STIX
DURCHFLUSSMESSTECHNIK

EsuMag® SERIES

ELECTROMAGNETIC FLOW METERS

ESM 720 / 730

User Manual

STIX Durchflussmesstechnik GmbH
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Table of content

1. Manufacturer information

Manufacturer:	STIX Durchflussmesstechnik GmbH Silcherstrasse 16/1 72664 Kohlberg Germany
Product type:	Electromagnetic flow meter - In compact and remote version
Product name:	EsuMAG®

2. Certifications and standards

CE

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

This product meets the legal requirements of the relevant EU directives.
For full details of EU directives, standards and approved certifications, please refer to the product's EU Declaration of Conformity.

3. Basic safety considerations

For safe and proper use of this product, please read this instruction manual thoroughly before installation. Only qualified employees should install and/or repair this product.

If a fault appears, please contact your distributor.

	**INFORMATION!** **The manufacturer is not liable for damage resulting from improper use or use for purposes other than those intended.**

	**CAUTION!** **The operator is solely responsible for the use of the meters with regard to suitability, intended use and corrosion resistance of the materials used to the measured fluid.**

	**WARNING!** **If the device is not used according to the operating conditions, the intended protection could be affected.**

3.1 Installation

- Do not place the meter on an unstable surface that could cause the meter to fall.
- Do not place the meter above a radiator or heater.
- Also route all cables away from potential hazards.
- Disconnect the power supply before removing any covers.

3.2 Power connection

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 and consider compatibility with the type plate (mains voltage and frequency).

3.3 Repair of faults

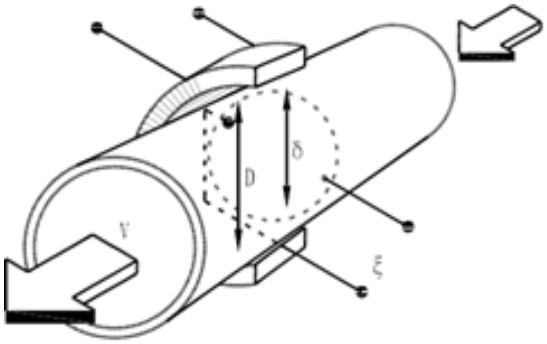
Disconnect all units from power supply and have it repaired by a qualified service person if any of the following occurs:

- 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.

Failure to adhere to these safety instructions may result in damage to the product or serious bodily injury.

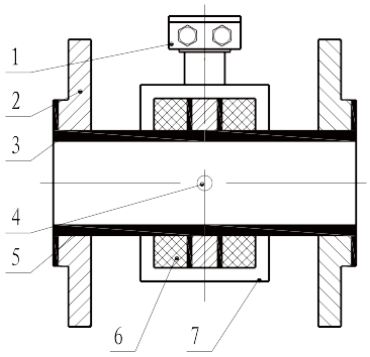
4. Operation principle

The operation of a magnetic flowmeter is based on Faraday's law, which states that the voltage induced in any conductor moving perpendicularly through a magnetic field is proportional to the velocity of that conductor. With the fluid flow acting as a moving conductor, two opposing measuring electrodes conduct the induced voltage, which is proportional to the flow velocity, to the amplifier. The flow rate is calculated from the pipe diameter.



The electromagnetic flowmeters are designed to measure all liquids with an electrical conductivity of at least 5 µS/cm (20 µS/cm for demineralised water). The EsuMag® series is characterised by high accuracy. Measurement results are independent of density, temperature and pressure. The EsuMag® is suitable for measuring the volume flow of a wide range of acids, alkalis, salt solutions, paper pulp, slurries and other conductive liquids or liquid-solid two-phase media.

Sensor Structure



1. Junction box 2. Flange 3. Insulated liner 4. Electrode 5. Measuring tube 6. Excitation coil 7. Shell

5. Installation

	The following safety precautions and installation instructions must be followed to ensure proper operation and accurate measurement of the flowmeter. The safety of any system in which the meter is installed is the responsibility of the system installer and operator.

5.1. General precautions

5.1.1 Temperature ranges

- Observe the maximum temperature range of the amplifier and detector.
- 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 separate amplifier and detector (separate version).

Transmitter	Ambient temp.	-20 to + 70 °C
Sensor	Fluid temp. PTFE / PFA	-40 to +150 °C
	Hard rubber	0 to+80 °C
	Soft rubber	0 to+80 °C

5.1.2 Protection class

In order to maintain the characteristics of the relative protection class of the equipment, the following precautions must be observed:

- 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, route the cable downwards. This will prevent moisture from entering the cable inlet.

The meters are supplied with IP67 protection as standard. Optionally, IP68 protection is available on request. In this case the meters must be ordered separately.

5.1.3. Mechanical installation and handling

Storage

- Store the device in a dry, dust-free location.
- Avoid continuous direct sunlight.
- Store the device in its original packaging.
- Storage temperature: -50...+70°C / -58...+158°F.

Transport

	▪ Use lifting lugs when lifting meter flow tubes that are 150 mm diameter or larger. ▪ Do not lift meter on measuring amplifier or on detector's neck. ▪ Do not lift meter with a forklift on the jacket sheet. This could damage the body. ▪ Do not use rigging chains, forklift forks, etc. in or through the flow tube of the meter to lift the meter. This could damage the insulator.

5.1.4. Installation environment

Sensor installation

- In the case of flanged fittings, installation must be carried out carefully and accurately so that the flange bolt holes on the pipe and flowmeter are flush and the bolts can pass easily to facilitate integration between the sensor and the process pipe.
- Installation must ensure that the sensor and process pipe are accurately aligned and a good earth connection is made, otherwise measurement errors will occur.
- Observe the forward flow label on the meter body and install the meter accordingly.

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

- Avoid installation in places where water may accumulate. A suitable location is a ventilated room or shaft.
- The unit should be protected from direct sunlight and rain. For outdoor installation, a protective shield should be considered.
- Avoid mounting on pipes with strong vibrations. If this is unavoidable, choose a remote transmitter.
- Avoid installation near equipment with strong electromagnetic fields, such as large motors, large transformers.
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5.1.5. 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.

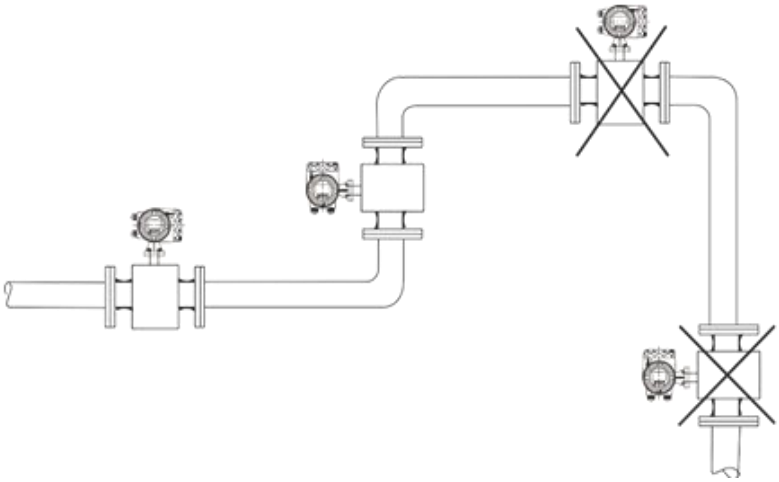
5.1.6. Inlet and outlet pipe

Avoid installing the meters in front of fittings producing turbulences. If this is simply not possible, foresee distances of > 3 x DN. Distance in outlet to be > 2 x DN.

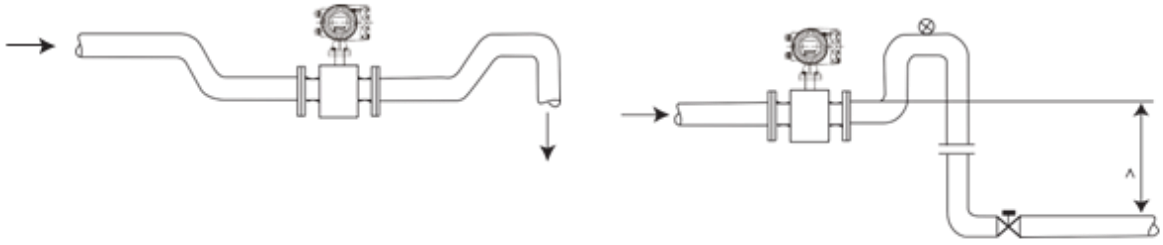
5.1.7. Meter placement

	▪ Do not install the detector on the suction sides of the pumps. This could damage the liner (in particular PTFE liners) ▪ Verify that the pipeline is always filled on the measuring point, if not an accurate or correct measurement is not possible. ▪ Do not install the detector at the highest point of a piping system. This may cause gas accumulation. ▪ Do not install the detector in down comer pipes with free outlet.

Observe and follow below graphic precautions 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).



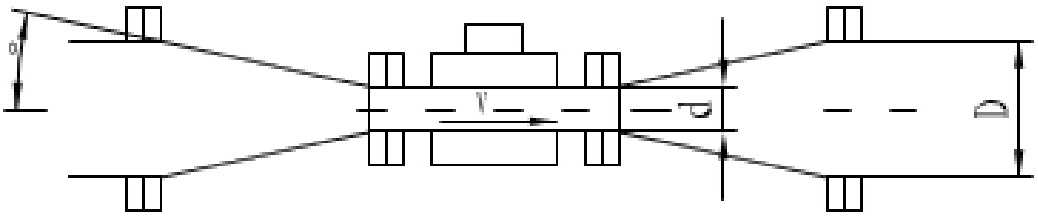
Try to install in lower positions. Use an exhaust valve if drop pipe is more than 5 m.

In longer pipe systems, install control valve and cut-off valve on downstream side of flow meter. Do not install on suction side of pump.

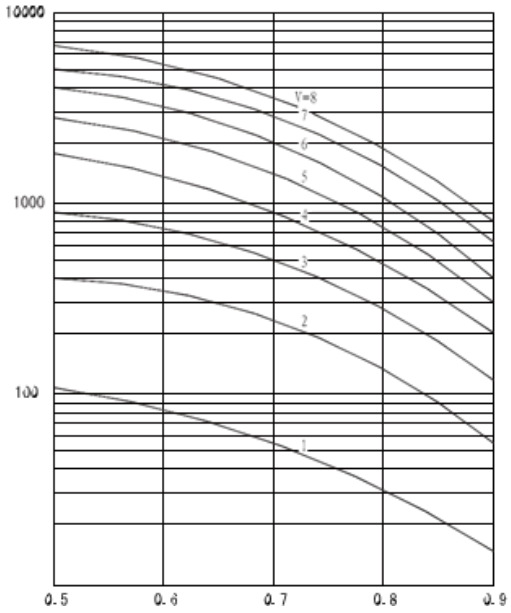
5.2 Pipe reducer requirements

DIN 28545 pipe reducers can be used to fit detectors into larger pipes. The pressure drop can be determined using the nomogram shown (only for liquids of similar viscosity to water).

Note: In cases where the flow velocity is very low, the flow velocity can be increased by reducing the size of the measuring point.



D: Pipeline, d: Sensor. V: Flow rate [m/s]



(d/D)

Define pressure loss:

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

5.3 Separate version

Provide a separate version in the following cases:

- Detector protection class IP 68, optional
- Fluid temperature > 100 °C
- Strong vibrations

	**CAUTION!** Do not install the signal cable close to power cables, electric machines, etc. Fix signal cables. Due to capacity changes, cable movements may result in incorrect measurements

Ensure that the wall bracket is securely mounted to prevent movement of the converter/transmitter and strain on the cables. Use adequate material to ensure a load capacity of 4 times the weight of the remote equipment.

5.4 Cables

Route all cabling away from potential hazards. Always consider proper cable materials for fixed installations, which are compatible with the local regulatory or site guidance for insulation and flame protection.
The use of a minimum UL 2556 VW-1 flame protection class for wires is mandatory.
Use cables which are consistent with the environmental requirements of the site, e.g. considering temperature and humidity.

Item	Name	Specification
1	Signal line	PVC sheathed 2 core shielded cable 2X16/015 (SBWP) PVC sheathed 2 core shielded cable 2X80/015 RWP Ship sealed with rubber insulated cable 2X0.5
2	Excitation wire	Two core plastic cable 2X1.0 mm^2（YHZ Marine soft ethylene-propylene rubber insulated cable 2X1.0(CEFR-C)
3	Output signal lines	General Color plastic double-stranded copper wire

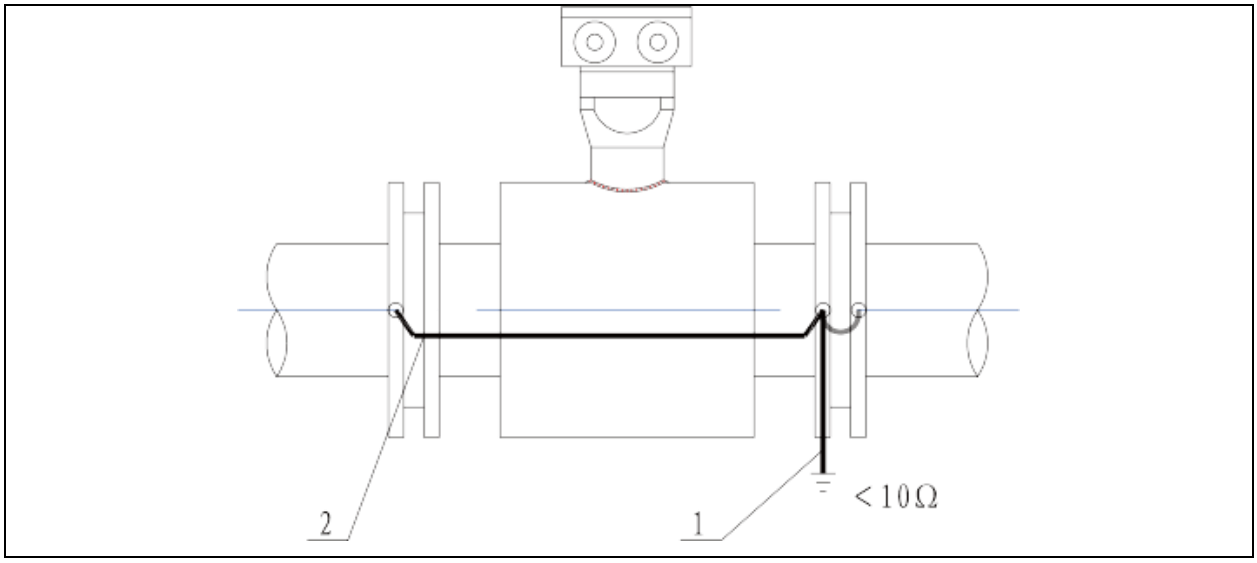
5.5 Grounding and potential equalization

For accurate measurement, the detector and the liquid must be at the same electrical potential. If flanged or intermediate flanged versions with additional ground electrode are used, the ground is provided by the connected pipework.

	For the flanged version, in addition to the fixing screws, a connection cable (min. 4 mm²) must be used between the earth screw on the meter flange and the counter flange. Check that the electrical connection is correct. Colour or corrosion on the counterflange can affect the electrical connection.

Metal pipes

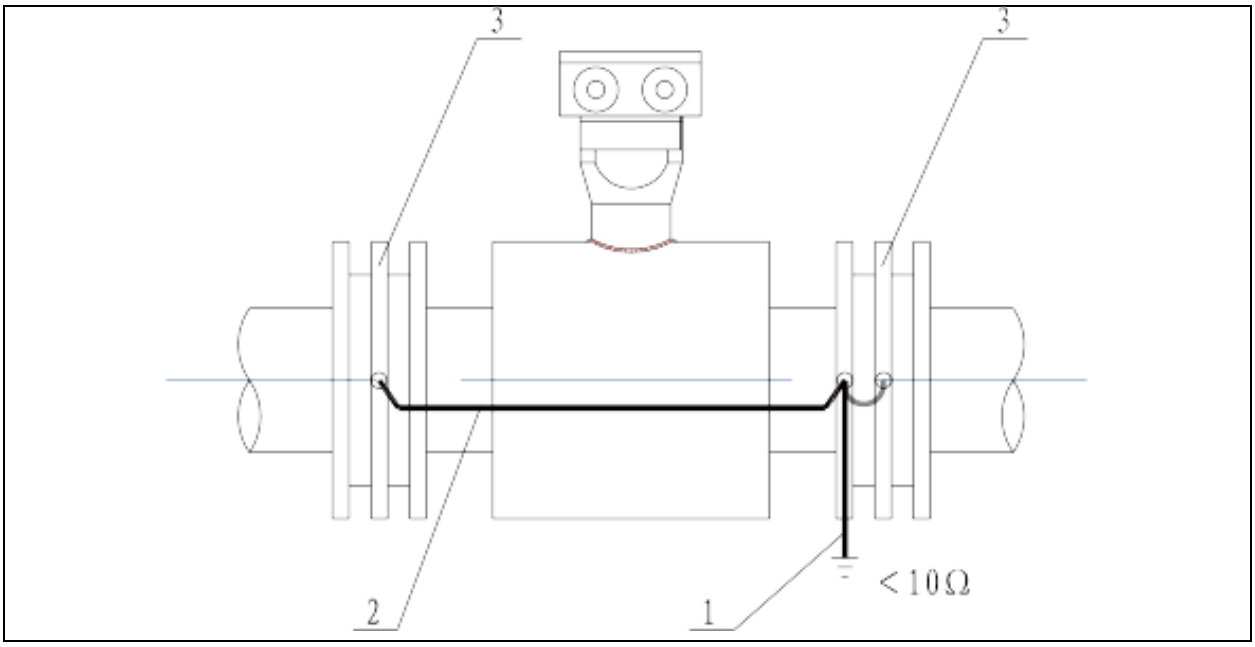
1. Grounding line (grounded independent from other interfering devices)
2. Flowmeter grounding line



Plastic or lined pipeline

1. Grounding line (grounded independent from other interfering devices)
2. Flowmeter grounding line
3. Grounding or earthing ring flange

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.

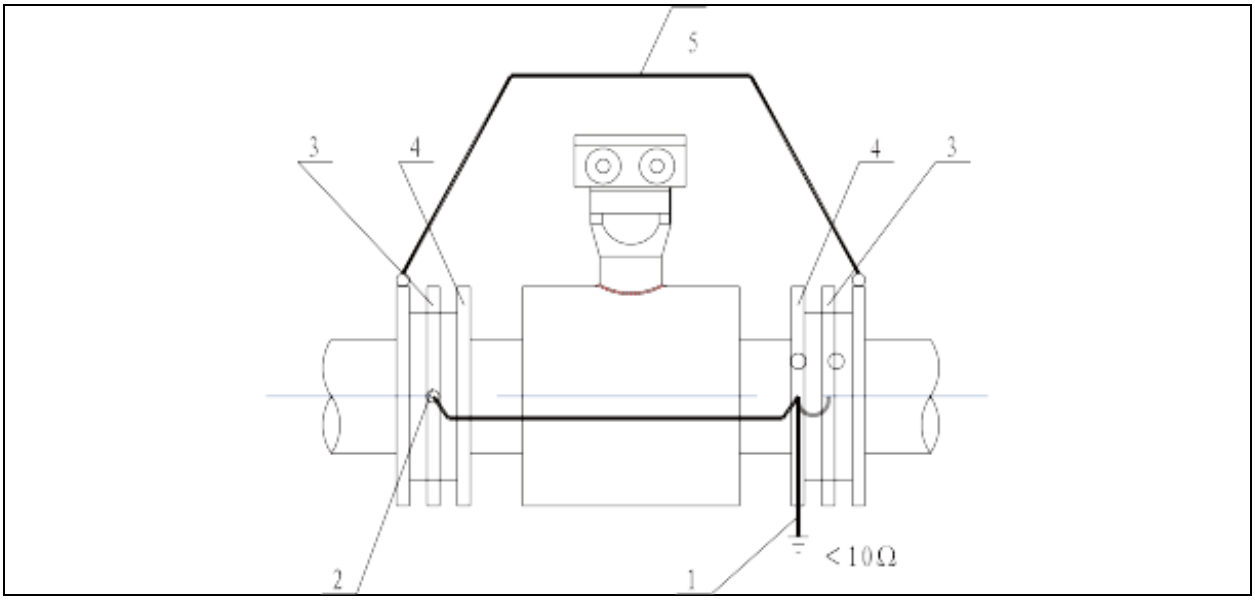


	**CAUTION!** If grounding rings are used, ensure that the material is corrosion resistant. When measuring aggressive liquids, use grounding electrodes.

Pipelines with cathodic protection

1. Grounding device line (grounded independent from other interfering devices)
2. Flowmeter grounding line
3. Grounding or earthing ring flange must be consistent with the flange connecting pipe insulation
4. Bolts (must be installed with the flange and should be mutual insulated)
5. Connect

As for pipelines with cathodic protection, the meter must be installed floating. There must be no electrical connection from the meter to the pipeline system and the power supply must be provided via an isolating transformer.



	**CAUTION!** 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.

5.6 Power connections

- For the 3 x M20 cable inlets only use flexible electric cables.
- Use separate cable inlets for auxiliary power, signal and input/output cables.

5.7 Auxiliary power

- Do not connect meter under impressed mains voltage.
- Take national applicable rules into account.
- Observe type plate (mains voltage and frequency).

6 Electrode material

Available electrode materials and a brief about their performance against corrosion are shown in below table:

Material	Corrosion performance
Acid-resistant steel 1Cr18Ni9Ti	To nitric acid, phosphoric acid and other cold inorganic acid, a variety of salt and alkali solutions, organic acids, water-resistant for a good corrosion resistance. Formic acid of boiling, Oxalic acid , industrial acid-ming, as well as sodium carbonate and chlorine, bromine, iodine, such as poor chemical stability of medium, not corrosion.
stainless steel containing molybde-num 0Cr18Ni12Mo2Ti 0Cr18Ni12Mo3Ti	In the reductive medium (such as hydrochloric acid) compared with 1Crl8N 9Ti have stronger corrosion resistance. Less than 50% of the nitric acid, at room temperature less than 50% of sulfuric acid and 20% of the hydrochloric acid, alkali solution, boiling phosphoric acid, formic acid, under pressure from a certain sub-sulfuric acid, water, acetic acid and other media have a strong corrosion resistance , can be widely used in petrochemical, urea, vinylon industry. Intolerant of hydrofluoric acid, chlorine, bromine, iodine and other medium.
HastelloyB	Below the boiling point of all the following concentrations of hydrochloric acid with good corrosion resistance, is also resistant to sulphuric acid, phosphoric acid, hydrofluoric acid, organic acids and other non-oxidising acids, alkalis, salt solution of non-oxidative corrosion.
HastelloyC	Oxidation of acid-resistant, such as nitric acid, mixed acid or chromic acid and sulfuric acid corrosion of mixed medium, but also resistant to oxidation of the salts such as Fe ", Cu +2 corrosion or other oxidants. Such as higher than normal temperature of the hypochlorite solution. Seawater corrosion resistance is very good
Ti	Medium resistance of oxygen and nitric acid, chloride, hypochlorite and chlorine the corrosion resistance of a good medium

7 Lining material

Following are standard available lining materials and their characteristics. Customized materials are also available upon request.

Lining material	Main performance	App. Temp.
PTFE	It is the most stable plastic material. Suitable for measuring water at high temperatures, hydrochloric acid, sulphuric acid, nitric acid and aqua regia, but also has strong resistance to alkali, organic agents, molten alkali. It is abrasion resistant.	-80～250°C
chloroprene rubber	Have good flexibility, high tensile strength, abrasion resistance, good impact resistance. Acid, alkali, salt and other corrosive media. Intolerance of oxidative corrosive media.	0～80°C
Polyurethane Rubber	Has an excellent wear resistance, which is equivalent to ten times that of natural rubber.	0～60°C

8 Installation notes

If the electromagnetic flow meter is not installed properly, it will significantly affect the measurement accuracy. Before installation, please read the instruction sections carefully.

CAUTION!

Transmitter's configuration is in accordance with the order requirements. Users should check the instrument nameplate to confirm that the instrument operating parameters are set as required. The instrument is ready for use after connection to the power supply. To ensure that the system operates normally, the measuring tube must be completely filled with medium. Empty or half-empty piping would cause serious measurement errors in electromagnetic flowmeters.

Electromagnetic flowmeters are designed to measure conductive liquids (conductivity ≥ 5μS/cm, demineralised water ≥ 20μS/cm).

The flowmeter should be installed and used strictly in accordance with the specification and in compliance with relevant national standards, safety and accident prevention requirements.

8.1 Environment temperature

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

8.2. Installation environment

Avoid installation in highly corrosive atmospheres. The installation site should have adequate ventilation. Protective measures should be taken to prevent corrosive gases and moisture from entering the unit. Avoid direct sunlight, especially on the liquid crystal display. Avoid strong vibrations.

8.3. Power line connection

	**CAUTION!** 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. When using instruments in hazardous areas, regulations around "Ex" standards must be followed. The instrument should be connected to the electrical supply before energising.

8.4. Instrument Power supply

This series of transmitters have the following power supply types.

1. AC Power supply range: 85VAC-265VAC, 50Hz power ~ 10VA (including sensors).
2. DC power supply range: 18VDC-36VDC; power ≤ 10W (including sensors).

	**CAUTION!** In order to avoid disoperation and make instrument error or damage, please see the nameplate and arengment of the electrical terminals and the types of instructions, careefully Before connecting the power supply.

8.5. How to run the device

1. Open the rear cover of the transmitter.
2. Thread a dedicated power supply input line through the waterproof connector into the instrument cavity.
3. Connect the earth lead to the transmitter side of the earth.

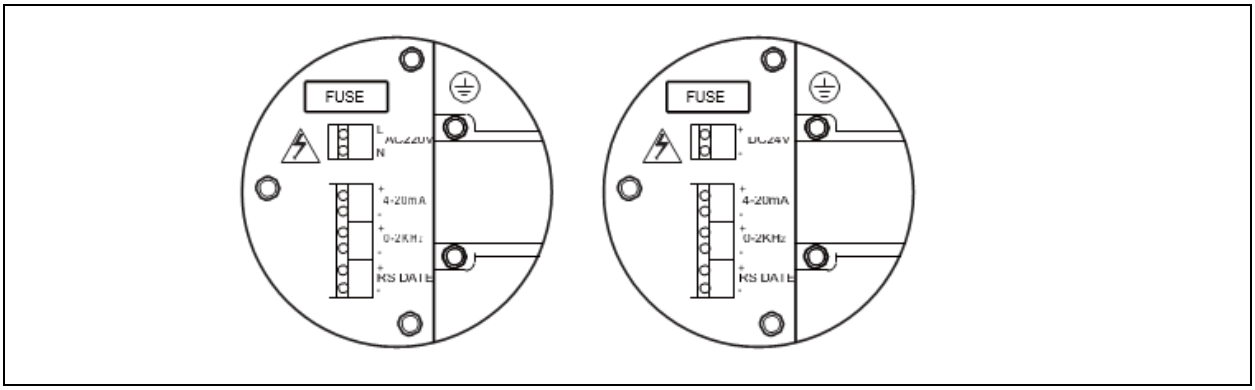
4. Connect the AC power cables to L and N.
5. Connect the direct current (DC) power supply to the + and – in terminals.
6. Replace the waterproof plug screw to restore the factory sealed condition.

	**CAUTION!** Please take care of the following when connecting the power to instrument. 1. Don't twist the power cord inside the transmitter. 2. The power input line should be separated from other input and output lines, threading through the separate glands. 3. Observe the positive and negative polarity of the DC power supply. If reversed, the unit will not work. 4. The power supply should be well earthed to ensure the safety of the operators.

	AC powered product variants have hazradeous 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 acording 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.

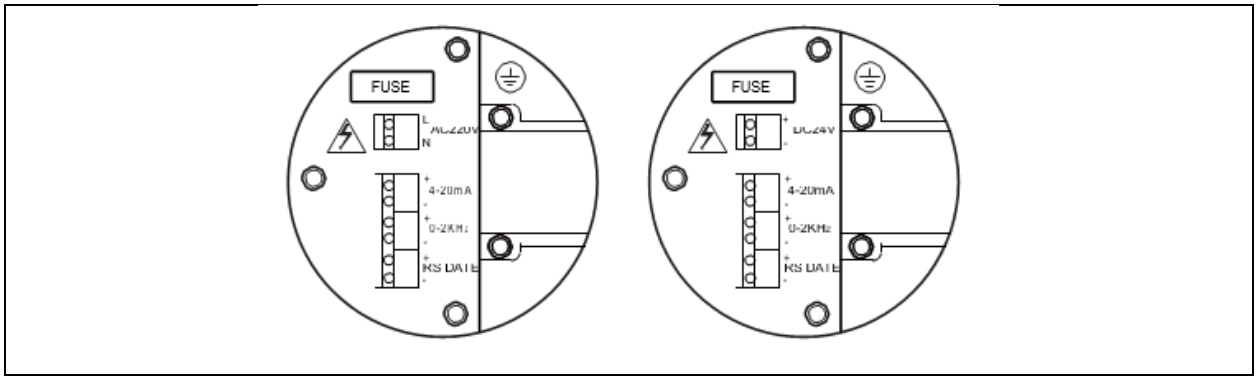
9 Power terminals

Identifier	Functional	Description
L	220VAC Power, L terminal	Power range: 85 VAC-265VAC 50 Hz
N	220VAC Power, N terminal	
+	24 VDC Power, positive terminal	Power range: 18 VDC -36VDC
-	24 VDC Power, negative terminal	
	Power Ground terminal	Grounding resistance <= 10 Ω



Power terminals

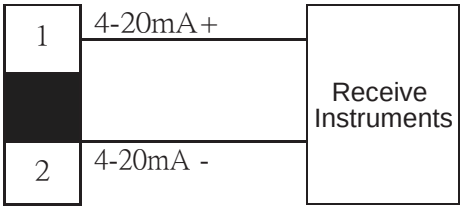
9.1 Output signals



Output signal terminal

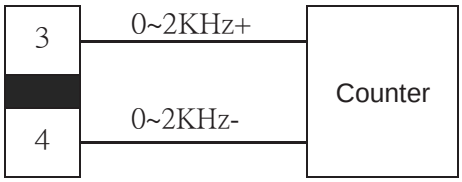
Items	Lable	Function Instructions	Remarks
1	4-20mA +	4-20mA Output positive terminal	1: Load resistance:750Q (with link) 2: HART® Communications external 24VDC power supply Active Output
2	4-20mA -	4-20mA Output negative terminal	
3	0~2KHz+	Frequency/pulse output positive terminal	The output amplitude of 24V load current <=50mA
4	0~2KHz-	Frequency/pulse output negative terminal	
5	RS485date+	RS485 Communication positiveterminal	RS485 communication function (n just for transmitter has this function
6	RS485date -	RS485 Communication negativeterminal	

9.2 Electric current output



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. The maximum current output load resistance is 750Ω including the load resistance of used cable. The recommended current output cable is RWP2x16/015 PVC insulated sheathed cable with white shield.

9.3 Pulse/ Frequency output

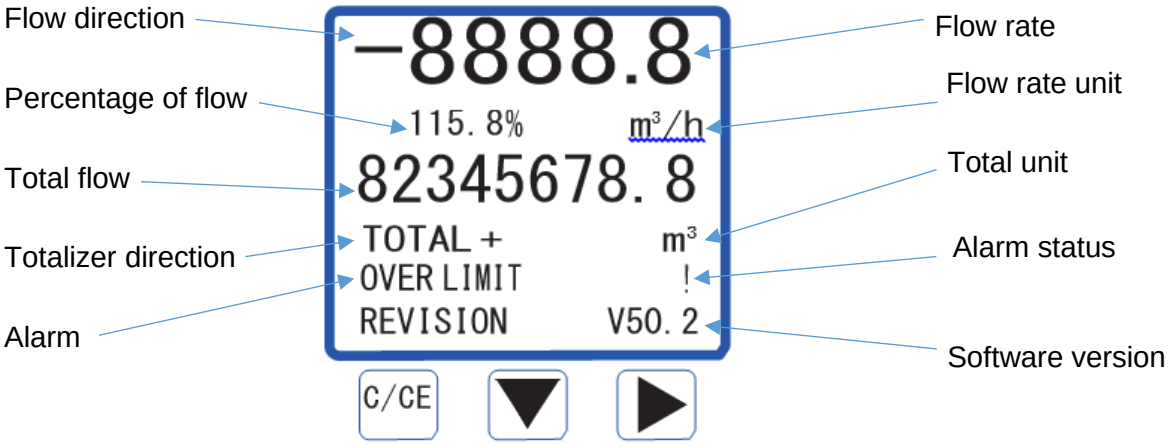


The Transmitter frequency, pulse output is electrically isolated. It is transistor output type. Maximum pulse output frequency is 5 KHz and the output pulse amplitude is 24V. The maximum load current is 5 KHz in active mode and 0,2 A in passive mode. As the frequency and pulse output terminals are shared, one mode at a time is selectable. Frequency output upper limit corresponds to the measured flow value by the parameter item "scale flow value". Pulse output is also selectable with scalable pulse per liter rate.

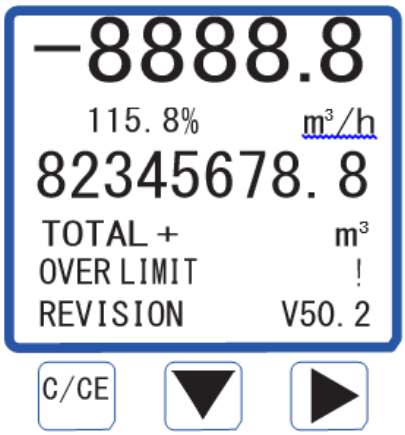
10 Communication, Operation and Display

Transmitter is equipped with RS485 communication with MODBUS ASC, MODBUS RTU communication capabilities (requires user specification at time of order). Modbus protocol and registration maps are available.

10.1 DC/AC powered devices



Panel construction and key definitions



C\CE Parameter confirmation and withdraw from subprogram.

Set item (the key of downward and decrease of data variable).

Set item (the key of move to right).

Short key and multiple key

Press , Hold it and then press : Shortcut to “set zero”.

Press to access “flow rate unit”, “total direction” and “total unit”. Use to choose between them.

10.1.1 Menu construction

1.BASIC SETUP	1.1. Damping(s) (0,1 – 99,9)	
	1.2. PV Decimal (1, 2, 3)	
	1.3. Total decimal (1, 2, 3)	
	1.4. LCD Rotate (0, +90, 180, -90)	
2. SYSTEM SETUP	2.1. Signal	2.1.1. Qmax (m^3/h) 2.1.2. Low cut off % 2.1.3. Max limit % 2.1.4. Limit time (s) 2.1.5. Direction 2.1.6. Indication
	2.2. Pulse output	2.2.1. Freq. Max (Hz) 2.2.2. Liter / Pulse 2.2.3. Pulse width (m/s)
	Modbus	Protocol Baud rate Parity Dev address
	Clear total	
	Load settings	
3. TRANSMITTER TRIM	3.1. Tube Trim	3.1.1. Empty trim 3.1.2. Full trim 3.1.3. Tube region %
	3.2. Loop trim	3.2.1. 4 mA trim 3.2.2. 20 mA trim
	3.3. Zero trim	
	3.4. K carachter	
	3.5. Total preset	
	3.6. Manual adjust	3.6.1. Actual zero (mV) 3.6.2. Empty Freq 9Hz) 3.6.3. Full Freq (Hz)
4. Output check	4.1. Loop test	
	4.2. Pulse test	

10.1.2 Detailed information

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

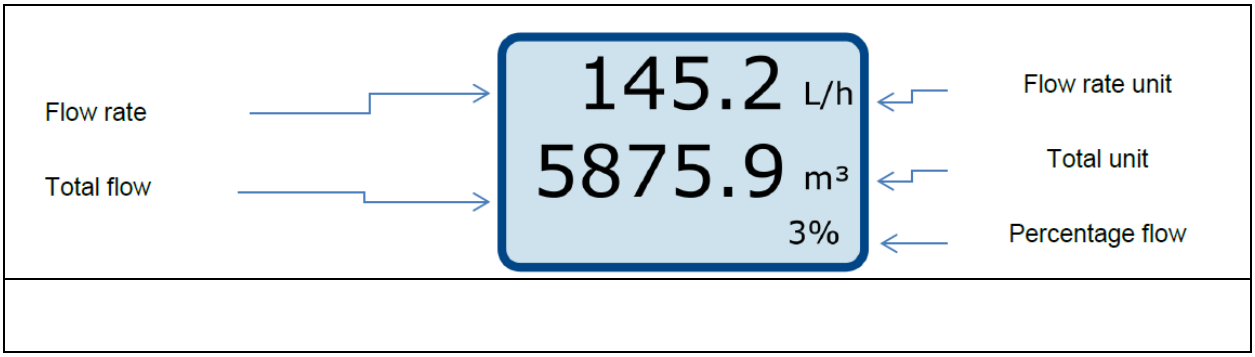
System		
Language	Select language of the meter / display	
Reset	Reset all values to the default setting	
Load Parameters	Load configurated parameters	
Signal	Qmax (m3/h)	Set the maximum flow rate. This quantity is then used as a reference value for output variables such as analogue outputs, frequency/pulse output or to determine percentage flow.
	Creeping quantity %	Sets the percentage of creep (0-9.9%), relative to Qmax, 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 Qmax. (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
	Device address	Setting the unit address in the Modbus network

Calibration		
Zero adjustment	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.	
Adjustment pipe	empty adjustment	Automatic calibration of the parameter "Frequency empty tube". The measuring tube must be empty for this.
	Full adjustment	Automatic calibration of the parameter "Frequency empty tube". The measuring tube must be full for this.
	Tube Region %	Set the percentage limit for empty tube detection.
	Frequency empty tuber	Parameter for empty pipe detection. This parameter is determined by calibration
	Frequenz full tube	Parameter for empty pipe detection. This parameter is determined by calibration.
Loop adjustment	4 mA adjustment	Fine adjustment of the lower 4 mA range for the analogue output
	20 mA adjustment	Fine adjustment of the upper 20 mA range for the analogue output.
	Loop Modus	Coding selection: 4-20 mA corresponds to the positive flow direction 0 to Qmax. 4-12-20 mA corresponds to coding for bi-directional measurements from -Qmax to +Qmax
K-factor	Correction factor for fine adjustment of the internal device K-factor in the range 0.97-1.03. The following applies here:	
	$Kfactor_{total} = kfactor_{internal} * Kfactor_{correction}$	

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

10.2 Battery powered device



10.2.1 Menu construction

1.BASIC SETUP	1.1. Damping(s) (0,1 – 99,9)	
	1.2. PV Decimal (1, 2, 3)	
	1.3. Total decimal (1, 2, 3)	
	1.4. LCD Rotate (0, +90, 180, -90)	
3. SYSTEM SETUP	2.1. Signal	2.1.1. Qmax (m^3/h) 2.1.2. Low cut off % 2.1.3. Max limit % 2.1.4. Limit time (s) 2.1.5. Direction 2.1.6. Indication
	2.2. Pulse output	2.2.1. Freq. Max (Hz) 2.2.2. Liter / Pulse 2.2.3. Pulse width (m/s)
	Modbus	Protocol Baud rate Parity Dev address
	Clear total	
	Load settings	
4. TRANSMITTER TRIM	3.1. Tube Trim	3.1.1. Empty trim 3.1.2. Full trim 3.1.3. Tube region %
	3.2. Loop trim	3.2.1. 4 mA trim 3.2.2. 20 mA trim

	3.3. Zero trim	
	3.4. K carachter	
	3.5. Total preset	
	3.6. Manual adjust	3.6.1. Actual zero (mV) 3.6.2. Empty Freq 9Hz) 3.6.3. Full Freq (Hz)
4. Output check	4.1. Loop test	
	4.2. Pulse test	

10.1.2 Detailed information:

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

System		
Language	Select the display language.	
Load Parameter	Load configuration parameters	
Signal	Qmax (m3/h)	Set the maximum flow rate. This quantity is then used as a reference value for output variables such as analogue outputs, frequency/pulse output or to determine percentage flow.
	Creeping quantity %	Adjustment of the percentage of creep (0-9.9%) relative to Qmax, above which the flow is declared as zero flow.
	Direction	Setting 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 calculating mass data
	LPM-Modus	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).
Pulse output	max frequency (Hz)	Reference for the frequency coding of the output. This value corresponds to Qmax. (100-5000 Hz) if "Freq Enable" is activated

	Liter / Pulse	Configuration of the valence for the pulse output.
	Pulse width (ms)	Setting the pulse width in ms
	Pulse level	Set whether the pulses are in Active High or Active Low mode.
	Freq Enable	Set whether the frequency/pulse output should be configured as a frequency output.
RS485 output	RS485-Protocol	Set the Modbus protocol as Modbus-RTU or Modbus-ASC
	Baud rate	Set 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
	RS485 enable	Activate RS485 communication
Total Admin	reset	Reset all values to the default setting
	FWD Preselection (m^3)	Manually set the counter for the forward direction.
	REV Preselection (m^3)	Set the counter for the reverse direction manually.

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

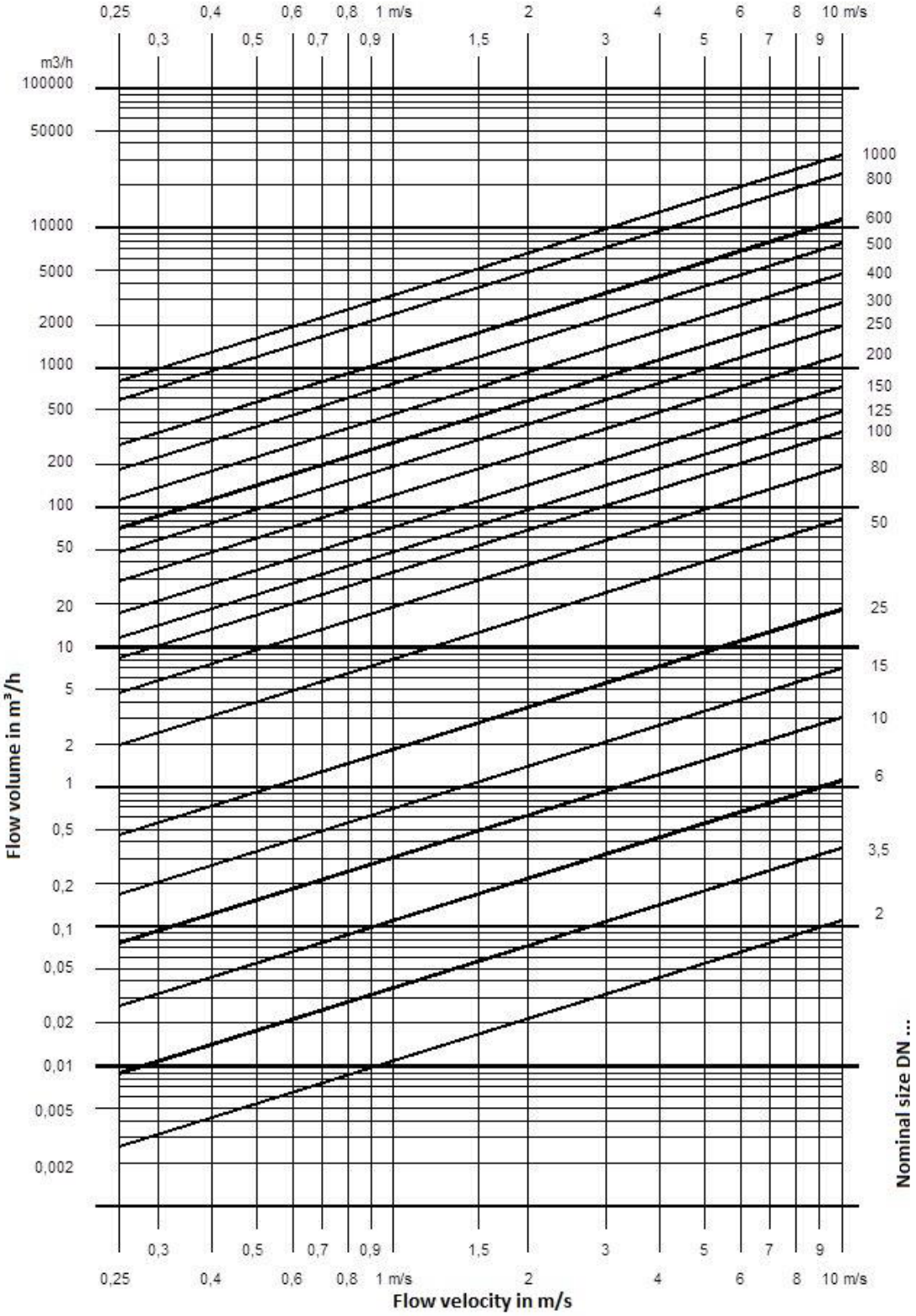
11 TECHNICAL DATA

Detector / Sensor	
Size	DN10 to DN2000
Connections	Flange: DIN, ANSI, AWWA, JIS, Wafer Connection, Thread-connection, Tri-Clamp and customized connections on request
Protection Class	IP67 (Optional IP68 with remote converter)
Nominal Pressure	Up to PN40 (up to PN100 on request)
Working Temperature	-20 °C to +60 °C (-40 °C to +150 °C with PTFE/ETFE) 0 °C to +70 °C (compact mounted , rubber liner) 0 °C to +90 °C (remote mounted , rubber liner) -40 °C to +100 °C (compact mounted, with PTFE liner) -40 °C to +160 °C (remote mounted, with PTFE liner)
Electrode Material	SS 316, Hastelloy C, Hb, Ti, Ta, Pt, Others on request
Liner Material	Hard/Soft Rubber/ PTFE/ ETFE/ FEP/Polyurethane
Measuring Tube Material	SS 316
Housing	Carbon Steel / Optional Stainless Steel
Lay length	Std. acc. ISO 13359, (Others on request)

Transmitter / Converter	
Type	Transmitters Model: ESM720 – external powered ESM730 – battery powered
Size	DN10 to DN2000
Flow Direction	Bi - Directional
Accuracy	ESM720: ± 0.20 % of actual flow, ± 1 mm/s from end value ESM730: ± 0.40 % of actual flow, ± 1 mm/s from end value
repeatability	0,1 %
Conductivity	≥ 5 µS/cm
Ambient temperature	-20 °C to +70 °C, relative humidity 90 %
Power supply	85-265 VAC (50/60 Hz) / 9-36 VDC / Battery (appr.5 years lifetime)
Flow Range	0.03 – 12 m/s
Analogue Output	4 – 20 mA
Digital Output	Frequency output/ Pulse (Active)
Empty pipe detection	YES
communication	RS485 or HART® Protocol
Display	7 Digits flow rate / 8 digits totalizer / LCD Graphic display
housing	Aluminum IP65 / 67 (optional IP68)
Remote version	Standard 10m cable, up to 100m with standard junction box

11.1 FLOW RANGE CHART BY PIPE SIZE

Determination of the end values of the measuring range or selection of the nominal meter size (DN):



11.2 FLOW CHARACTERISTIC VALUES BY PIPE SIZE

Nominal Diameter		**Recommended flow** **Min / Max full scale value** **Velocity ~ 0.03 – 12 m/s** **(Recommended, flow velocity is 2-3 m/s)**
[mm]	[Inch]	
15	½	4 to 100 l/min
20	-	6 to 200 l/min
25	1	9 to 300 l/min
32	-	15 to 500 l/min
40	1 ¼	25 to 700 l/min
50	2	2.1 to 66 m^3/h
65	-	3.6 to 120 m^3/h
80	3	5.4 to 180 m^3/h
100	4	8.7 to 282 m^3/h
125	5	13.2 to 450 m^3/h
150	6	20 to 600 m^3/h
200	8	35 to 1100 m^3/h
250	10	55 to 1700 m^3/h
300	12	80 to 2400 m^3/h
350	14	110 to 3300 m^3/h
400	16	140 to 4200 m^3/h
500	20	220 to 6600 m^3/h
600	24	310 to 9600 m^3/h
700	28	410 to 12000 m^3/h
800	32	560 to 16000 m^3/h
900	36	800 to 17500 m^3/h
1000	40	1200 to 20000 m^3/h

11.3 Dimensions and weight– Compact Version:

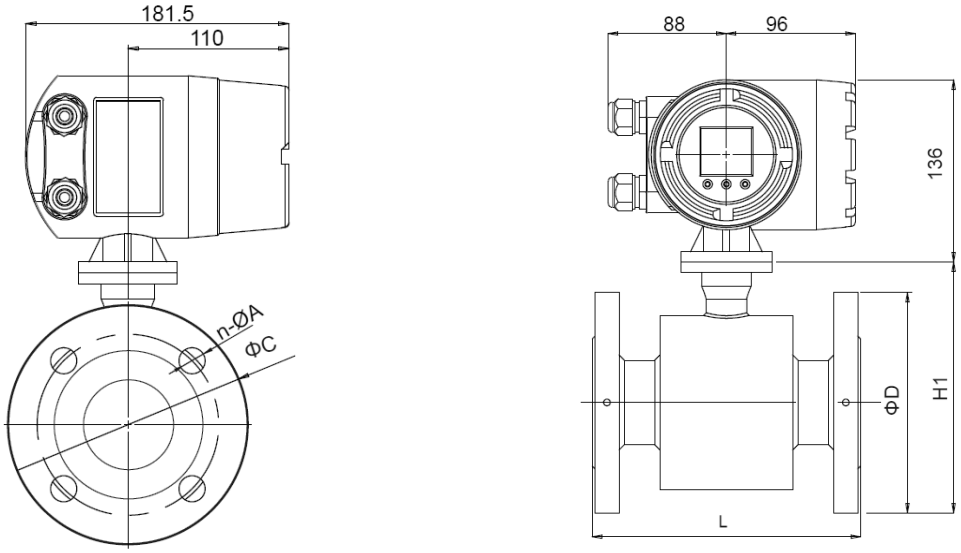
External dimensions for compact and remote type (Base on DN standard)

Unit (mm)

DN mm	Working pressure MPa	L	D	C	n-øA	H1	Compact Weights (KG)	Remote Weights (KG)
10	4. 0	150	90	60	4-ø14	130	6	4
15		150	95	65	4-ø14	132. 5	6	4
20		150	105	75	4-ø14	137. 5	8	6
25		150	115	85	4-ø14	145	9	7
32		150	140	100	4-ø18	162. 5	11	12
40		150	150	110	4-ø18	172. 5	13	14
50		200	165	125	4-ø18	187. 5	15	15
65		200	185	145	8-ø18	202. 5	16	18
80		200	200	160	8-ø18	220	19	20
100	1. 6	250	220	180	8-ø18	230	23	25
125		250	250	210	8-ø18	270	27	29
150		300	285	240	8-ø22	302. 5	33	36
200	1. 0	350	340	295	8-ø22	352. 5	51	49
250		400	395	350	12-ø22	407. 5	70	70
300		500	445	400	12-ø22	460	102	100
350		500	505	460	16-ø22	517. 5	123	121
400		600	565	515	16-ø26	572. 5	147	145
450		600	615	565	20-ø26	622. 5	212	207
500		600	670	620	20-ø26	675	229	210
600		600	780	725	20-ø30	745	252	250
700		700	895	840	24-ø30	892	352	350
800		800	1015	950	24-ø33	1002. 5	462	460
900		900	1115	1050	28-ø33	1102. 5	558	550
1000	0. 6	1000	1175	1120	28-ø30	1182. 5	690	680
1200		1200	1405	1340	32-ø33	1397. 5	785	780
1400		1400	1630	1560	36-ø36	1610	1258	1250
1600		1600	1830	1760	40xø36	1810	1565	1550
1800		1800	2045	1970	44xø39	2017. 5	2085	2080
2000		2000	2265	2180	48xø42	2227. 5	2605	2600

* Note: Please advise standard if need special requirements.

ESM 720 - Compact Version



11.4 Dimensions and weight– Remote Version:

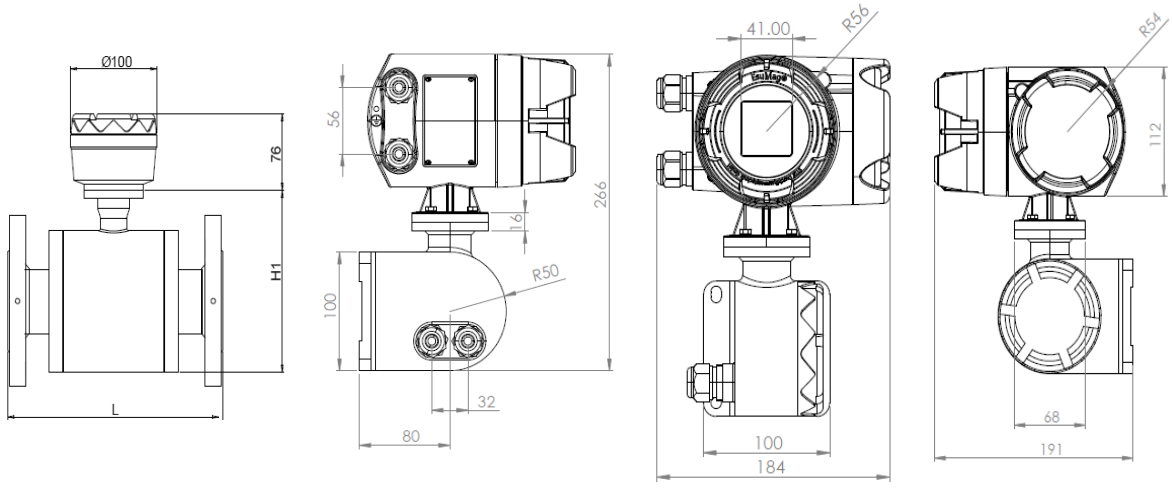
External dimensions for compact and remote type (Base on DN standard)

Unit (mm)

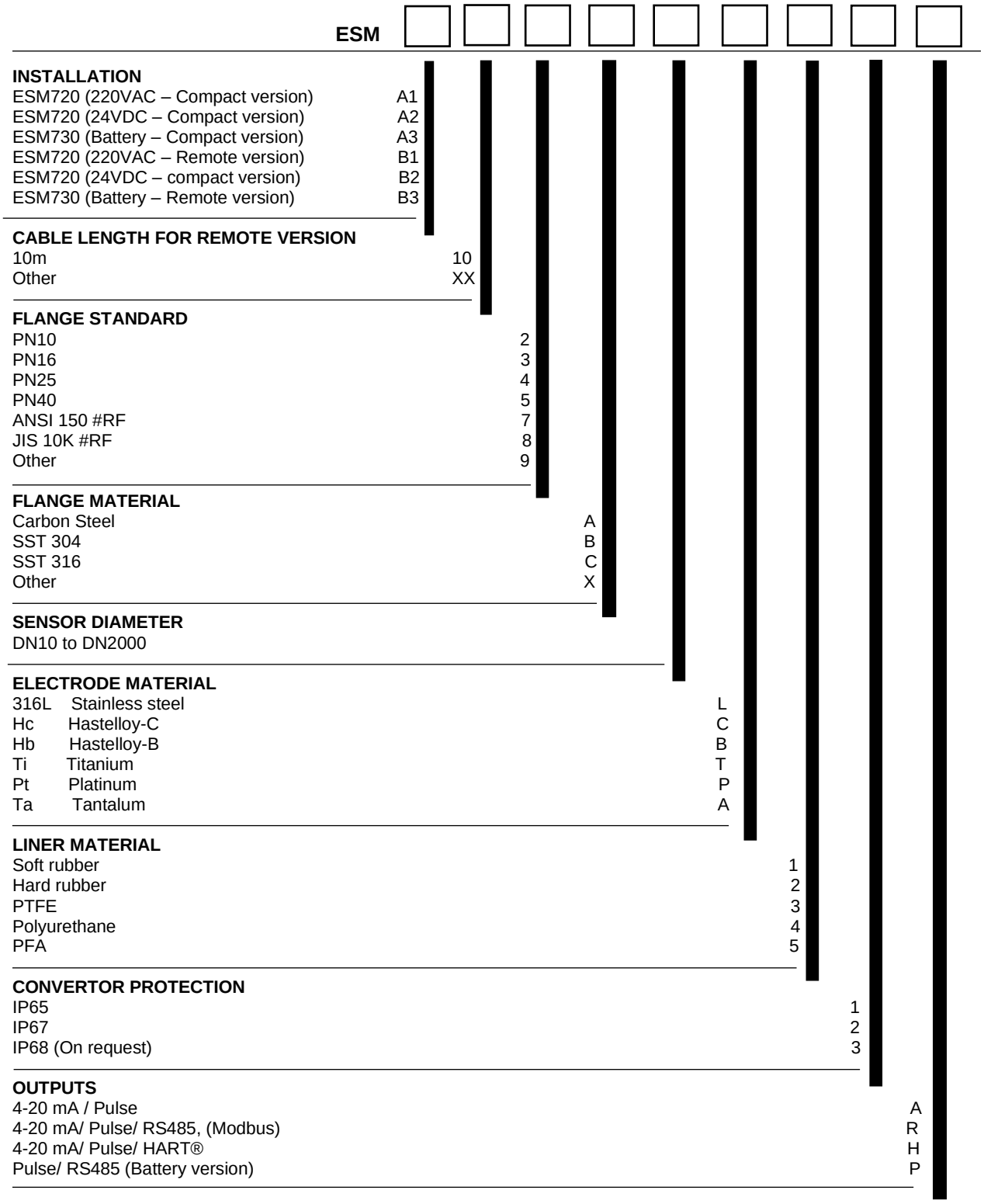
DN mm	Working pressure MPa	L	D	C	n-øA	H1	Compact Weights (KG)	Remote Weights (KG)
10	4. 0	150	90	60	4-ø14	130	6	4
15		150	95	65	4-ø14	132. 5	6	4
20		150	105	75	4-ø14	137. 5	8	6
25		150	115	85	4-ø14	145	9	7
32		150	140	100	4-ø18	162. 5	11	12
40		150	150	110	4-ø18	172. 5	13	14
50		200	165	125	4-ø18	187. 5	15	15
65		200	185	145	8-ø18	202. 5	16	18
80		200	200	160	8-ø18	220	19	20
100	1. 6	250	220	180	8-ø18	230	23	25
125		250	250	210	8-ø18	270	27	29
150		300	285	240	8-ø22	302. 5	33	36
200	1. 0	350	340	295	8-ø22	352. 5	51	49
250		400	395	350	12-ø22	407. 5	70	70
300		500	445	400	12-ø22	460	102	100
350		500	505	460	16-ø22	517. 5	123	121
400		600	565	515	16-ø26	572. 5	147	145
450		600	615	565	20-ø26	622. 5	212	207
500		600	670	620	20-ø26	675	229	210
600		600	780	725	20-ø30	745	252	250
700		700	895	840	24-ø30	892	352	350
800		800	1015	950	24-ø33	1002. 5	462	460
900		900	1115	1050	28-ø33	1102. 5	558	550
1000	0. 6	1000	1175	1120	28-ø30	1182. 5	690	680
1200		1200	1405	1340	32-ø33	1397. 5	785	780
1400		1400	1630	1560	36-ø36	1610	1258	1250
1600		1600	1830	1760	40xø36	1810	1565	1550
1800		1800	2045	1970	44xø39	2017. 5	2085	2080
2000		2000	2265	2180	48xø42	2227. 5	2605	2600

* Note: Please advise standard if need special requirements.

ESM 730 - Remote Version



12 model code description:



EXAMPLE: ESM B1 10 3 A 200 C 1 2 A

- Customized Cable length/Connections/ Flange material shall be ordered separately.
- Grounding Method (Grounding electrode in standard, Grounding ring shall be ordered separately).
- DN10 to DN40, meter with PTFE liner in Standard,
- PN40 - meter with grounding electrode up to DN20, meter lay length +50 mm

13 Troubleshooting

Electromagnetic flowmeters generally do not require regular maintenance. However, the fluid being measured may deposit or leave sediment on the electrodes. Regular cleaning should be considered when measuring liquids with sediment.

Any damage to the liner or electrodes caused by corrosion or improper handling will result in measurement errors or failures.

Some common errors are listed in the table below:

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

For any other faults or defects that cannot be rectified using the above guidelines, please contact your dealer with details of the faults and error signs displayed on the screen.

14 Error Information

Error	Description	Troubleshoot
Upper limit	Flow measurement value is over than the upper limit value alarm	The alarm limit value is lower than the flow measurement. ➔ Modify the upper limit value
Lower limit	Flow measurement value is lower than the lower limit value alarm	The alarm limit value is over the flow measurement. ➔ Modify the lower limit value
Excitation	Excitation circuit is not working correctly	1. Check cable terminals and electrical excitation of the terminal connections. 2. Check the meter excitation circuit not to be open or short circuit. 3. Excitation coil temperature is too high. 4. Excitation frequency set too high.
Empty pipe	Empty pipe alarm is on or meter shows random data	1. Flowmeter is not full of medium. 2. Electrode surface is completely covered with insulating layer. 3. Flow lines are quite irregular. 4. Medium conductivity is lower than limit.. 5. Empty and full trim is not correct, or tube region % is high sensitively set.
Zero point	Zero point value is too High	1. Pipe was not full when zero trimmed. 2. Fluid was non static on zero trimming. 3. Flowmeter grounding is incorrect or unreliable.
Over range	Instant value exceeds instrument declared value	1. Flow rate is over the maximum measurable value of meter. 2. Select a larger meter size.

15 Sales and Services

16.1. Quality assurance

Only original spare parts supplied by the manufacturer shall be used. Service work should be carried out by qualified personnel only.

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

Please contact our customer service department if your flow meter does not work properly or requires repair.

16.2. 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.

16.3. Availability of services

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

16 Disclaimer

16.1 General

The manufacturer shall not be liable for any damages of any kind arising from the use of its product, including but not limited to direct, indirect, incidental and consequential damages. This exclusion of liability does not apply if the manufacturer has acted intentionally or with gross negligence. If any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, to the extent such law applies, some or all of these disclaimers, exclusions or limitations may not apply to you. Each 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 change the content of its documents, including this disclaimer, in any way, at any time, for any reason, without prior notice, and will not be liable in any way for the consequences of such changes.

16.2 Product liability and warranty

The operator is responsible for the suitability of the equipment for its intended use. The manufacturer accepts no responsibility for the consequences of misuse by the operator. Improper installation or operation of the equipment will invalidate the warranty. In addition, the respective "General Terms and Conditions" on which the sales contract is based apply.

16.3 Documentation

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To prevent injury to the user or damage to the equipment, it is essential that you read the information in this document and comply with applicable national standards, safety requirements and accident prevention regulations. If this document is not in your native language and 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 the information in this document. This document is intended to help you establish operating conditions that will allow safe and efficient use of this equipment. The document also describes special considerations and precautions that must be taken into account.