minimize the risk of non-reversible damages.

The manufacturer provides an optional connection cable for the connection to the transmitter. The cable length is 2 m / 6.56 ft., but can be cut to shorter length.

Cable connection

Pin	Function	Wire colour
1	Not used	White
2	+24 VDC	Red
3	Ground (GND)	Blue
4	Frequency output (+)	Yellow
5	Frequency output (GND)	Grey
6	Current output (+)	Brown
7	Current output (-)	Green
8	To be connected for service only	Pink


WARNING!

To comply with the EMC standard EN 61326-1: 2013, follow the cable guidelines. Disregarding this warning could lead to electromagnetic interferences which could harm the meter as well as other electrical equipment in the proximity of the device.

Cable guide lines

- Use shielded cables if the cable length > 2 m/ 6.6 ft (with a maximum length of 10 m/ 32.8 ft)
- The outer shielding is open at the M12 connector on the flowmeter side
- Connect the outer shielding at the safety ground at the counter side for a proper signal performance

4.4 Connection diagrams

4.4.1 Current output active

**CAUTION!**

To avoid damage or destruction of the device always note the following items:

- Observe the connection polarity!
- Note the properties of the current output in the technical data section.
- $U_{nom} = 24 \text{ VDC} \pm 1\%$
- $U_{int} = 22 \text{ VDC}$
- $I = 4 \dots 20 \text{ mA}$
- $R_L \leq 400 \Omega$

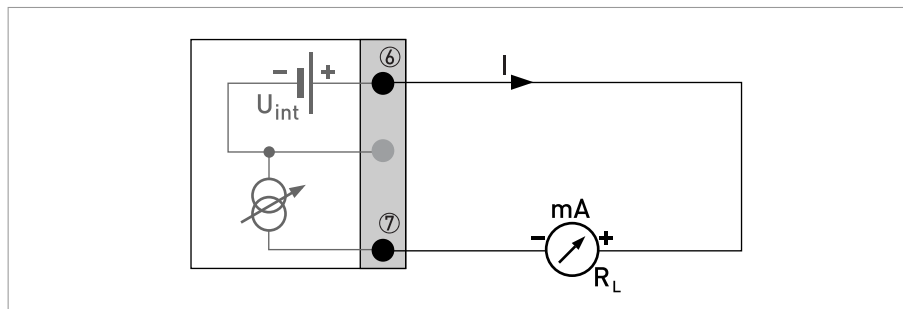


Figure 4-2: Connection diagram of current output (active)

4.4.2 Pulse/frequency output active


CAUTION!

To avoid damage or destruction of the device always note the properties of the pulse output: refer to Technical data on page 36.

Pulse/frequency output active:

- $U_{nom} = 24 \text{ VDC}$
- For $\frac{1}{4}$ " :
 f_{max} set to 10000 Hz
 For $\frac{3}{8} \dots 1$ " :
 f_{max} set to 1000 Hz
- the build in load resistance $R_L = 2.2 \text{ k}\Omega$
- the load impedance $15 \text{ k}\Omega \leq R_i \leq 200 \text{ k}\Omega$

If the inner resistance = $1 \text{ M}\Omega$ you can add a parallel resistor R

Example: $R = 22 \text{ k}\Omega$ and $R_i = 1 \text{ M}\Omega$ then $R_L = 21.5 \text{ k}\Omega$

$U_0 = 21.5 \text{ V}$ at $0.1 \dots 1 \text{ mA}$ (contact closed); $I \leq 0.05 \text{ mA}$ when contact is open

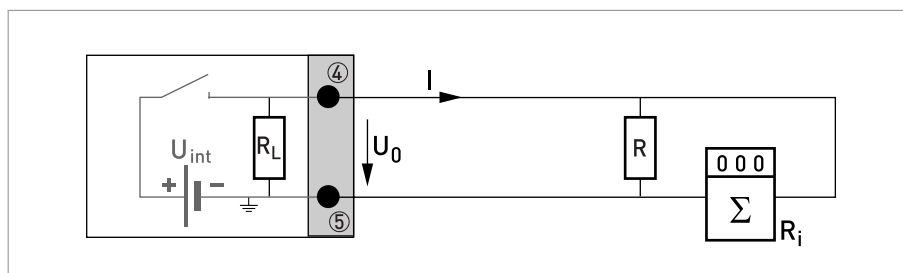


Figure 4-3: Connection diagram of pulse output

5.1 Configuration of the transmitter

All operating data for the transmitter is set at the factory. This includes the maximum flow rate/measuring range and the maximum flow rates for the tube sizes, which are printed on the nameplate.

Flow ranges (standard factory settings)

Flow tube size	Flow range. (approximate flow max. in standard) [l/min]	Customized maximum flow (up to) [l/min]
ID ¼"	0.015 to 3	11
ID 3/8"	0.07 to 14	25
ID ½"	0.1 to 20	45
ID ¾"	0.3 to 62	100
ID 1"	0.5 to 75	180



INFORMATION!

Customer specified flow ranges are available on request. Please contact the local office of the manufacturer for more information. Refer to the device stickers for precise Qmax to set up.

5.2 Calculation of flow rate in the control system

The configuration of the analogue output and frequency output is already set in the factory during calibration of the transmitter and cannot be changed in the field. In order to translate the value, provided by the output to an actual flow rate value the next formulas have to be implemented into the control system:

$$Q = Q_{\max} \cdot k \cdot (I - 4) / 16$$

$$Q = Q_{\max} \cdot k \cdot f / f_{\max}$$

Q = flow rate in l/min

Q_{max} = maximum flow rate of the tube (on transmitter nameplate)

k = calibration factor of the tube (on tube label)

I = current in mA

f = frequency in Hz

f_{max}; depends on setting 1000...10000 Hz

5.3 Parameters to set when installing the transmitter

For initial setup of the flow rate calculation at the installation of the transmitter (or change of transmitter), the next constants have to be entered to the formulae in the control system;

tube size: 1/4" (small)

$Q_{\max} 1/4"$ = maximum flow rate of the 1/4" tube

tube size: 3/8"- 1/2" (medium)

$Q_{\max} 3/8"$ = maximum flow rate of the 3/8" tube

$Q_{\max} 1/2"$ = maximum flow rate of the 1/2" tube

tube size: 3/4"- 1" (large)

$Q_{\max} 3/4"$ = maximum flow rate of the 3/4" tube

$Q_{\max} 1"$ = maximum flow rate of the 1" tube

The ratio between both $Q_{\max}$. of a flow tube is a characteristic of the transmitter. Below the approximate ratios that are applying:

For the transmitter with medium size flow tube 3/8"-1/2": $Q_{\max} 3/8" = 0.71 * Q_{\max} 1/2"$

For the transmitter with large size flow tube 3/4"-1": $Q_{\max} 3/4" = 0.83 * Q_{\max} 1"$

When specified at the order, setting of a customized maximum flow is possible for one diameter. The other $Q_{\max}$ is set up with the defined ratio.

The exact $Q_{\max}$ value, corresponding to the full scale, to set up in data acquisition systems is written on the stickers of the transmitter. Between transmitters, different $Q_{\max}$ values are possible.

5.4 Parameters to set at each change of the flow tube

The tube is marked with the k factor and the diameter of the tube. The corresponding max flow is written on the name plate of the transmitter (one max flow per diameter). The two values (k factor and max flow) need to be entered into the flow rate calculation formulae of the control system.



CAUTION!

For the correct calculation of the flow rate make sure that;

- *after each change of the single-use flow tube, to check and enter the maximum flow ($Q_{\max}$.) and the k-factor of the new flow tube into the formula of the control system.*
- *the k factor is put in the control system correct and accurately (without typing an error, with 3 digits after the decimal point) as printed on the flow tube label.*
- *the tube diameter is entered in the control system (1/4 - 3/8 - 1/2 - 3/4 or 1", as printed on the label).*

6.1 Cleaning

Surface cleaning on the FLEXMAG 4050 C housing is done with a soft wet cloth moistened with water or IPA (isopropyl alcohol) cleaning agent.



INFORMATION!

The flow tubes are designed as single-use parts and cleaning is therefore not advised. If cleaning is necessary, please refer to your local procedures and regulations.

6.2 Verification kit

A verification kit consisting of a tube calibrated with a calibration certificate is available on demands. The kit is not clean and not made for production purposes.

6.3 Spare parts availability

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

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

6.4 Availability of services

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



INFORMATION!

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

6.5 Returning the device to the manufacturer

6.5.1 General information

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



WARNING!

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

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



WARNING!

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

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

6.5.2 Form (for copying) to accompany a returned device



CAUTION!

To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

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

6.6 Disposal



LEGAL NOTICE!

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

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:



According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.

The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

6.7 Disassembly and recycling

This section briefly describes the instructions of handling and disassembling the device when it has reached the end of its useful life (EOL) or is disposed of after usage. The information given is sufficient to gather the most important parts of the device (by the end-user) which can be used for recycling.

Detailed information needed by WEEE collection and/or dismantling centre and recycling operators (and companies) is available on request at the support centre.

Product description and data/info:

Electromagnetic flowmeter for liquid flow measurement

Averages values	Size and values are depending on version [S/M/L] : ①	
L x W x H:	150 x 100 x 55 [mm]	5.9" x 3.9" x 2.2" [inch]
Volume:	0.0006...0.0010 m ³	38...60 inch ³
Weight:	0.4...0.5 kg	0.88...1.1 lb
Weight, metal parts:	0.2...0.25 kg	0.44...0.55 lb
Weight, plastic parts:	0.15...0.20 kg	0.33...0.44 lb

The mentioned (average) values are an indication and depending on the version (small, medium or large). For detailed information refer to *Dimensions and weights* on page 41



INFORMATION!

The device has to be de-installed from the piping-circuit and cleaned properly before disassembling is possible. The device does not have a battery (or circuit board cell) inside and the printed circuit board material used, contains a minimal weight percentage of brominated flame retardants. The device is RoHS compliant.

Always disconnect the device and all cables before continuing disassembling.



INFORMATION!

Before disassembling the device make sure you have the proper tools needed:

- Torx screwdriver T1 and 2
- Pozidriv screwdriver PZ1 (1 x 75)
- (Adjustable) wrench 18 - 19mm



CAUTION!

- Wear personal protective equipment.
 - Make sure that you use a stable workplace/bench to do the disassembly actions.
- There are no special guidance or actions necessary to disassemble the device.*

**DANGER!**

The device **MUST** be disconnected from mains power before disassembling.

**Remove flow tube and connection cable**

- Remove the (optional) flow tube and connection cable if these are still attached to the transmitter. Pack the flow tube in a plastic pouch for a separate and/or specific disposal.

Material/components connection cable

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Plastics, copper and/or steel mixture	0.1	0.2	2 meters external cable (option)

Material/components of flow tube

Material (or material code)	Weight			Additional information
	[kg]	[lb]	% of total weight	
Flow tube	0.007...0.044	0.015...0.1		depending on size
Mixture PSU (Polysulfone)	0.005...0.034	0.01...0.075	± 75%	UL-94 compliant
Stainless steel	0.002...0.01	0.0044...0.022	± 25%	electrodes



Disassembling the device

- Unscrew the 2 Torx screws from the metal clamp and remove the clamp.
 - Remove all the Torx screws from the backside of the device, open it and put front and back piece flat on your workbench/table.
 - Unscrew the Philips screw and unplug the connector on the side of the PC board.
 - Unplug all other connectors and remove the little PCB. (remove any solid soldered wire from the circuit board).
 - Slide the coil holder backwards and remove it from the housing. (remove any solid soldered wire from the circuit board).
 - Remove the silicon caps around the 3 electrodes (at the small part of the PCB) and put both the PCB aside.
 - Unscrew the nut and bush of the electric connector with the use of 2 (adjustable) wrench.
 - Remove all wire and connector parts, twist back the bush and nut and put it together with the coil.
- ➡ All parts are now disassembled and can be shipped separately for reuse and/or recycling.

Exploded view

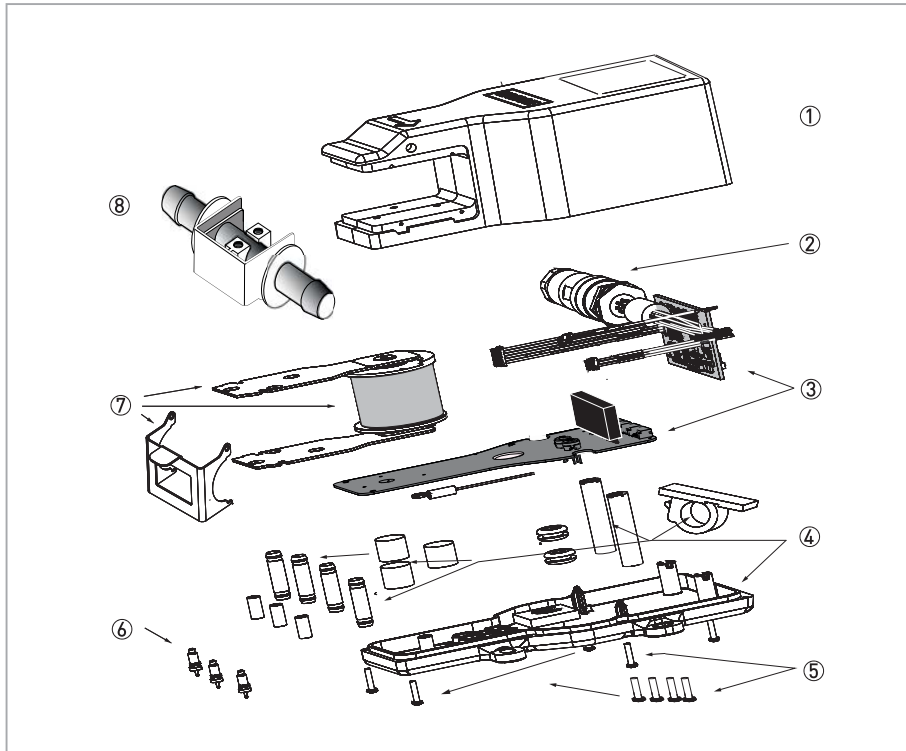


Figure 6-1: Disassembled device

- ① Plastic part of the upper housing
- ② Connector part
- ③ PC board(s) with components and wire connections
- ④ Plastic and rubber components/parts and backside of housing
- ⑤ Different screws (metal)
- ⑥ Separated electrodes (gold plated)
- ⑦ Metal parts clamp and coil holder with coil (copper wire)
- ⑧ Separate flow tube

Overview of the materials and components

The items mentioned in the listing below are the main parts of the device. The values depends on the version and are only an indication.

Materials/components, which must be removed and treated separately

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Printed Circuit Boards	0.05	0.1	average size: ~63 cm ² / 9.8 inch ² (± 3%)
Electrolyte capacitor	-	-	
Battery	-	-	
LCD screen	-	-	

Material/components, which can disturb recycling processes

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Mixture ABS / steel	0.005	0.011	e.g. plastic components, rings, screws
Plastics mixture	0.003	0.007	e.g. strap
Silicon / rubber	0.002	0.004	e.g. rubber ring, foam
PVC & connector parts	0.03	0.07	connector and inner cables, ferrite

Beneficial material/components, useful for recycling

Material (or material code)	Weight		Additional information
	[kg]	[lb]	
Stainless steel	0.002	0.004	clamp
Aluminum	0.002	0.004	screws
Metal mixture	0.02	0.044	coil bracket
Copper	0.18	0.4	coil
ABS/ plastics	0.13	0.29	housing
Part ⑥	0.002	0.005	gold plated electrodes

Total (average) *	0.426	0.94	* depending on version
Printed circuit board	0.05	0.1	10%
Plastic content	0.130	0.29	30%
Metal parts content	0.210	0.46	50%



INFORMATION!

The values in the table are an indication of the different material content in the device

7.1 Measuring principle

An electrically conductive fluid flows inside an electrically insulated pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils.

Inside of the fluid, a voltage U is generated:

$$U = v * k * B * D$$

in which:

v = mean flow velocity

k = factor correcting for geometry

B = magnetic field strength

D = inner diameter of flowmeter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate Q . A transmitter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

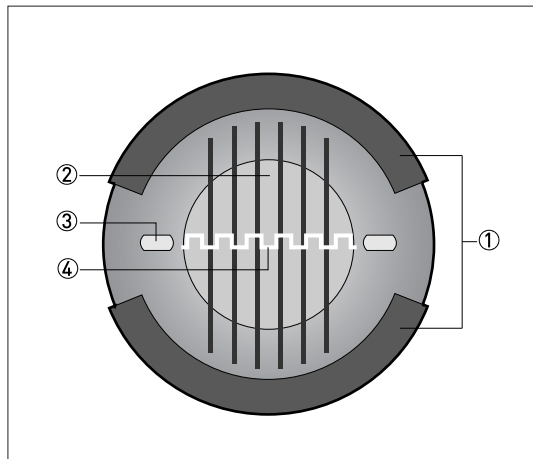


Figure 7-1: Measuring principle

- ① Field coils
- ② Magnetic field
- ③ Electrodes
- ④ Induced voltage (proportional to flow velocity)

7.2 Technical data



INFORMATION!

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

Measuring system

Measuring principle	Faraday's law
Application range	Electrically conductive fluids
Measured value	
Primary measured value	Flow velocity

Design

Modular construction	The measurement system consists of a transmitter and a single use flow tube
Features	One transmitter for 2 diameters of flow tubes
Version	FLEXMAG 4050 C
Nominal diameter	Transmitter (Small) 1/4", (Medium) 3/8" and 1/2", (Large) 3/4" and 1".

Measuring accuracy

Measuring error	$\pm 1\% + 1 \text{ mm/s}$
	Depends on flow velocity, size and installation. For detailed information refer to <i>Measurement accuracy</i> on page 40
Measuring range (factory set up)	ID 1/4" = 0.015...3 litre per minute
	ID 3/8" = 0.07...14 litre per minute
	ID 1/2" = 0.1...20 litre per minute
	ID 3/4" = 0.3...62 litre per minute
	ID 1" = 0.5...75 litre per minute
	Customer specific ranges on request. Refer to the device sticker, for the exact value.
Maximum flow (on request)	ID 1/4": 11 litre per minute
	ID 3/8": 25 litre per minute
	ID 1/2": 45 litre per minute
	ID 3/4": 100 litre per minute
	ID 1": 180 litre per minute
Maximum measuring error	The additional typical measuring deviation for the current output is $\pm 5 \mu\text{A}$
	The max. measuring error depends on the installation conditions
Repeatability	0.5% ($v > 0.5 \text{ m/s}$)
Calibration / Verification	Standard:
	Calibration in factory for transmitter and separate flow tubes. Batching calibration of flow tubes in factory.
	No on-site calibration required
Optional:	
Special calibration	On request

Operating conditions

Temperature	
Process temperature	+2...+45°C / 35...+113°F
Ambient temperature	+2...+60°C / 35...+140°F
Storage temperature	-40...+60°C / -40...+140°F
Shelf life (flow tube)	3 years
Pressure	
Ambient pressure	Atmospheric
Process pressure	Up to 4 bar/58 psi
Burst pressure	20 bar/290 psi
Chemical properties	
Physical condition	Electrically conductive liquids
Electrical conductivity	Water: $\geq 20 \mu\text{S/cm}$

Installation conditions

Installation	Assure that the flow sensor is always fully filled
	For detailed information refer to <i>Installation conditions</i> on page 16.
Flow direction	Forward
	The arrow on the transmitter indicates the positive flow direction
Inlet / Outlet	ID ¼", 3/8", and ½": no straight lengths required.
	ID ¾" and 1": 1 DN
Dimensions and weights	For detailed information refer to <i>Dimensions and weights</i> on page 41.

Materials

Transmitter housing	Polycarbonate/Acrylonitrile butadiene styrene (PC/ABS)
Flow tube	Manufactured in clean room at ISO 13485 certified site. Packed in individual double sealed packing material (pouches).
Wetted materials flow tube	Thermoplastic: Polysulfone (UDEL 1700)
Material of flow tube pouches	Polyamide/Polyethylene (PA/PE)
Measuring electrodes	Hastelloy C22
Earthing electrodes	Hastelloy C22
Sterilization of flow tube outside of the original pouch	Gamma sterilizable up to 50 kGy and autoclavable up to 121°C for 30 min

Process connections

Single barb	¼", 3/8", 1/2", 3/4" or 1" ID.
-------------	--------------------------------

Electrical connections

Mains	
Power supply	For pulse output: 24 VDC ± 25% (18...30 VDC)
	For current output: 24 VDC ± 1%
Power consumption	≤ 3 W
Cable connections	Standard; 1 x M12, 8-pin connector
Outputs	
General	All operating data are preset at the factory
Pulse output	Pulse/frequency output active
	¼": 0...10000 Hz; 10000 Hz at Q _{max} (up to 120%) 3/8"...1": 0...1000 Hz; 1000 Hz at Q _{max} (up to 120%)
Pulse width value (at full scale)	Pulse width = symmetrical, 1:1
Active operation	U ₀ nom = 24 V
Current output	Current (active)
	4...20 mA; 4 mA at 0 litre per minute; 20 mA at Q _{max}

Approvals and certificates

CE	
This device fulfils the statutory requirements of the EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.	
	For full information of the EU directive & standards and the approved certifications; please refer to the EU Declaration of Conformity or the website of the manufacturer.
Compliance	
Raw material (wetted part)	FDA 21 CFR 177
	ISO 10 993
	Material certificate 3.1
	Hemolysis
Manufactured tubes	USP VI
	USP 87, USP 88.
	USP 661
	BSE/TSE free
	Extractable on demand
Clean room	ISO 13485
	Particulate matters USP 788, EP 2.9.19.
	Endotoxin EP 2.6.14
	Bioburden EN NF ISO 11737-1
Other approvals and standards	
Protection category acc. to IEC 60529	IP54
Vibration resistance	IEC 60721-3-3 Stationary operation at weather protected locations Class 3M5
Shock resistance	

7.3 Measurement accuracy

Every electromagnetic flowmeter is calibrated by direct volume comparison. The wet calibration validates the performance of the flowmeter under reference conditions against accuracy limits.

The accuracy limits of electromagnetic flowmeters are typically the result of the combined effect of linearity, zero point stability and calibration uncertainty.

Reference conditions

- Medium: water
- Temperature: +5...35°C / +41...95°F
- Operating pressure: 0.1...5 barg / 1.5...72.5 psig
- Inlet section: ≥ 5 DN
- Outlet section: ≥ 2 DN

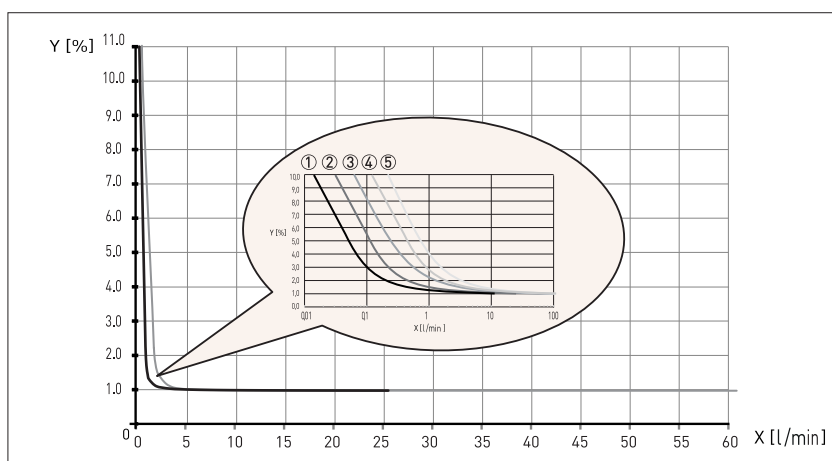


Figure 7-2: Flow rate versus accuracy

X [litre/minute]: flow rate

Y [%]: deviation from the actual measured value (MV)

Accuracy

Nominal size	Minimal flow rate [l/min]	Flow rate for 3...1% error [l/min]	Flow rate for 1% error [l/min]	Curve
ID 1/4"	0.015	0.1...1	1...3	①
ID 3/8"	0.07	0.2...2	2...14	②
ID 1/2"	0.1	0.4...4	4...20	③
ID 3/4"	0.3	0.9...8.5	8.5...62	④
ID 1"	0.5	1.5...15	15...75	⑤



INFORMATION!

Check for the exact values the stickers on the flow tube and transmitter

7.4 Dimensions and weights



INFORMATION!

The measured values are according standard DIN 16901-130

Transmitter dimensions

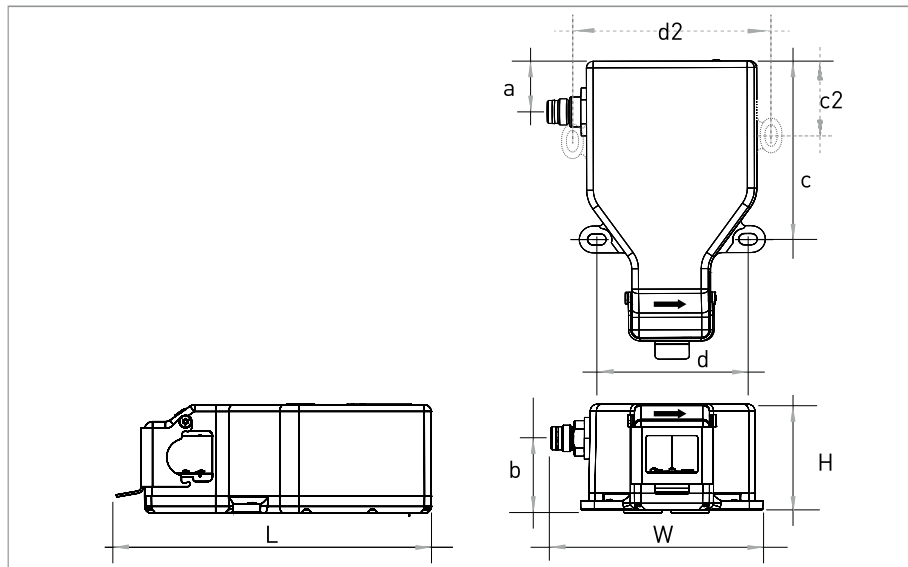


Figure 7-3: Dimensions of transmitter

Nominal size	Dimensions transmitter [mm]							Weight [g]
	L	W	H	a	b	c	d	
Large	160	100	60	23	42	100	59	460
Medium	139	90	48	23	33	82	66	390
Small	144	90	48	28	33	94	66	400
Mounting holes diameter 5.2 x 8.2 mm Note: only for Large version: c2 = 41 mm / d2 = 84 mm								

Nominal size	Dimensions Transmitter [inches]							Weight [ounce]
	L	W	H	a	b	c	d	
Large	6.3"	4.0"	2.4"	0.9"	1.7"	4.0"	2.3"	16.2
Medium	5.5"	3.6"	1.9"	0.9"	1.3"	3.2"	2.6"	13.8
Small	5.7"	3.6"	1.9"	1.1"	1.3"	3.7"	2.6"	14.1
Mounting holes diameter 0.2 x 0.3 inch Note: only for Large version: c2 = 1.6" / d2 = 3.3"								



INFORMATION!

Dimension L: the total space minimal needed to open the clamp and remove the flow tube is size $L + 25 \text{ mm} / 1" + \text{size } W \text{ of the flow tube}$ (see next page for W dimensions.)

Flow tube dimensions

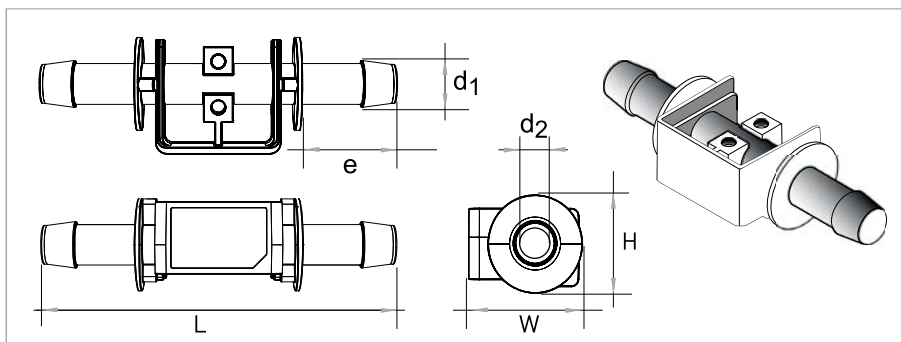


Figure 7-4: Dimensions of the flow tubes

Nominal size	Dimensions flow tube [mm]						Wetted surface [mm ²]	Wetted volume [mm ³]	Weight [g]
	L	W	H	e	d1	d2			
ID ¼"	70	22	17	16.6	8.5	5.5	1270	1802	6.4
ID 3/8"	95	30	25	25.6	13.6	9.5	2652	5847	13
ID ½"					16.9	12.7	3650	10987	14
ID ¾"	125	45	41	36.0	23.0	19.0	7199	33148	36
ID 1"	140			44.0	30.0	22.2	10026	57470	44

Nominal size	Dimensions flow tube [inches]						Wetted surface [inch ²]	Wetted volume [inch ³]	Weight [ounce]
	L	W	H	e	d1	d2			
ID ¼"	2.8"	0.9"	0.7"	0.7"	0.3"	0.2"	2.0	0.11	0.22
ID 3/8"	3.7"	1.2	1"	1"	0.5"	0.4"	4.1	0.36	0.46
ID ½"					0.7"	0.7"	5.7	0.67	0.49
ID ¾"	4.9"	1.8"	1.6"	1.4"	0.9"	0.9"	11.2	2.0	1.3
ID 1"	5.5"			1.7"	1.2"	1.2"	15.5	3.5	1.6





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

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

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