

Electromagnetic Flowmeter

SpiraMAG®

Operating Manual



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1. Identification

Manufacturer:

Bopp & Reuther Messtechnik GmbH
 Am Neuen Rheinhafen 4
 67346 Speyer
 Germany

Phone: +49 6232 657-0
 Fax: +49 6232 657-505

2. Information concerning certifications and standards






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 of the product.


3. Basic safety information


Description of symbols:


	<p>Important Notes!</p> <p>Please consider these notes carefully to achieve a reliable functional system. The accompanying text contains important information about the product, handling the product or about a section of the documentation that is of particular importance.</p>
	<p>WARNING!</p> <p>Failure to take the prescribed precautions could result in death, severe bodily injury, or substantial material damage.</p>
	<p>WARNING!</p> <p>Hazard of electrical shock!</p> <p>Failure to take the prescribed precautions could result in death, severe bodily injury, or substantial material damage.</p>


Basic safety notes:

	<p>For safe and proper use of this product, please read this instruction manual thoroughly before installation.</p> <p>Only qualified personnel should install and / or repair this product. If a fault appears, contact your distributor.</p>
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	<p>The manufacturer is not liable for any damage resulting from improper usage or use for other than the intended purpose.</p> <p>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.</p>
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	<p>If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.</p>
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	<p style="text-align: center;">Carrying and Mounting of Heavy parts</p> <p>Be careful during mounting and installation of heavy product variants (e.g. for high nominal sizes). Always secure the device to prevent it from falls. Consider proper fixation tools to prevent injuries.</p> <p>Do not place any unit on an unstable surface that may allow it to fall.</p>
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	<p>Failure to adhere to these safety instructions may result in damage to the product or serious bodily injury.</p> <p>Please also consider dedicated safety notes in chapter „Installation Notes“.</p>
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Handling of faults:

	<p>Disconnect all units from power supply and have it repaired by a qualified service person if any of the following occurs:</p> <ul style="list-style-type: none"> •If any power cord or plug is damaged or frayed •If a unit does not operate normally when operating instructions are followed •If a unit exposed to rain/water or if any liquid has been spilled into it •If a unit has been dropped or damaged •If a unit shows a change in performance, indicating a need for service
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4. Intended Use

4.1. Intended Usage

This electromagnetic flowmeter device is designed exclusively to measure the flow of electrically conductive, liquid media (fluids) in a fixed industrial equipment context.


This device is not intended to be used in safety critical environment or for safety critical applications according to DIN/EN/IEC 61508-1.

The device may be used according to directive 2014/68/EU, only if the resulting classified category of the system is less than category I. This device is intended to be used only for fluids of group 2 according to directive 2014/68/EU. Such fluids are not classified as physical or health hazardous.




	<p>No safety component!</p> <p>This device is not a safety component in accordance with Directive 2006-42-EC (Machine Directive). Never use it as a safety component.</p>
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4.2. Intended User

The intended user is not a general purpose user and interacts with the device using the “*User Interface*” or by accessing data provided by the *output* connections.

	<p>The intended user is not allowed to open, manipulate the device and touch electrical connections or circuits.</p> <p>The device may be installed, maintained, services or opened only by dedicated and qualified service personal.</p> <p>Special instruction for service personal is given in chapters “Installation Notes”.</p>
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4.3. Intended environmental conditions

	<p>This device is a group 1, class A device as specified within EN55011:2016+A1:2017. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.</p>
	<p>Environment altitude for AC powered devices</p> <p>The AC powered device family is intended to be used only in an altitude up to 2000 m.</p>
	<p>Avoid installation in strong corrosive atmospheric environments. Installation location should have adequate ventilation. Protective properties should be recruited to prevent the corrosive gases and moisture into the instrument. Avoid direct sunlight, especially on the liquid crystal display part. Strong vibrations should be avoided.</p>

Environmental conditions:

Usage	Indoor and outdoor depending on IP class	
Altitude	up to 2000 m	
Temperature range (ambient)	Converter	-25 to +60°C (powered variants) -10 to +60°C (battery variants)
Temperature range (fluid)	Sensor	PTFE / PFA -40 to +160°C* 0 to +70°C (compact mounted , rubber liner) 0 to +90°C (remote mounted , rubber liner) -40 to +100°C (compact mounted, with PTFE/PFA liner) -40 to +160°C* (remote mounted, with PTFE/PFA liner) * fluid temperatures over 100°C or any other pressurized gases (non-fluids) are not part of the intended use for this product according to 2014/68/EU, if it will lead to categories > category I.
Relative humidity	90 %	
Main supply voltage fluctuations	±10 % of nominal voltage	
Overvoltage	category II (IEC/EN/DIN 61010-1)	
Wet environment	see IP class	
Pollution degree	2	



Large temperature changes should be avoided. If the meter installed by the thermal radiation, please provide the thermal isolation or ventilation. For converters installed in the switch box, there should be appropriate considerations of temperature and ventilation.

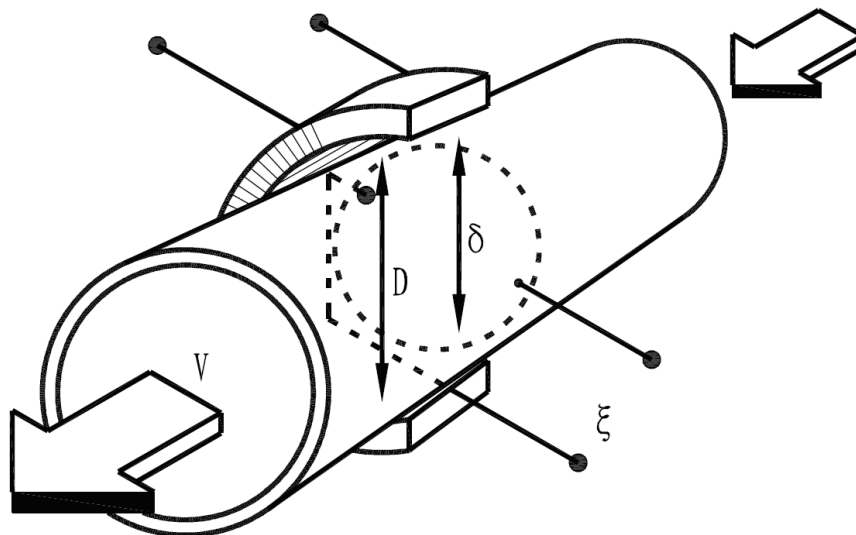
Never place the units above a radiator or heating unit.

Notes on temperature ranges

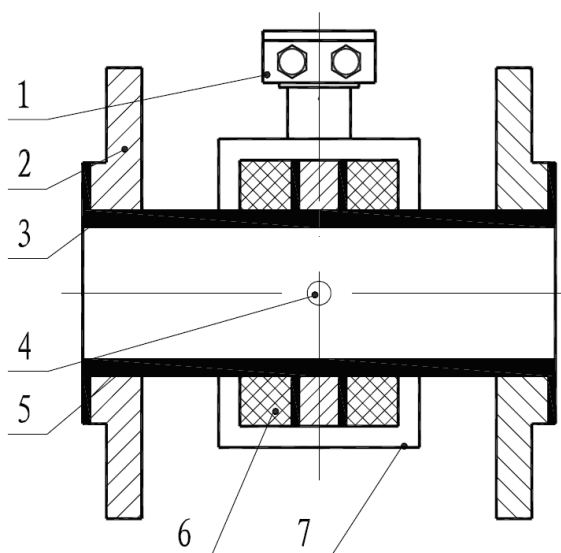
- Strictly observe the components maximum temperature ranges
- In regions with extremely high ambient temperatures, it is recommended to protect the amplifier from direct sunlight
- In cases where fluid temperature exceeds 100°C, foresee adequate variants (e.g. remote and PTFE / PFA)
- For compact version flowmeters, converter working environment temperature should be considered

5. Operation principle

The operation of a electromagnetic flowmeter is based Aon Faraday's induction law, which states that the voltage induced across any conductor as it moves at right angles through a magnetic field is proportional to the velocity of that conductor. With fluid flow acting as moving conductor, two opposite measuring electrodes conduct the induced voltage which is proportional to flow velocity to the amplifier. Flow volume is calculated based on pipe diameter.



The electromagnetic flowmeters are intended for the metering of all fluids with electric conductivity of at least 5 $\mu\text{S/cm}$ (20 $\mu\text{S/cm}$ for demineralized water). These series of meters is characterized by a high degree of accuracy. Measuring results are independent of density, temperature and pressure. Water, waste water, a variety of acids, alkali, salt solution, paper pulp, slurry and other conductive liquids or liquid-solid two-phase fluid flows are measurable with these series of flowmeters.



Sensor Structure:

- 1: Junction box, 2: Flange, 3: Insulating liner, 4: Electrode, 5: Measuring tube, 6: Excitation coil to generate a magnetic field, 7: Shell**

6. Product family description

ORDERING MATRIX SPIRAMAG®

SPM									
TYPE / SENSOR DIAMETER									
DN 15 (1/2")	0015								
...	...								
DN 1000 (40")	1000								
POWER SUPPLY									
85 – 265 VAC		A							
18 – 36 VDC		D							
Battery powered		B							
TRANSMITTER DESIGN									
Compact Design				C					
Remote Design (IP 67), cable length 10 m (Standard)				W					
Remote Design (IP 68), cable length 10 m (Standard)				R					
CABLE GLANDS									
Cable gland CM20 (M20 x 1,5)					M				
Adapter CM 20 to 1/2"-NPT					N				
FLANGE MATERIAL									
Carbon Steel, epoxy-coated						CS			
Stainless Steel SS 304						04			
Stainless Steel SS 316									
ELECTRODE MATERIAL									
Hastelloy C (2.4610)							10		
Titanium							TI		
Stainless Steel, platinum-plated							PT		
(others on request)							16		
LINER MATERIAL									
Soft rubber								S	
Hard rubber								H	
PTFE (Teflon)								T	
(others on request)									
HYDRAULIC CONNECTION									
DIN PN 6 (Standard for DN 1000 / NPS 40)									Y
DIN PN 10 (Standard for DN 200 – DN 900 / NPS 8" – NPS 36", optional for DN 1000)									A
DIN PN 16 (Standard for DN 100 – DN 350 / NPS 4" – NPS 14", optional for DN 400 – DN 900)									B
DIN PN 25 (optional for DN 100 – DN 350 / NPS 4" – NPS 14")									C
DIN PN 40 (Standard for DN 15 – DN 80 / NPS 1/2" – NPS 3")									D
ANSI 150									E
JIS B2220 10 K									J
Tri-Clamp (for DN15 – DN 100 / NPS 1/2" – NPS 4")									Z
OUTPUTS									
Pulse / RS485 (for Battery version "B" only)									P
4-20 mA / Pulse / RS485									4
4-20 mA / Pulse / HART									H
EXAMPLE: SPM 0050 A C M-CS-10-S-B-4									

- Customized cable length / Connections / Flange material shall be ordered separately.
- Grounding method is grounding electrode as standard. Grounding rings shall be ordered separately, if required.
- Protection class is IP67 as standard. IP68 available on request only.

7. Installation notes



Safety precautions and installation instructions must be observed in order to guarantee proper functioning and accurate measurement of the flowmeter.

The safety of any system incorporating the equipment is in the responsibility of the assembler of the system and the operator of the facility.

7.1. Storage

- Store the device in a dry, dust-free location
- Avoid continuous direct sunlight
- Store the device in its original packaging
- Storage temperature: -50 to +70°C

7.2. Lifting, carrying, handling and transport



Use lifting lugs when lifting meter flow tubes that are 150 mm diameter or larger.

Do not lift the flowmeter on measuring amplifier or on sensor's neck.
Do not lift the flowmeter with a fork lift on the jacket sheet. This could damage the body of the device.

Never place rigging chains, forklift forks, etc. inside or through the flowmeter's pipe, since this can damage the isolating liner or electrodes.

The customer is responsible for proper handling of the device. Failure by the customer to comply with the handling or installation instructions will void the product warranty. The product is an accurate measurement instrument and should be treated carefully.

When hoist rings are not fitted with the device, use slings around the flowmeter body to handle device with weights > 18 kg.




Operators of hoist equipment should follow proper rigging procedures at all times.
Never allow the flowmeter to swing out of control.
Do not drop or allow hard impact from tools, bars, etc.
Do not use any equipment inside the flowmeter; this would damage the inner parts.

7.3. IP class

Protection Class	IP67 (standard variants) IP68 (optional order, only with converter remote mounted variants)
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All terminal compartments have been designed to allow an adequate sealing e.g. using O-rings and cable inlets.

	<p>In order to save the features of relative protection class of device, following cautions shall be considered:</p> <ul style="list-style-type: none"> - Body seals need to be undamaged and in proper condition. - All of the body screws need to be firmly screwed. - Outer diameters of the used wiring cables must correspond to cable inlets (for M20 Ø 5...10 mm). In cases where cable inlet is not used, put on a dummy plug. - Tighten cable inlets. - If possible, lead cable away downwards. Thus humidity cannot get into cable inlet.
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7.4. Sensor installation

- On flanged connection devices, installation shall be done carefully and accurate so that flange screw holes on pipe and flowmeter get lined and bolts can be passed smoothly to facilitate the integration between the sensor and process piping.
- Installation must ensure that sensor and process pipe align accurately and a good grounding line is formed, otherwise it would cause measurement error.

7.4.1. Installation environment

Although the instruments are addressed to industrial protection classes, following precautions will lead to more durability and lifetime of flowmeters:

- Avoid installing at the places with chance to accumulation of water. Proper place is a ventilated chamber
- The instrument should be protected from direct sunshine and rain. For open-air installation, a protection shield shall be considered
- Avoid installing on pipes with strong vibration. If it is inevitable, choose remote converter.
- As far as possible avoid to install near strong electromagnetic field equipment such as large motors, large transformers

7.4.2. Meter orientation

Meters can operate accurately in any pipeline orientation. Meters can be installed in horizontal as well as in vertical pipelines. Meters perform best when placed vertically with liquid flowing upward as it prevents solids build-up.


When installing the meter on a horizontal pipe, mount the meter to the pipe with the flow measuring electrode axis in a horizontal plane as it prevents that gas bubbles result in a temporary isolation of the flow-measuring electrodes.

Please consider the installation direction in accordance to the “flow direction arrow” indicated on the sensor. You can adjust the alignment of the transmitter on site by opening the 4 screws of the transmitter housing and carefully rotating the housing by 90°/180°. Please be careful to not damage the connection cables to the sensor. Please ensure that the O-ring is correctly seated when reattaching the screws.

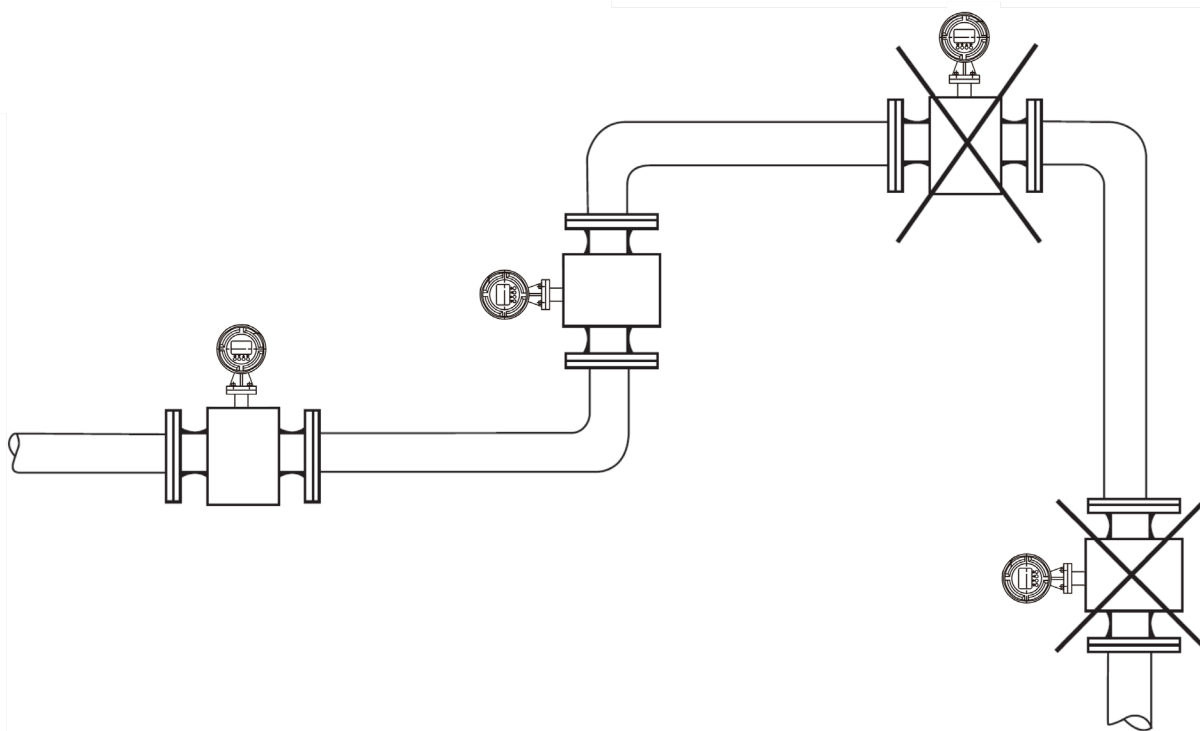
7.4.3. Inlet and outlet pipe

Avoid installing the sensors after fittings producing turbulences. If this is simply not possible, foresee distances of > 5 x DN. Distance in outlet to be > 3 x DN.

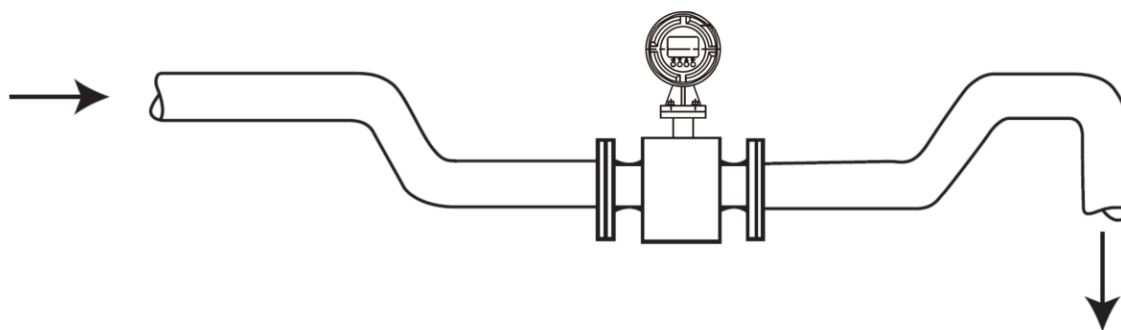
7.4.4. Meter placement

	<p>Do not install the sensor on the suction sides of pumps. This could damage the liner (in particular PTFE liners). Verify that the pipeline is always filled on the measuring point, if not - a correct or accurate measurement is not possible. Do not install the sensor on the highest point of a pipeline system. Gas accumulation may follow. Do not install the sensor in down comer pipes with free outlet.</p>
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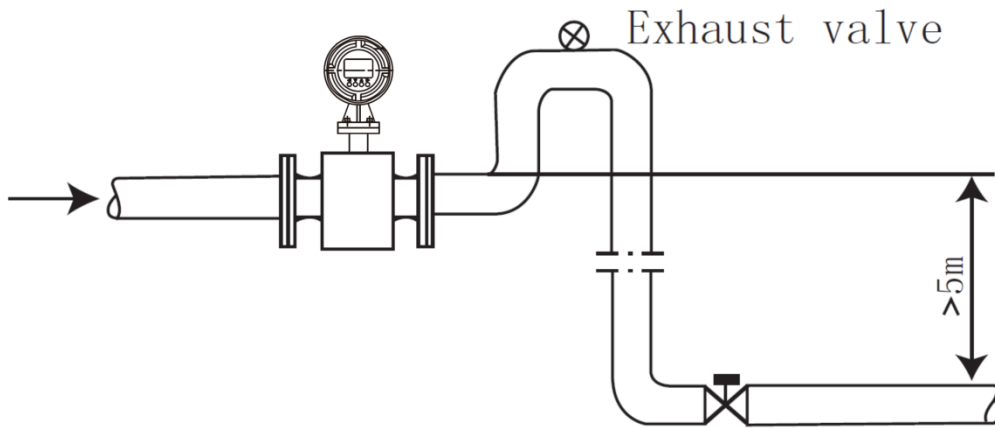
Please consider the following installation notes to prevent turbulent flows or air/bubble disturbances, which may impact the flow accuracy:



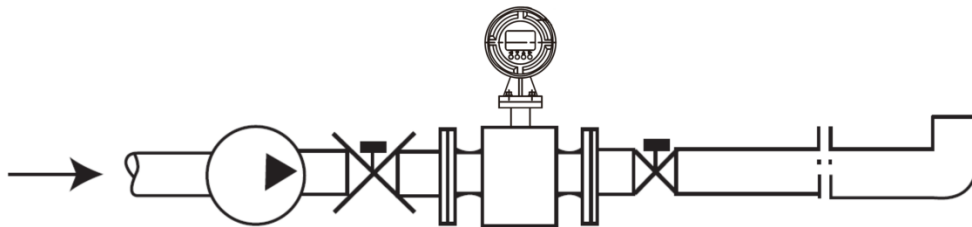
Prevent installation at highest point of pipe (gathered bubbles).
 Prevent installation on downward pipes (semi-filled pipe will easily be formed).



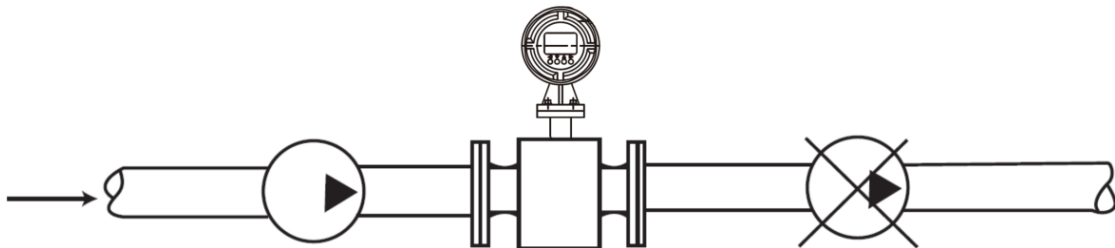
Try to install in lower positions in case of injection or outlet.



Use an exhaust valve if drop pipe is more than 5 m.



In longer pipe systems, install control valve and cut-off valve on downstream side of flowmeter.

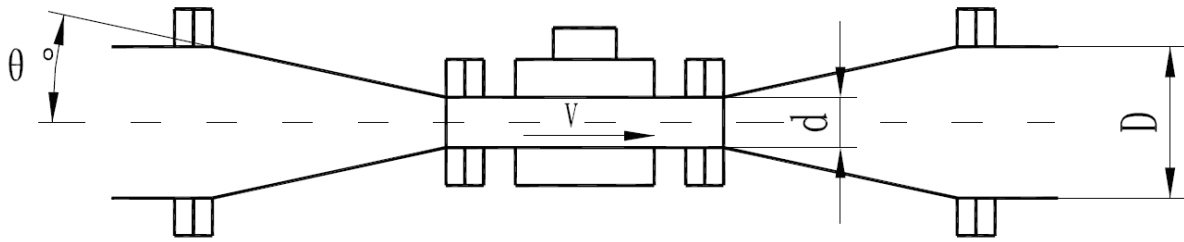


Do not install on suction side of pump.

7.4.5. Pipe reducer requirements

With pipe reducers as per DIN 28545, sensors can be mounted in larger pipelines. You can determine the occurring pressure drop by using the shown figure (only applicable to liquids with similar viscosity like water).

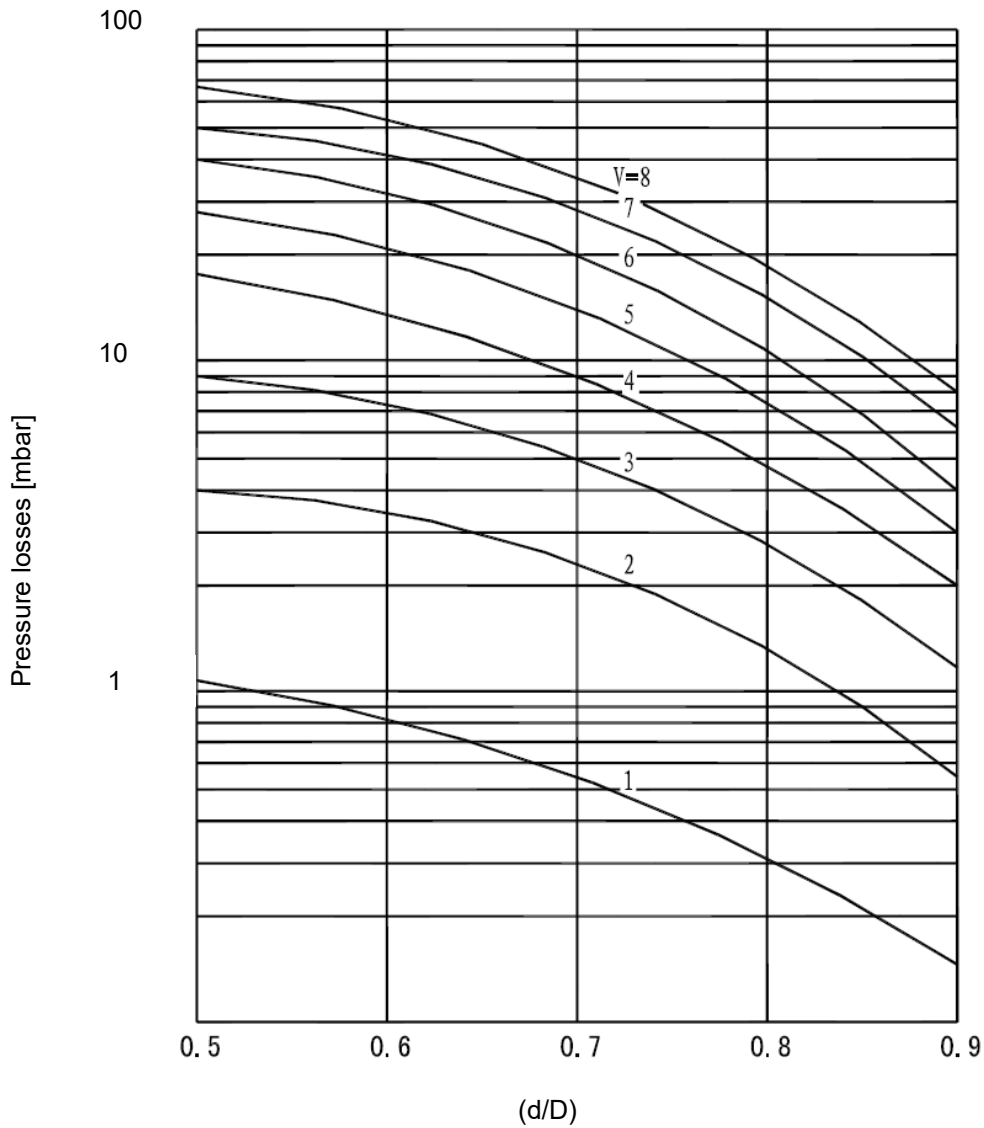
Note: In cases where flow velocities are very low, you can increment them by reducing the size on the measuring point and hence obtain a better measuring accuracy.



D: Pipeline

d: Sensor

V: Flow rate [m/s]



Define pressure loss:

1. Calculate diameter ratio d / D.
2. Read pressure loss depending on d/D ratio and flow velocity.

7.5. Remote wall-mounted variants

Only relevant for the following series variants

SPM xxxx - # - W	wall-mounted / remote design
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These variants are reasonable in the following situations:

- Sensor protection class IP 68
- Fluid temperature > 100°C in combination with PTFE/PFA liner
- Strong vibrations
- Better accessibility of the electronics

In Case of a wall-mounted variant a wall mounting adapter is delivered as an additional attachment to the converter. The sensor cables are connected to the adapter board.

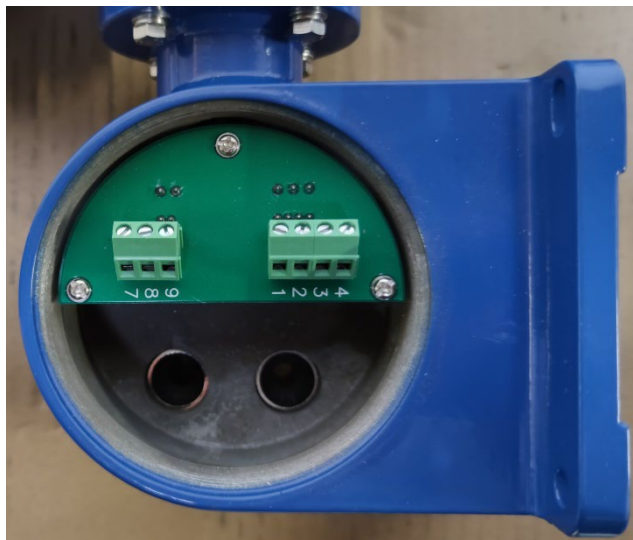


Figure 1: Sensor connection on the wall-mounting adapter




Consider stable mounting of the wall-mounting adapter to guarantee no displacement of converter/transmitter and no tensional stress to the cables.
Use adequate material to guarantee a load carrying stability of 4 times the weight of the remote equipment.

7.6. Cables




Route all cabling away from potential hazards.

	<p>Always consider proper cable materials for fixed installations, which are compatible with the local regulatory or site guidance for insulation and flame protection.</p> <p>The use of a minimum UL 2556 VW-1 flame protection class for wires is mandatory.</p> <p>Use cables which are consistent with the environmental requirements of the site, e.g. considering temperature and humidity.</p>
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The following table describes the specification for different applicable cables:

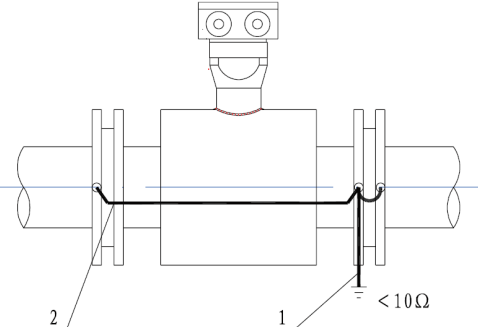
Cable	Specification
Signal line	PVC sheathed 2 core shielded cable 2 x 16/015 (SBWP) PVC sheathed 2 core shielded cable 2 x 80/015 RWP Ship sealed with rubber insulated cable 2 x 0.5
Excitation wire	Two core plastic cable 2 x 1.0 mm ² (YHZ) Marine soft ethylene-propylene rubber Insulated cable 2 x 1.0(CEFR-C)
Output signal lines	General color plastic Double-stranded copper wire

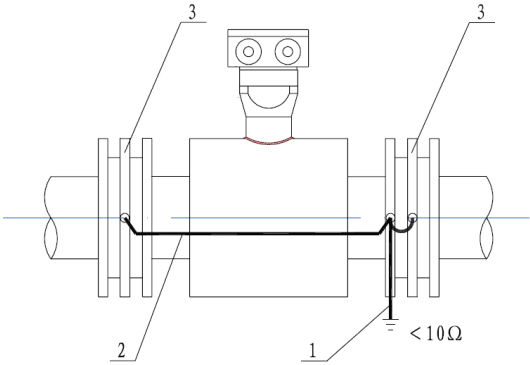
	<p>Do not install the signal cable close to power cables, electric machines, etc in order to avoid interference effects on the sensible sensing electronics.</p> <p>Please fix signal cables, since capacity changes due to cable movements may result in incorrect measurements.</p>
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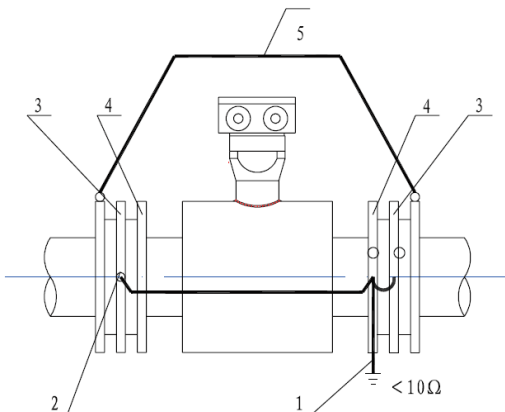
7.7. Grounding and potential equalization

In order to obtain an accurate measurement sensor and fluid need to be on the same electric potential. If flange or intermediate flange versions with additional grounding electrode are used, grounding is provided by the connected pipeline.


	<p>In case of a type with flange, a connection cable (min. 4 mm²) between grounding screw on the meter's flange to the counter flange is to be used in addition to the fixing screws. Verify that a perfect electric connection is provided.</p> <p>Color or corrosion on the counter flange may have a negative effect on the electric connection.</p>
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	<p>Metal pipes</p> <p>1: Grounding line (grounded independent from other interfering devices)</p> <p>2: Flowmeter grounding line</p>
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	<p>Plastic or lined pipeline</p> <p>1: Grounding line (grounded independent from other interfering devices)</p> <p>2: Flowmeter grounding line</p> <p>3: Grounding or earthing ring flange</p> <p>If non-conductive pipelines or pipelines lined with non-conductive material are used, install an additional grounding electrode or grounding rings between the flanges. Grounding rings are installed like gaskets between the flanges and are connected with a grounding cable to the meter.</p> <p>Caution:</p> <ul style="list-style-type: none"> When grounding rings are used, please make sure that the material is resistant to corrosion. If aggressive fluids are measured, use grounding electrodes.
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	<p>Pipelines with cathodic protection</p> <p>1: Grounding device line (grounded independent from other interfering devices)</p> <p>2: Flowmeter grounding line</p> <p>3: Grounding or earthing ring flange must be consistent with the flange connecting pipe insulation</p> <p>4: Bolts (must be installed with the flange and should be mutual insulated)</p> <p>5: Connecting wire, copper cross-sectional area of 16 mm².</p> <p>For pipelines with cathodic protection, please install meter in a potential-free condition. No electric connection from the meter to the pipeline system may exist and power supply must be provided via isolating transformer.</p> <p>Caution:</p> <ul style="list-style-type: none"> Use grounding electrodes (grounding rings also need to be installed isolated from the pipeline system). Observe national rules in respect of a potential-free installation.
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7.8. General requirements


	<p>Transmitter's configuration is in accordance with the order requirements.</p> <p>Users are to check the meter nameplate to confirm that the instrument operating parameters are set as desired.</p> <p>Device can be put into use after connecting to power. In order to ensure that the system runs on normal operation, measuring pipe shall be fully filled with medium.</p> <p>Emptiness or semi-emptiness of pipe would generate serious measurement errors in electromagnetic flowmeters.</p>
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The electromagnetic flowmeters is dedicated to measure conductive fluids (conductivity $\geq 5\mu\text{S/cm}$). For demineralized water $\geq 20\mu\text{S/cm}$ is recommended.

Flowmeter installation and usage should be in strict accordance with the specification, and to comply with the relevant national standards, safety requirements and accident prevention requirements


7.9. Power line connections and power supply

	<p style="text-align: center;">Hazard of electrical shock</p> <p>Electrical installation work must be done by qualified staff. Please read this operation manual carefully before operation in field. Transmitter must have a good grounding in order to protect personal safety.</p> <p>Electrical power should be deactivated using dedicated power switches during installation and setup.</p> <p>Device mounting shall not block any disconnecting devices.</p> <p>Instructions in chapter IP Class must be followed strictly to prevent penetration of water and humidity into the device, which may affect the electrical safety.</p>
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	<ul style="list-style-type: none"> • Use only the type of power source suitable for electronic equipment. If in doubt, contact your distributor. • Ensure that any power cables are of a sufficiently high current rating. All units must be earthed to eliminate risk of electric shock. • Failure to properly earth a unit may cause damage to that unit or data stored within it. • Do not connect meter under impressed mains voltage. • Take national applicable rules into account. • Consider compatibility with the type plate (mains voltage and frequency).
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This series of transmitters have the following power supply types.

1. AC Power supply range: 85 VAC-265 VAC, 50 / 60 Hz, power $\sim 12\text{ W}$ (including sensors)
2. DC power supply range: 18 VDC-36 VDC, power $\leq 12\text{ W}$ (including sensors)


	<p>In order to avoid disoperation and instrument error or damage, please see the nameplate and arrangement of the electrical terminals and the types of instructions, carefully before connecting the power supply.</p>
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Cautions

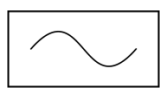

Please take care of the following when connecting the power to instrument

1. The power cable of inside the transmitter should not be wounded.
2. The power input line should be separated from other input and output lines, threading through the separate glands.
3. Care the positive and negative polarity of DC power supply. If reverse, the instrument does not work.
4. Power supply should have a good grounding in order to protect the operating personnel safety.

7.9.1. AC powered variants (relevant for SPM-xxxx-A)

	AC powered product variants have hazardous live voltage connections. Only certified personal is allowed to perform installation procedures. Never open the device in normal operation.
	Power lines shall be protected by external overcurrent circuit breakers according to the national and site regulatory requirements.
	A switch or circuit-breaker must be included in the installation side for this device. It must be suitably located and easily accessible. It must be marked as the disconnecting device for the equipment.

Power Terminals are marked as following:

Voltage Type	Identifier	Functional	Description
	L	220 VAC Power, L terminal	Power range: 85 – 265 VAC 50 / 60 Hz
	N	220 VAC Power, N terminal	
		Protective Earth	Grounding resistance $\leq 0.1\Omega$

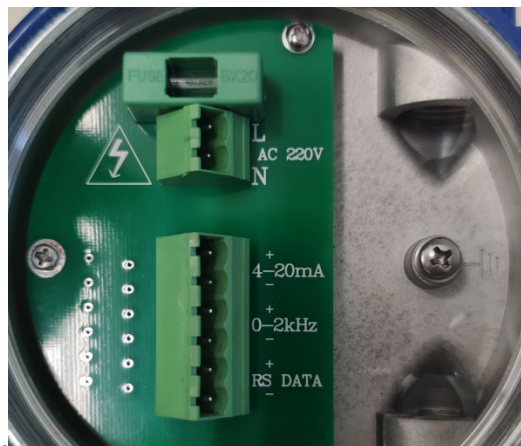


Figure 2: power relevant connections

Follow the below instructions to connect the cables


- Ensure that power is switched off safely secured against uncontrolled power-up.
- Open the rear cover of the converter.
- Thread a dedicated power supply input line through the waterproof connector into the instrument cavity.

- Connect the grounding wire to the converter side of the protective earth.
- Connect AC power lines to L and N to the dedicated connectors.
- Check O-ring and close the rear cover.

The AC powered variants include protective overcurrent fuses.



Use the following fuses to replace the fuse if necessary:

F2AL250V (2A, 250V) with size 5x20 mm

	<p>The replacement of fuses has to be applied by dedicated and qualified service personal.</p> <p>Always be sure to secure a dispowered voltage power before opening the device and exchange of fuses.</p>
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7.9.2. DC powered variants (relevant for SPM-xxxx-D)

Power Terminals are marked as following:

Voltage Type	Identifier	Functional	Description
	+	24 VDC Power, positive terminal	Power range: 18 VDC – 36 VDC
	-	24 VDC Power, negative terminal	
		Functional earth	

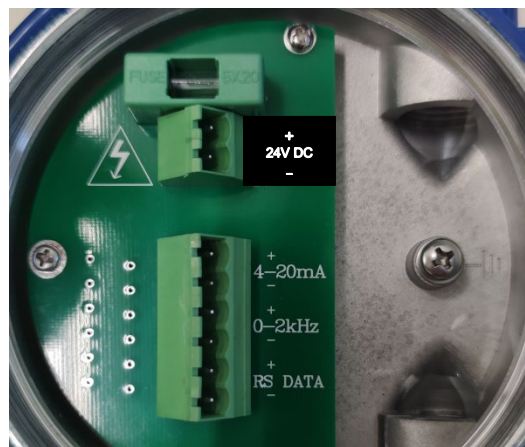


Figure 3: DC power connections

Follow the below instructions to connect the cables

- Ensure that power is switched of safely secured against uncontrolled power-up.
- Open the rear cover of the transmitter / converter.
- Thread a dedicated power supply input line through the waterproof connector into the instrument cavity.
- Connect the grounding wire to the transmitter side of the grounding.
- Connect DC power lines to + and - to the dedicated connectors.
- Check O-ring and close the rear cover.

7.10. Output signals

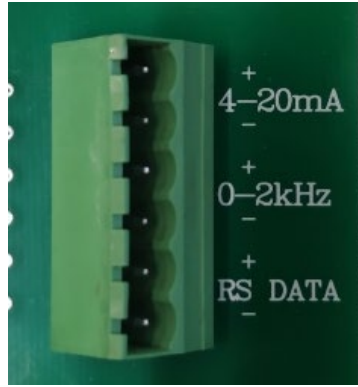
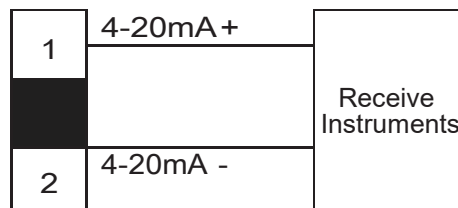


Figure 4: Output signal connections

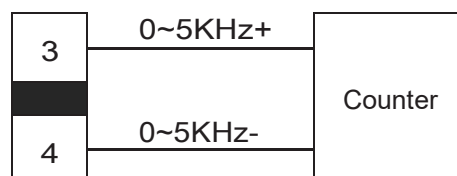
Items	Label	Function Instructions	Remarks
1	4-20 mA	4-20 mA output positive terminal	- load resistance: 750 Ohm (including cables) - external 24 VDC power supply active output
2	4-20 mA	4-20 mA output negative terminal	
3	0~2 KHz	Frequency / pulse output positive terminal	output amplitude 24 V load current ≤ 50 mA
4	0~2 KHz	Frequency / pulse output negative terminal	
5	RS 485 date+	RS 485 Communication positive terminal	RS 485 communication function
6	RS 485 date-	RS 485 Communication negative terminal	

Electric current output is defined as the following:



The transmitter current output is electrically isolated. It is an active 4 – 20 mA output in which 20 mA is addressed to full scale flow, which is adjusted on the device. The maximum current output load resistance is 750 Ω including the load resistance of used cable. Recommended current output cable is RWP2x16/015 PVC insulated sheathed cable with shield.

Frequency / pulse output is defined as the following:

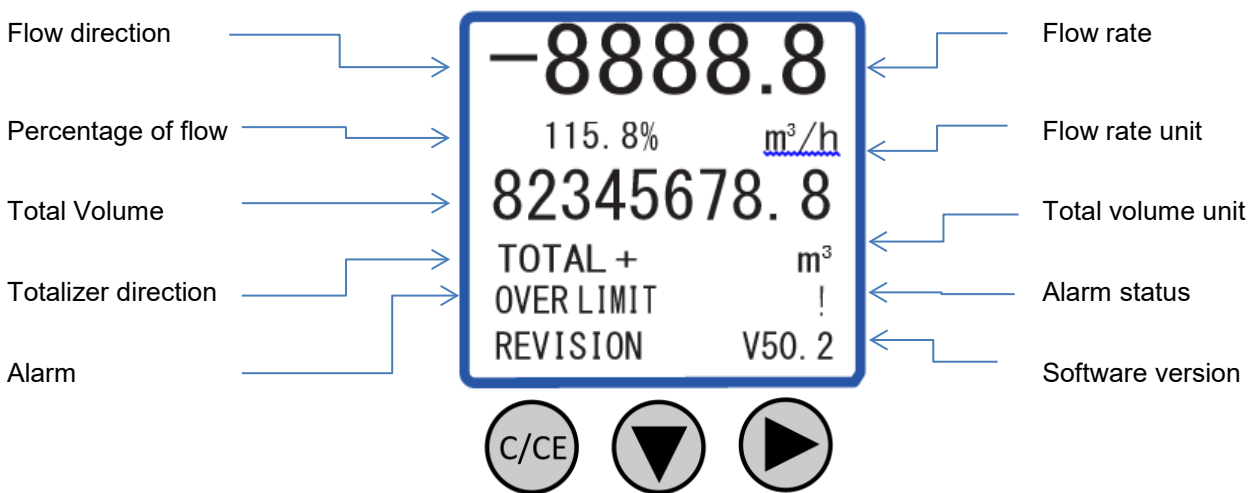



The transmitter frequency, pulse output is electrically isolated. It is a transistor output type. Maximum pulse output frequency is 5 KHz and the output pulse amplitude is 24V. The maximum load current is 50 mA in active mode and 200 mA in passive mode. The pulse output is active if the variable parameter "Liter / Pulse" is configured with a value greater than zero. If this value is set to zero, the frequency output is automatically active and the maximal frequency Freq. max (Hz)" corresponds to the maximal configured flow rate on the device "Q_{max}".


The transmitter is equipped with RS485 communication, with MODBUS ASC, MODBUS RTU communication capabilities (depending on the product variant). Please compare chapter "Product family description".


8. Operational interface and navigation



8.1. DC/AC powered devices





 Parameter confirmation and withdraw from subprogram.

 Change or modify item

 Set item

Press and hold  and then press  : Shortcut to "set zero".

Press  to access "flow rate unit", "total direction" and "total unit".

Use  to choose between them.

Menu structure:

BASIC SETUP	Damping(s) (0.1 – 99.9)	
	PV decimal (1, 2, 3)	
	Total decimal (1, 2, 3)	
	LCD rotate (0, +90, 180, -90)	
	Noise limit	
SYSTEM SETUP	Language	
	Signal	Q _{max} (m ³ /h) Low cut off % Direction Indication Density (g/mL)
	Pulse output	Freq. max (Hz) Liter / pulse Pulse width (ms) Pulse level Pulse power
	RS485 output / Modbus	RS485 protocol Baud rate Data bit Parity Stop bit Dev address
	Clear total	
	Load settings	
TRANSMITTER TRIM	Zero trim	
	Tube trim	Empty trim Full trim Tube region % Empty freq Full freq
	Loop trim	4 mA trim 20 mA trim Loop mode
	K-Character	
Output check	Loop test	
	Pulse test	
	Coil test	

Detailed information:

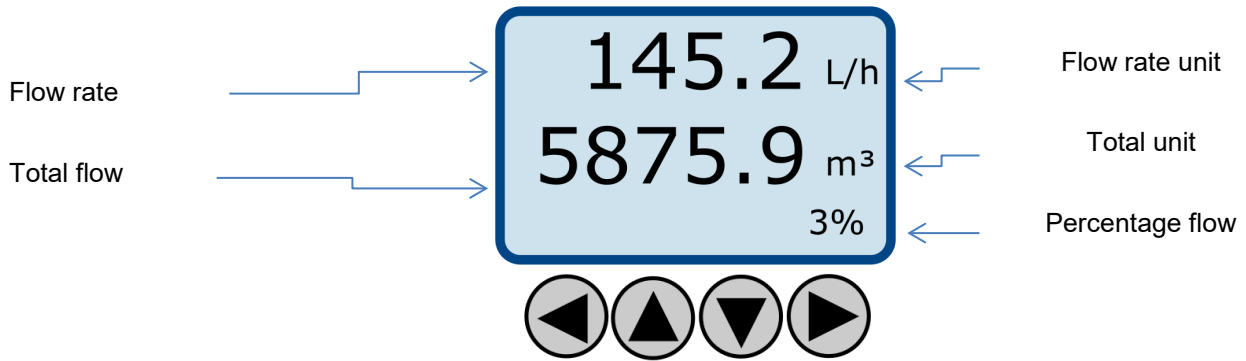
Basic Setup	
Damping (s) (0.1 – 99.9)	<i>Set the damping constant (0.1-99.9)s to damp fluctuations.</i>
PV Decimal (1, 2, 3)	<i>Set the number of decimal places for the flow rate..</i>
Total Decimal (1, 2, 3)	<i>Set the number of decimal places in the meter.</i>
LCD rotate (0, +90, 180, -90)	<i>Rotate the display via software.</i>
Max. interference signal	<i>Activate noise suppression if external disturbances influence the measurement signal</i>





System Setup		
Language	Select the display language.	
Signal	Q _{max} (m ³ /h)	Setting the maximum flow rate. This quantity is then used as a reference value for output variables such as analogue outputs, frequency/pulse output or for a determination of the percentage flow.
	Creeping quantity %	Setting of the percentage creep quantity (0-9.9%) related to Q _{max} , above which the flow is declared as zero flow.
	Direction	Set the preferred flow direction (forward, reverse, bidirectional).
	Indication	Setting the direction for the positive sign or the positive counter (up, down)
	Density (g/ml)	Setting the density of the medium for the calculation of mass indications
Pulse output	Frequency max (Hz)	Reference for the frequency coding of the output. This value corresponds to Q _{max} . (100-5000 Hz) if frequency coding is activated.
	Liter / Pulse	Configuration of the valence for the pulse output. If this value is set to 0, frequency coding is automatically activated.
	Pulse width (ms)	Setting the pulse width in ms
	Pulse level	Set whether the pulses are in Active High or Active Low mode.
	Pulse Power	Set whether the power is provided internally or externally.
RS485 output	RS485-Protocol	Setting the Modbus protocol as Modbus-RTU or Modbus-ASC
	Baud rate	Setting the baud rate (1200, 2400,4800, 9600)
	Data Bit	Setting the data bit
	Parity	Setting the parity (none, even, odd)
	Stop bit	Setting the stop bit
	Device address	Setting the unit address in the Modbus network
Reset	Reset all values to the default setting.	
Load Parameters	Load configuration parameters.	



Trim / Calibration		
Zero adjustment	<i>Adjust the zero level if, for example, external disturbances should influence the measuring signal. The pipe must be filled and there must be no medium flowing in the measuring pipe.</i>	
Adjustment pipe	empty adjustment	<i>Automatic calibration of the parameter "Frequency empty tube". The measuring tube must be empty for this.</i>
	Full adjustment	<i>Automatic calibration of the parameter "Frequency empty tube". The measuring tube must be full for this.</i>
	Tube Region %	<i>Set the percentage limit for empty tube detection.</i>
	Frequency empty tuber	<i>Parameter for empty pipe detection. This parameter is determined by calibration.</i>
	Frequenz volles Rohr	<i>Parameter for empty pipe detection. This parameter is determined by calibration.</i>
Loop adjustment	4 mA adjustment	<i>Fine adjustment of the lower 4 mA range for the analogue output.</i>
	20 mA adjustment	<i>Fine adjustment of the upper 20 mA range for the analogue output.</i>
	Loop Modus	<i>Coding selection: 4-20 mA corresponds to the positive flow direction 0 to Qmax. 4-12-20 mA corresponds to the coding for bidirectional measurements from -Qmax to +Qmax</i>
K-factor	<i>Correction factor for fine adjustment of the internal device K-factor in the range 0.97-1.03. The following applies here:</i> $Kfactor_{total} = kfactor_{internal} * Kfactor_{correction}$	



Checking/testing the outputs	
Test loop	<i>Simulation of an analogue mA value for the analogue output 4-20 mA.</i>
Pulse Test	<i>Simulation of a pulse output to test communication with other devices..</i>
Coil Test	<i>Test of the excitation coils.</i>


8.2. Battery powered devices



-  Parameter confirmation and withdraw from subprogram.
-  Decrease of data variable
-  Increase of data variable
-  Set item

Press and hold  and then press  : Shortcut to “set zero”.

Press  and  to navigate in the main menus.

Press  to enter setup navigation:

Menu structure:

BASIC SETUP	PV units	
	PV decimal	
	Total decimal	
	Total decimals	
	Damping (s)	
	Noise limit	
SYSTEM SETUP	Language	
	Signal	Q _{max} (m ³ /h) Low cut off % Direction Indication Density(g/ml) LPM mode
	Pulse output	Freq. max (Hz) Liter / pulse Pulse width (m/s) Pulse level Freq enable
	RS485 output	RS485 protocol Baud rate Data bit Parity Stop bit Dev address RS485 enable
	2.5. Total admin	Clear total FWD preset (m ³) REV preset (m ³)
	2.6. Load Settings	
Calibration	Zero Trim	
	Tube Trim	Empty trim Full trim Tube region % Empty frequency Full frequency
	K-Factor	
Test	Loop test	
	Pulse test	

Detailed information:

Basic Setup	
PV Units	<i>Set the unit for the flow rate, e.g. m³/m.</i>
PV Decimal (1, 2, 3)	<i>Set the number of decimal places for the flow rate.</i>
Total Units	<i>Set the unit for the meter, e.g. m³.</i>
Total Decimal	<i>Set the number of decimal places for the counter..</i>
Damping (s)	<i>Set the damping constant (0.1-99.9)s to dampen fluctuations..</i>
Max. Interference signal	<i>Activate noise suppression if external disturbances influence the measuring signal.</i>

System Setup		
Language	<i>Select the display language.</i>	
Signal	Q _{max} (m ³ /h)	<i>Setting the maximum flow rate. This quantity is then used as a reference value for output variables such as analogue outputs, frequency/pulse output or for a determination of the percentage flow rate..</i>
	Creeping quantity %	<i>Setting of the percentage creep quantity (0-9.9%) related to Q_{max}, above which the flow is declared as zero flow.</i>
	Direction	<i>Setting the preferred flow direction (forward, reverse, bidirectional)</i>
	Indication	<i>Setting the direction for the positive sign or the positive counter (up, down)</i>
	Density (g/ml)	<i>Setting the density of the medium for calculating mass data</i>
	LPM-Modus	<i>Special "low power mode" for battery devices to save energy. Here the ratio to the measurement pause times is set (1:0, 1:2, 1:4, 1:8, 1:16, 1:32).</i>
Pulse output	max frequency (Hz)	<i>Reference for the frequency coding of the output. This value corresponds to Q_{max}. (100-5000 Hz) if "Freq Enable" is activated.</i>
	Liter / Pulse	<i>Configuration of the valence for the pulse output.</i>
	Pulse width (ms)	<i>Setting the pulse width in ms</i>
	Pulse level	<i>Set whether the pulses are in Active High or Active Low mode.</i>
	Freq Enable	<i>Set whether the frequency/pulse output should be configured as a frequency output.</i>
RS485 output	RS485-Protocol	<i>Set the Modbus protocol as Modbus-RTU or Modbus-ASC.</i>
	Baud rate	<i>Set the baud rate (1200, 2400, 4800, 9600).</i>
	Data Bit	<i>Setting the data bit</i>
	Parity	<i>Setting the parity (none, even, odd)</i>
	Stop bit	<i>Setting the stop bit</i>
	Device address	<i>Setting the unit address in the Modbus network</i>
	RS485 enable	<i>Activate RS485 communication</i>
Total Admin	reset	<i>Reset all values to the default setting.</i>
	FWD Preselection (m ³)	<i>Manually set the counter for the forward direction.</i>
	REV Preselection (m ³)	<i>Set the counter for the reverse direction manually.</i>
Load Parameter	<i>Load configuration parameters.</i>	

Calibration		
Zero adjustment	<i>Adjust the zero level if, for example, external disturbances should influence the measuring signal. The pipe must be filled and there must be no medium flowing in the measuring pipe.</i>	
Adjustment pipe	Empty adjustment	<i>Automatic calibration of the parameter "Frequency empty tube". The measuring tube must be empty for this.</i>
	Full adjustment	<i>Automatic calibration of the parameter "Frequency empty tube". The measuring tube must be full for this.</i>
	Tube region %	<i>Setting the percentage limit for empty pipe detection.</i>
	Frequency empty pipe	<i>Parameter for empty pipe detection. This parameter is determined by calibration.</i>
	Frequency full pipe	<i>Parameter for empty pipe detection. This parameter is determined by calibration.</i>

Checking / testing the outputs		
Pulse Test	<i>Simulation of a pulse output to test communication with other devices.</i>	
Coils test	<i>Testing the excitation coils.</i>	

9. Technical data

Sensor:

Size	DN 15 - DN 1000, Larger sizes on request (compare table dimensions)
Connections	flange: DIN, ANSI, JIS, Tri-Clamp customized connections on request
Nominal pressure	up to PN 40 (up to PN 100 on request)
Process temperature	0 to +70°C (compact mounted , rubber liner) ¹ 0 to +90°C (remote mounted , rubber liner) -40 to +100°C (compact mounted, with PTFE/PFA liner) -40 to +160°C* (remote mounted, with PTFE/PFA liner) * The intended use according to directive 2014/68/EU must be considered.
Electrode material	Hastelloy C (2.4610), stainless steel platinum plated, Titanium, others on request
Liner material	Soft rubber (standard) / Hard rubber / PTFE/PFA
Measuring tube material	Stainless-steel SS316
Housing	carbon steel / optional stainless steel
Length	Standard acc. to ISO 13359, others on request
Inlet / outlet sections	5 D / 3 D required
Conductivity	≥ 5 µS/cm
Flow Range	0.03 - 10 m/s (recommended: 2-3 m/s)

Converter / Transmitter:

Protection Class	IP67 (standard variants) IP68 (optional order, only with converter remote mounted variants)	
Flow direction	bi - directional	
Accuracy	Powered devices: ± 0.25 % of reading ± 0.1 % full scale Battery devices: ± 0.5 % of reading ± 0.1 % full scale	
Signal damping	adjustable 0.1-99.9 s	
Low flow cut-off	adjustable 0-9.9 %	
Power supply	variant SPM xxxx - A	85-265 V AC (50/60 Hz), P _{max} = 12 W
	variant SPM xxxx - D	9-36 V DC, P _{max} = 12 W
	variant SPM xxxx - B	battery powered
Analog output	4 - 20 mA	
Pulse or Frequency output	Liter / Pulse adjustable Frequency encoding 100-5000 kHz of the flowrate	
Empty pipe detection	Standard	
Communication	RS 485 Modbus or HART® protocol (on request)	
Display	7 Digits flow rate / 8 digits totalizer / LCD	
Housing	Aluminum	
Remote version	Standard 10 m, up to 100m with standard junction box	

Please compare also the **environmental conditions** described in the chapter "Intended use".

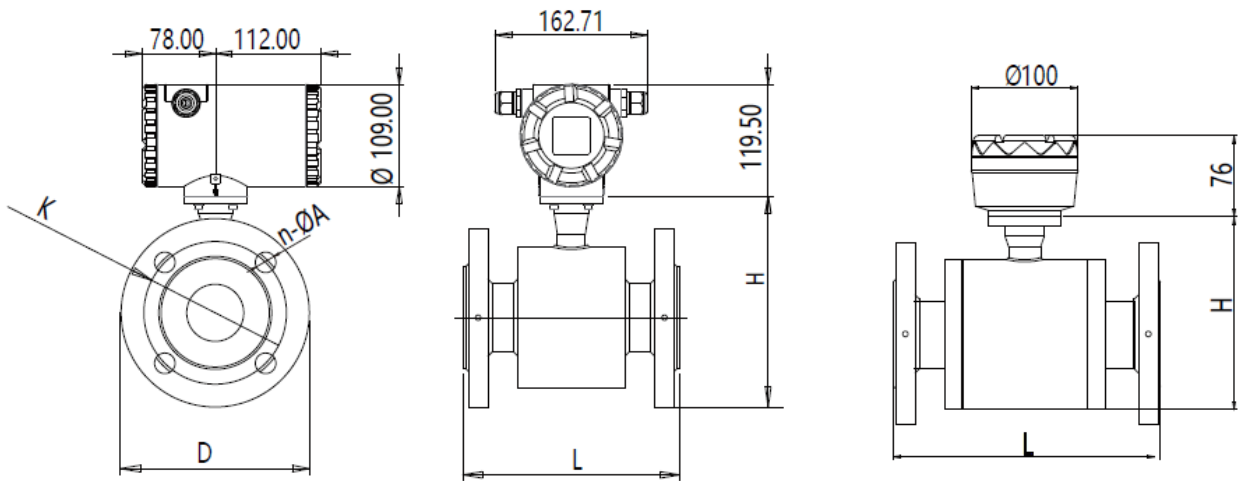
¹ The SpiraMAG® should be installed and operated in such a way that the transmitter does not experience a temperature above 70°C under any circumstances. If necessary, appropriate measures should be taken in advance (especially at higher ambient temperatures), such as installing a protective roof to avoid direct sunlight.

Sensor dimensions and measuring range

DN		Maximum operating pressure [bar]	Flow range [m³/h] (for flow velocity* ~ 0.3 – 10 m/s)		L [mm]	D [mm]	K [mm]	n-ØA	Weight** (compact version) [Kg]
[mm]	[Inch]		Min	Max					
15	½		40	0.2					
25	1	0.5		18	150	115	85	4-Ø14	7
32	1 ^{1/4}	0.9		29	150	140	100	4-Ø18	9
40	1½	1.5		45	200	150	110	4-Ø18	11
50	2	2.1		71	200	165	125	4-Ø18	12
65	2½	3.6		119	200	185	145	8-Ø18	17
80	3	5.4		181	200	200	160	8-Ø18	17
100	4	16	8.5	283	250	220	180	8-Ø18	22
125	5		13	442	250	250	210	8-Ø18	24
150	6		19	636	300	285	240	8-Ø22	35
200	8		34	1131	350	340	295	8-Ø22	45
250	10		53	1767	400	395	350	12-Ø22	84
300	12		76	2545	500	445	400	12-Ø22	102
350	14		104	3464	500	505	460	16-Ø22	123
400	16	10	136	4524	600	565	515	16-Ø26	147
450	18		172	5725	600	615	565	20-Ø26	212
500	20		212	7068	600	670	620	20-Ø26	229
600	24		305	10178	600	780	725	20-Ø30	252
700	28		416	13854	700	895	840	24-Ø30	352
800	32		543	18095	800	1015	950	24-Ø33	462
900	36		687	22902	900	1115	1050	28-Ø33	558
1000	40	6	848	28274	1000	1235	1120	28-Ø36	690

* Recommended flow velocity is 2-3 m/s.

** Remote variants are 2 kg lighter.



10. Troubleshooting

Electromagnetic flowmeters generally do not require regular maintenance. Anyhow measured medium would adhere or leave sediments on the electrodes. Periodic cleaning care shall be considered when measuring sediment liquids.

Any damage to liner or electrodes caused by corrosion or inappropriate handling will cause error or failure in measurement.

Some frequently occurring errors are listed in the following table:

Error	Possible cause	Recommended action
Meter does not function	No auxiliary power	Provide auxiliary power
	Fuse defective	Replace fuse
Fluid is flowing, however display shows zero	Signal cable is not connected or connection is interrupted	Check signal cable
	Sensor installed opposite to forward flow direction (see arrow on type plate)	Turn sensor by 180° or change direction in the configuration menu.
	Connection cable for coils or electrodes mixed-up	Check connection cable
Inaccurate measurement	Wrong parameters	Check parameters (sensor, amplifier and size) as per annexed data sheet
	Pipe not completely full	Check if measuring pipe completely full



In case of any other errors or defects, which are not possible to troubleshoot with help of above guidelines, please contact your distributor and provide information about the fault and errors signs which appear on the display.

Error Information:



Error	Description	Cause and Troubleshoot
Upper limit	Flow measurement value is over than the upper limit value alarm	Modify the upper limit value
Lower limit	Flow measurement value is lower than the lower limit value alarm	Modify the lower limit value
Excitation	Excitation circuit is not working correctly	<p>A) Check cable terminals and electrical excitation of the terminal connections</p> <p>B) Check the sensor excitation circuit not to be open or short circuit</p> <p>C) Excitation coil temperature is too high.</p> <p>D) Excitation frequency set too high</p>
Empty tube	Empty pipe alarm is on or meter shows random data	<p>A) Flowmeter sensor is not full of medium</p> <p>B) Electrode surface is completely covered with insulating layer</p> <p>C) Flow lines are quite irregular</p> <p>D) Medium conductivity is lower than limit</p> <p>E) Empty and full trim is not correct, or tube region % is high sensitively set</p>
Zero point	Zero point value is too high	<p>A) Pipe was not full when zero trimmed</p> <p>B) Fluid was non static on zero trimming</p> <p>C) Flowmeter grounding is incorrect or unreliable</p>
Over range	Instant value exceeds instrument declared value	<p>Flow rate is over the maximum measurable value of meter.</p> <p>Select a larger sensor size.</p>

11. Name plate details

Sensor nameplate consists of the following information. The flow direction arrow is indicating the calibrated flow direction in unidirectional applications. Please compare with chapter 7.4.

BOPP & REUTHER MESSTECHNIK					
Electromagnetic Flowmeter SpiraMAG®					
Type	SPM0200-D-C-M-CS-10-S-A-4		S/N	10083129	
DN	200		Flange	Carbon Steel	
PN	10	Liner	Soft Rubber	Electrode	Hastelloy C
					

Converter nameplate consists of the following information. Additional information regarding the electronic configuration can be obtained from the user interface (please compare chapter 8) or from the configuration report provided by the device.

Electromagnetic Flowmeter SpiraMAG®					
Type	SPM-0025-A-C-M-CS-10-S-D-4		S/N	10083099	
IP Class	IP67	Power Supply	AC 85-265 V 50/60 Hz , Pmax= 12W		
		Output	4-20mA/RS485/Pulse/Hart		
		BOPP & REUTHER MESSTECHNIK			
www.bopp-reuther.com Made in Germany		Am neuen Rheinhafen 4 67346 Speyer / Germany			

Additionally the model code given in the *Type* field can be used to extract relevant device information. Please compare with product family description given in chapter 0.

12. Maintenance and services

Only original spare parts provided by the manufacturer shall be used. Only service personal qualified by the manufacturer shall perform service procedures.

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

Please ask our customer service for help and advice if your flowmeter does not work properly or a repair may be necessary. Please use the [declaration of non-contamination](#) provided on our website (www.bopp-reuther.com). Please contact our service department for further information.

<p>Bopp & Reuther Messtechnik GmbH Service Am Neuen Rheinhafen 4 67346 Speyer / Germany Phone: +49 6232 657-420 Fax: +49 6232 657-561 E-Mail: service@bopp-reuther.com</p>
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13. Disclaimer

13.1. General

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, one may, if such law applies, not be subject to some or all this disclaimer, exclusions or limitations. Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our terms and conditions. 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.

13.2. 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.

13.3. Documentation

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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 cannot 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 must be considered.

Notes:

Our product portfolio:

Volume flowmeter:

- Oval wheel meter
- Turbine meter
- Electromagnetic flowmeter

Mass flowmeter:

- Vortex meter
- Compact orifice
- Coriolis mass flowmeter

Density and concentration meter (Measuring and testing equipment)

Dosing measurement technology

- Electromagnetic flowmeter
- Coriolis mass flowmeter
- Oval wheel meter
- Dosing control system

Energy Measurement

Accessories

- Processing electronics
- Mechanical indicator
- Pulse pick-ups
- Components

Measuring and testing equipment

Conformity assessment according to MID Directive 2014/32/EU

After Sales Service

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