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РАСХОДОМЕРЫ ЭЛЕКТРОМАГНИТНЫЕ

FLEXMAG 4050C

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
2020	ER 1.0.6_ (SW. REV. 3.2.3_)	1	MA FLEXMAG 4050C R04

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

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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.

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 signal transmitter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

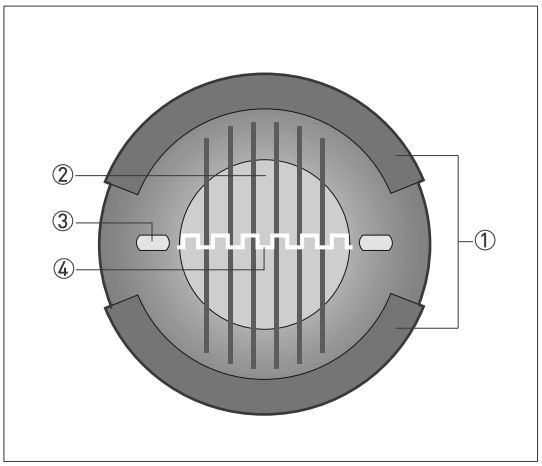

Figure 7-1: Measuring principle

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) ¼", (Medium) 3/8" and 1/2", (Large) 3/4" and 1".

Measuring accuracy

Measuring error	Depends on flow velocity, size and installation. For detailed information refer to *Measurement accuracy* on page 39
Measuring range (factory set up)	ID ¼" = 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
Maximum measuring error	The max. measuring error depends on the installation conditions
Repeatability	0.5% (v > 0.5 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: ≥ 20 µS/cm

Installation conditions

Installation	Assure that the flow sensor is always fully filled
	For detailed information refer to *Installation conditions* 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 *Dimensions and weights* on page 40.

Materials

Transmitter housing	Polycarbonate/Acrylonitrile butadiene styrene (PC/ABS)
Flow tube	Manufactured in cleanroom 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 Qmax (up to 120%) 3/8"...1": 0...1000 Hz; 1000 Hz at Qmax (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:
- Operating pressure:
- Inlet section: ≥ 5 DN
- Outlet section: ≥ 2 DN

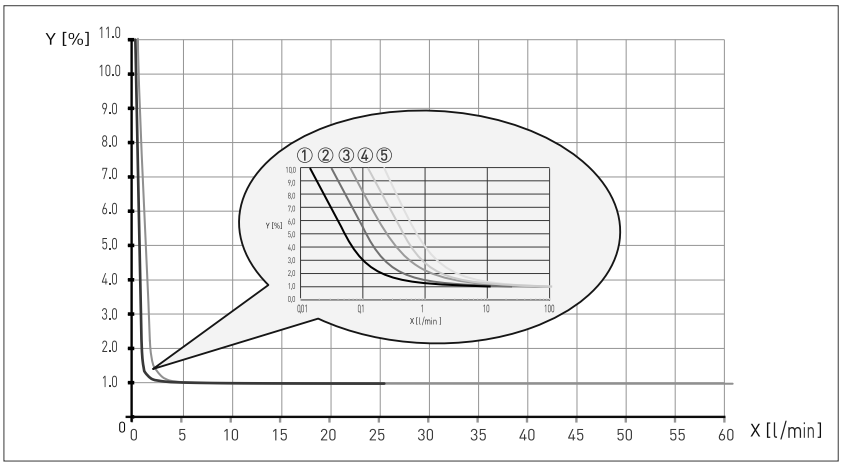

Figure 7-2: Flow rate versus accuracy
X [litre/minute]: flow rate
Y [%]: deviation from the actual measured value (MV)

Accuracy

Nominal size	Minimal flow rate [l/min]	Flow rate error [l/min] Pulse output: 3…1% Analog output: 5.5…1.2%	Flow rate error l/min] Pulse output: 1% Analog output: 1.2…1%	Curve
ID ¼"	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

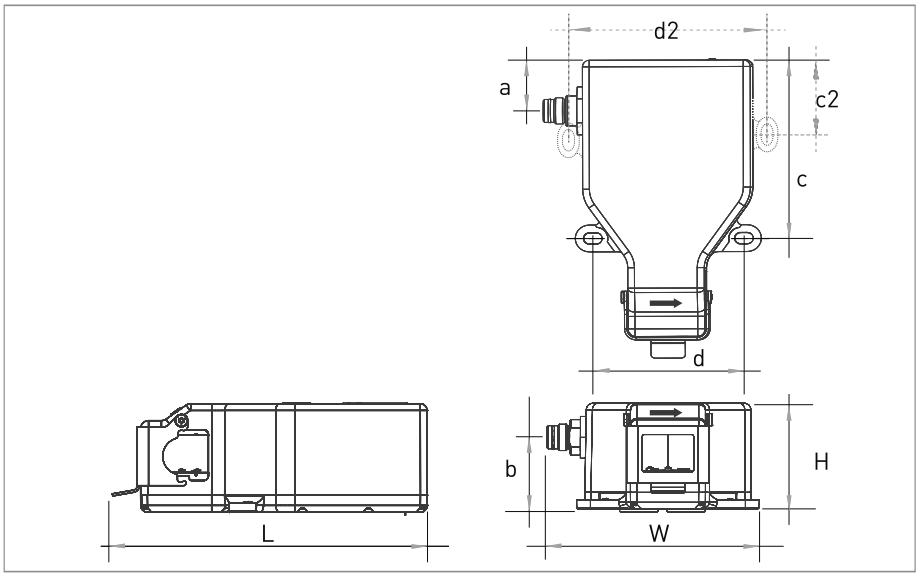

Figure 7-3: Dimensions of transmitter

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 mm / 1" + size W of the flow tube (see next page for W dimensions.)

Flow tube dimensions

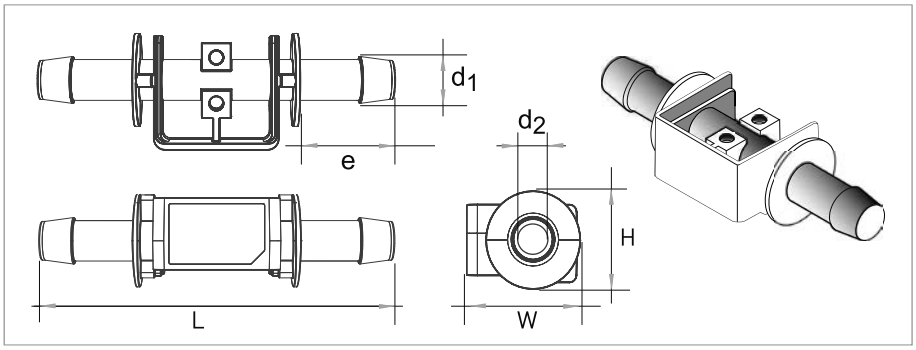

Figure 7-4: Dimensions of the flow tubes

Nominal size	Dimensions flow tube [mm]						Wetted surface [mm²]	Wetted volume [mm³]	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 [inch²]	Wetted volume [inch³]	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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