BERMAD - EUROMAG

Electromagnetic Flowmeters

EUROMAG INTERNATIONAL

BERMAD

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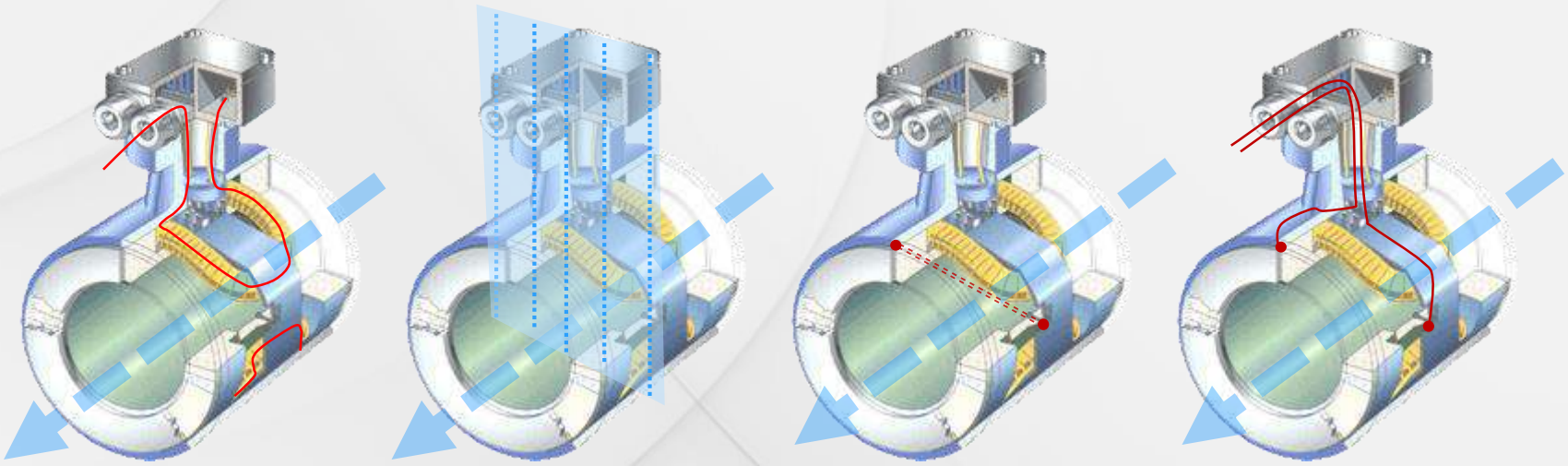
What is an electromagnetic flow meter?

A magnetic or mag meter is a flow meter that measures the flow rate based on the electromagnetic induction principle. A magnetic field is applied to the metering tube which results in a potential difference (voltage). This voltage is directly proportional to the velocity of the liquid running through the meter and it can be measured accurately.

Electromagnetic induction principle Faraday's law

According to Faraday's Law, an electrical conductor moving through a magnetic field produces an electric signal within the conductor. In the case of magmeters, the liquid is the conductor.



The electromagnetic coils are energized employing either AC or pulsed DC excitation.

They generate the magnetic field around the flow tube and perpendicular to the flow

An electric signal is produced within the conductor (the liquid that is been measured)

Two electrodes pick up the signal directly proportional to the flow velocity, the intensity of the magnetic field, and the width of the pipe

Sensor construction. Primary element

Closures

They keep coils and electrical connection inside the body of magmeter

Flow tube

Nonmagnetic pipe section generally made from 304 Stainless Steel. This allows the magnetic field to pas through the meter body into the pipe area to develop the flow signal

Coils

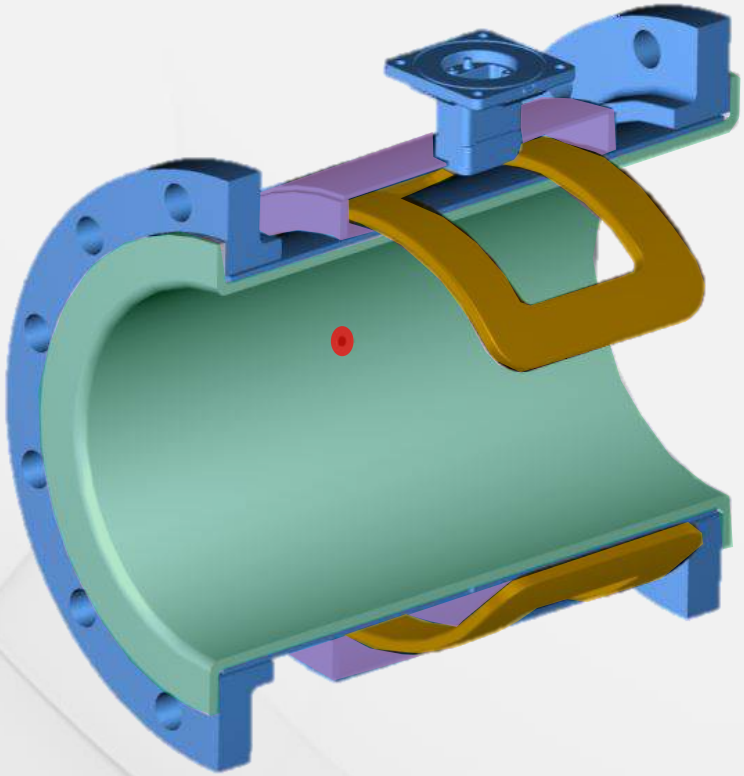
The electromagnetic coils that produce the flowmeter's magnetic field surround the outside of the pipe section. An alternating or pulsed direct current passing through the coils generates a magnetic field within this tub

Electrodes

Two electrodes embedded on opposite sides of the flow tube pick up the signal within the liquid. Generally the voltage developed across the electrodes is in the millivolt range

Lining

An insulating liner installed between the meter body and the electrodes prevents the flow signal from being shorted out. Generally the voltage developed across the electrodes is in the millivolt range



Different linings. PTFE or Ebonite or Rilsan®

Ebonite lining

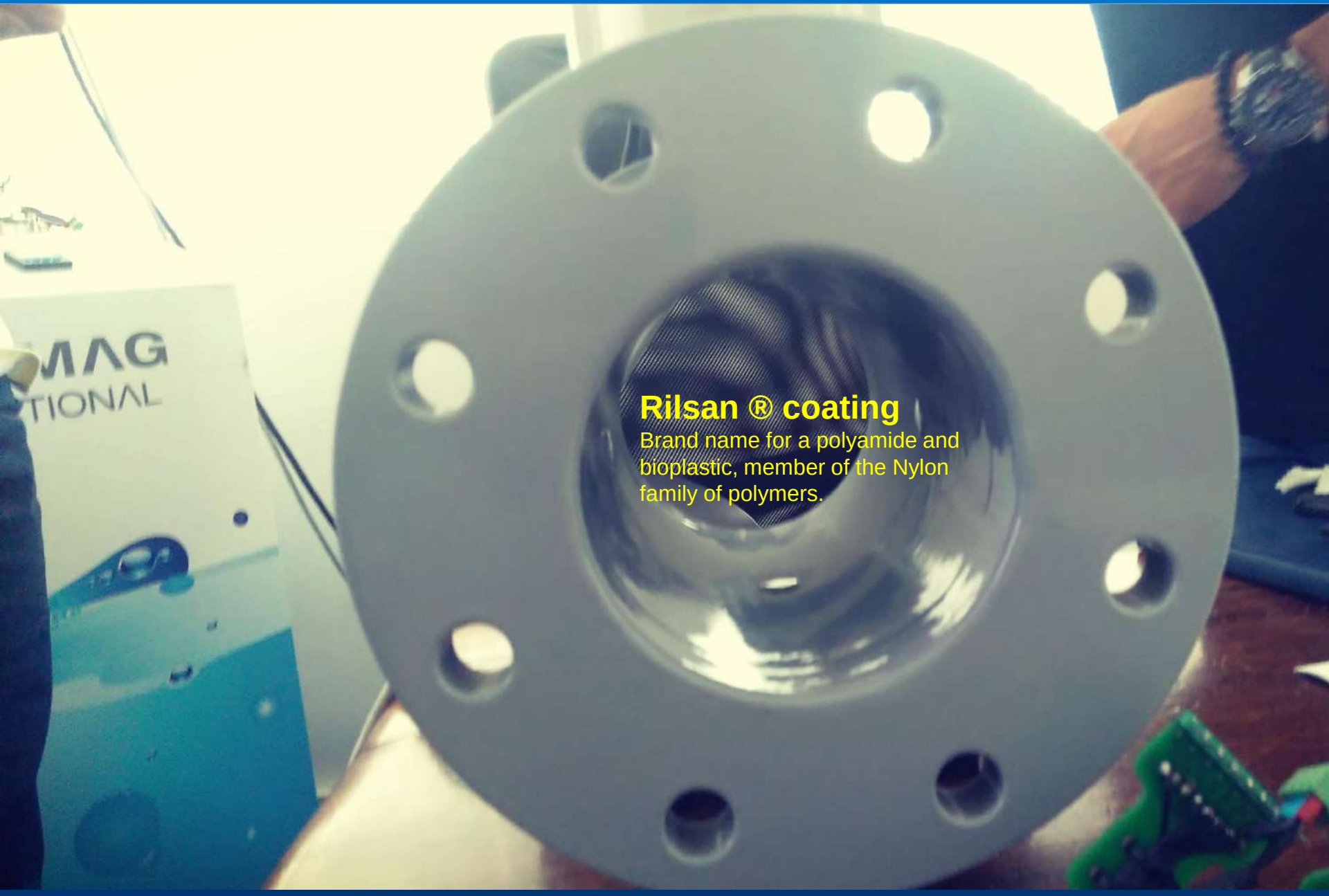
Brand name for very hard rubber and has formerly been called "vulcanite"

It is the most robust liner available on the market

PTFE lining

Polytetrafluoroethylene (PTFE) is a synthetic fluoropolymer of tetrafluoroethylene

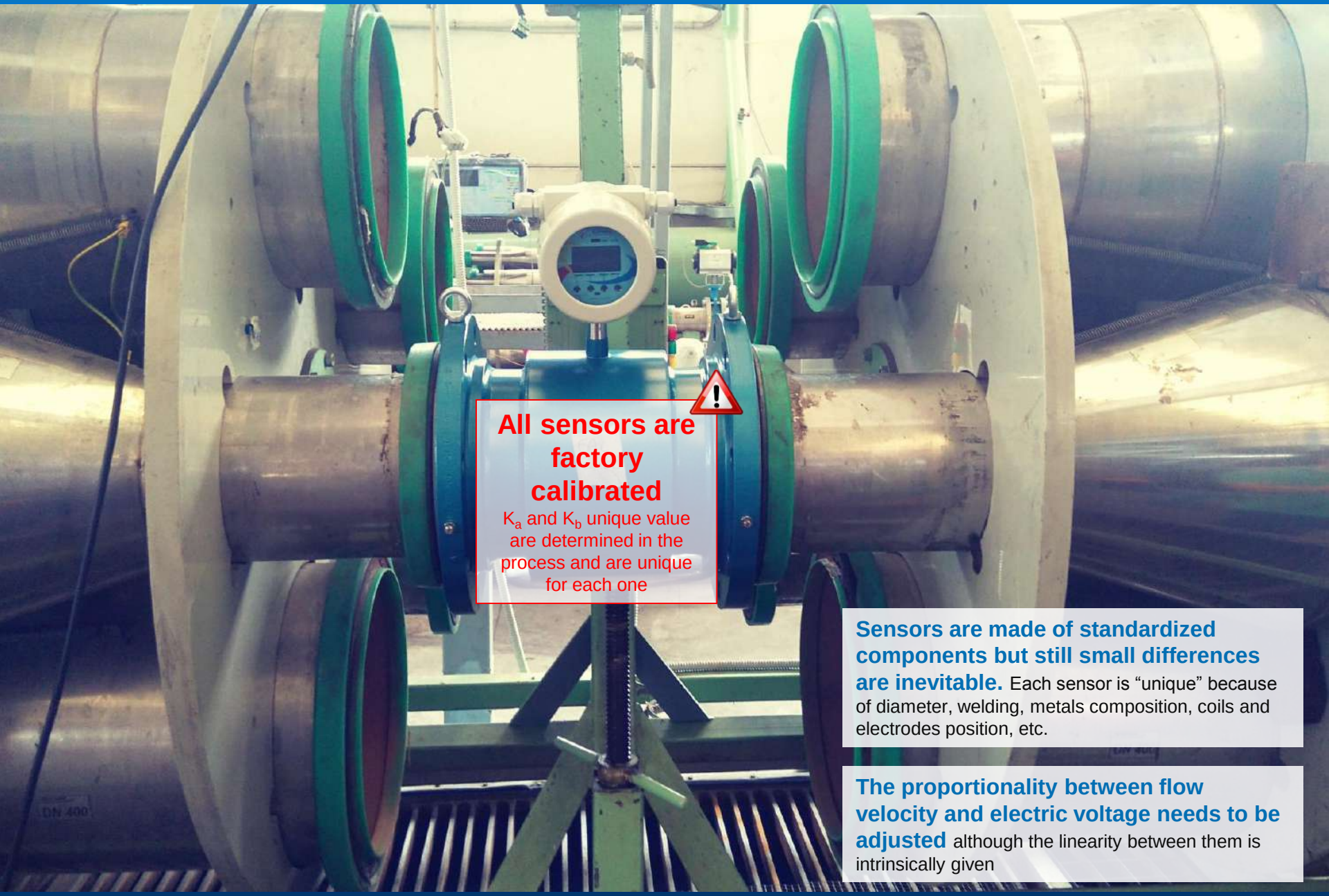
Different linings. PTFE or Ebonite or Rilsan®



Rilsan ® coating

Brand name for a polyamide and bioplastic, member of the Nylon family of polymers.

Factory calibration



All sensors are factory calibrated

K_a and K_b unique value are determined in the process and are unique for each one

Sensors are made of standardized components but still small differences are inevitable. Each sensor is “unique” because of diameter, welding, metals composition, coils and electrodes position, etc.

The proportionality between flow velocity and electric voltage needs to be adjusted although the linearity between them is intrinsically given

Euromag product line. Sensors and converters

MUT 2200 EL
Most popular full port magmeter

MUT 2300
Reduced port specially good at very low flows

MUT 1222
insertion flow meter

SENSORS

CONVERSORS

MC 608 A
Mains power version

MC 608 B
Battery powered

MC 608 R
Hybrid (mains and battery powered)

MC 406
New high–efficiency battery powered

MUT 2200 EL sensor

MUT 2200 EL features

Sizes: DN 15 to 2000 mm

Type: Full port magmeter

Class: PN64 & IP68

Connections: flanges (many standards)

Standard materials:

- 304 SST or Carbon steel tube and flanges
- PTFE (up to 100mm) or Ebonite lining (from 125mm)
- 4 Hastelloy C electrodes

Painting: Double spray epoxy

Special materials & paintings: On request

Approvals: WRAS, FDA, MID (with MC406).

Installation: needs straight sections before & after

The most common sensor

suitable for nearly all applications
due to it's high end wetted parts and robust construction
Ratio Q_3/Q_1=125

A pressure or temperature gauge can be installed directly in the sensor

MUT 2300 sensor

Reduced port sensor for accurate measurement at very low flows

Very low pressure drop
ΔP25 Class (< 0,25 bar at 1 m/s)

U0-D0 condition
No straight sections required

Ratio Q_3/Q_1=200

MUT 2300 features

Sizes: DN 50 to 300 mm

Type: Reduced port magmeter

Class: PN16 & IP68

Connections: flanges (many standards)

Standard materials:
- 304 SST or Carbon steel tube and flanges
- Ebanite lining
- 4 Hastelloy C electrodes

Painting: acrylic

Special materials & paintings: On request

Approvals: WRAS, FDA, MID (with MC406)

Installation: doesn't need straight sections before or after

SENSOR (MUT 1222) (INSERT)

Main characteristics

- Size
  - Small – DN50 – DN600
  - Medium – DN200 – DN1500
  - Large – DN450 - DN2600
- Body
  - AISI 304 Stainless Steel
- Pressure rating
  - 20 bar
- Material
  - Head of Sensor: POM
- Electrodes
  - AISI316L
- Liquid Temperature
  - -40°C / +80°C
- Protection Degree
  - IP68, 1.5m continous immersion (IEC 529)

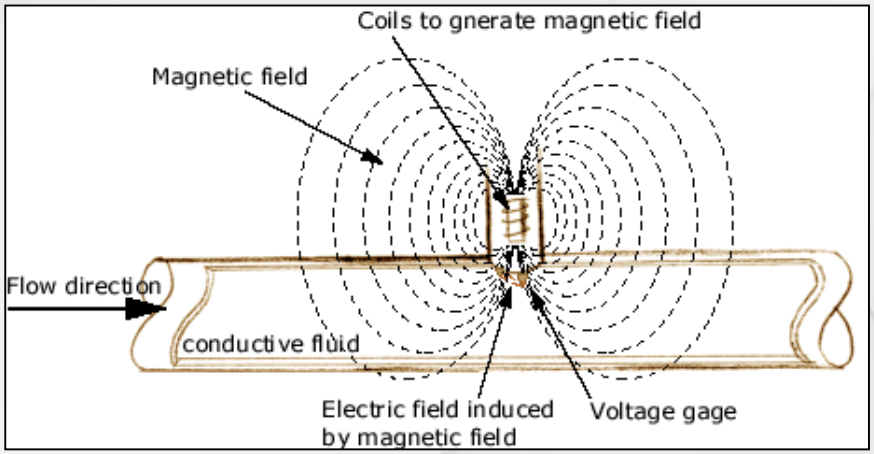
- Advantages
  - No moving parts
  - No pressure loss
  - Long lasting stability and precision
  - No filter needed, zero maintenance
  - Extremely sturdy structure
  - Internal parts protected by a bi-component resin in order to increase protection from external agents
  - Bi-directional measure

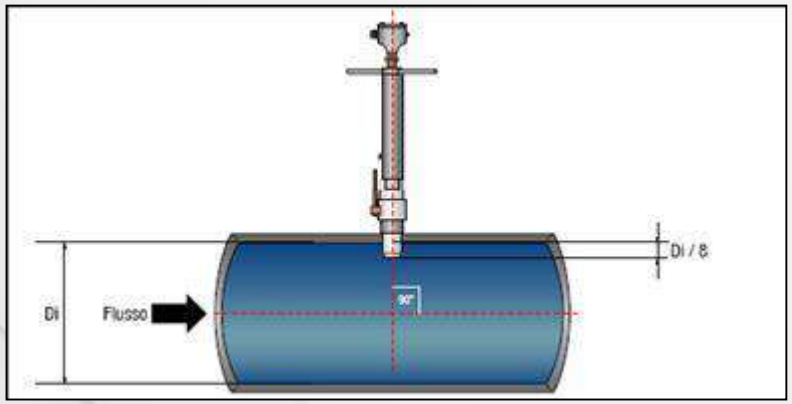
- Applications:
  - Water network management
  - Leakage control
  - District metering
  - Flow surveys
  - Flow profiling
  - Checking on-site flowmeters
  - Data capture reporting and analysis

INSERTION SENSOR

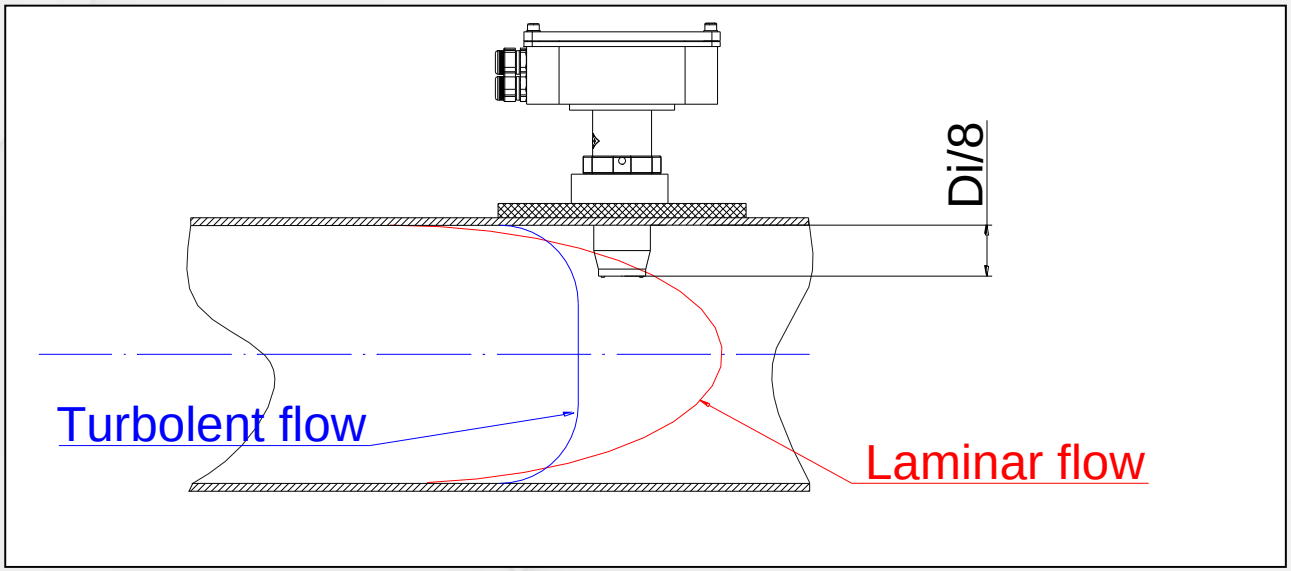
LOCAL MEASUREMENT !

- The measure is done in a segment of the pipeline.
- Basic assumption: the speed measured between the electrodes is the average speed.





Installation of an insertion sensor

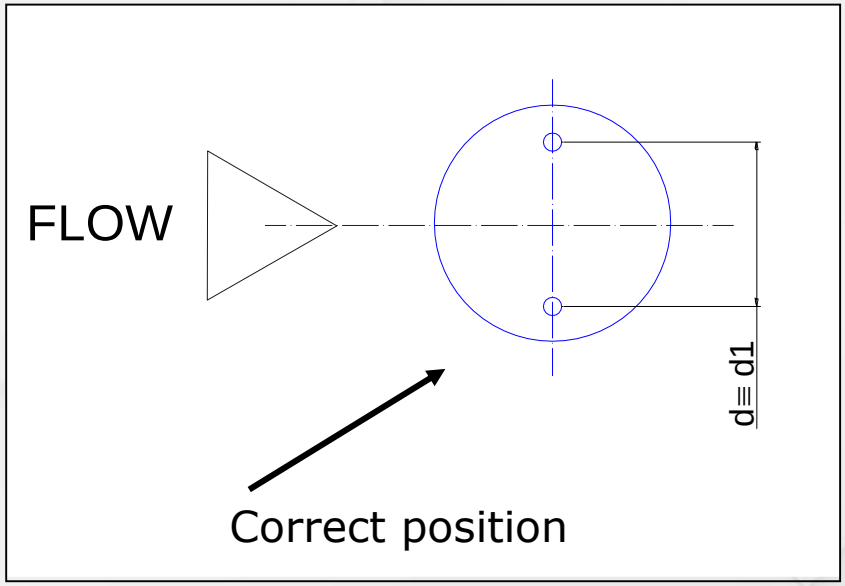


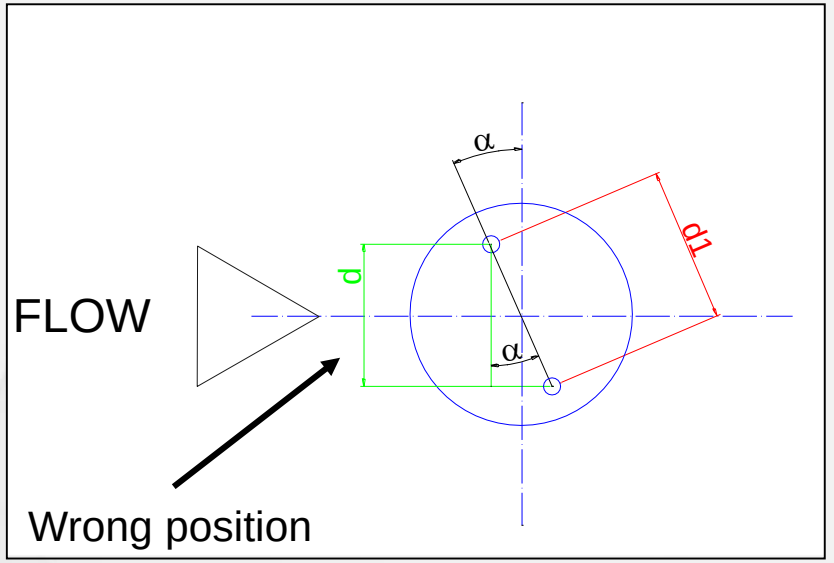
The head of the sensor (where the electrodes are placed) must be positioned at 1/8 Di (Di is the internal diameter of the pipe).

At 1/8 of the Di it is possible to measure the average speed with a reasonable accuracy.

Low velocity is the only limit.

The importance of positioning





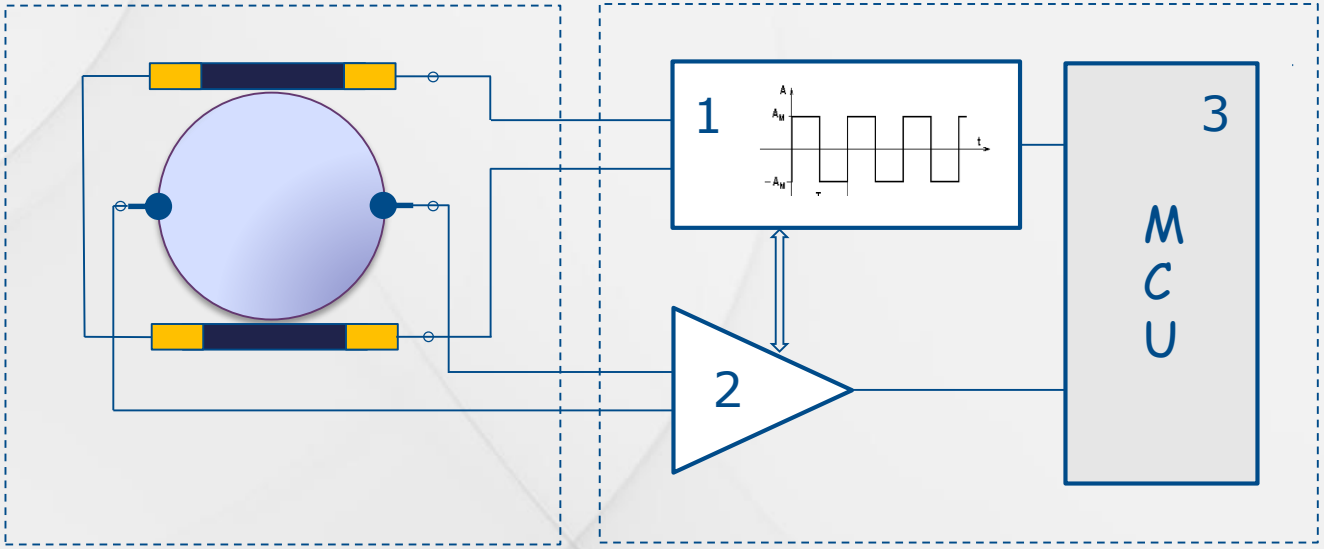
- ✓ insertion depth
- ✓ electrodes position compared to flowrate
- ✓ verticality pipe axis - sensor axis

CONVERTER INTRODUCTION

It is the mind of every electromagnetic flowmeter:

- gets the signal from electrodes
- supplies the magnetic field
- process, memorizes e shows data
- communicate with other instruments (which becomes part of a more complex system) through: 4-20mA, frequency, pulses, modbus (RS485)

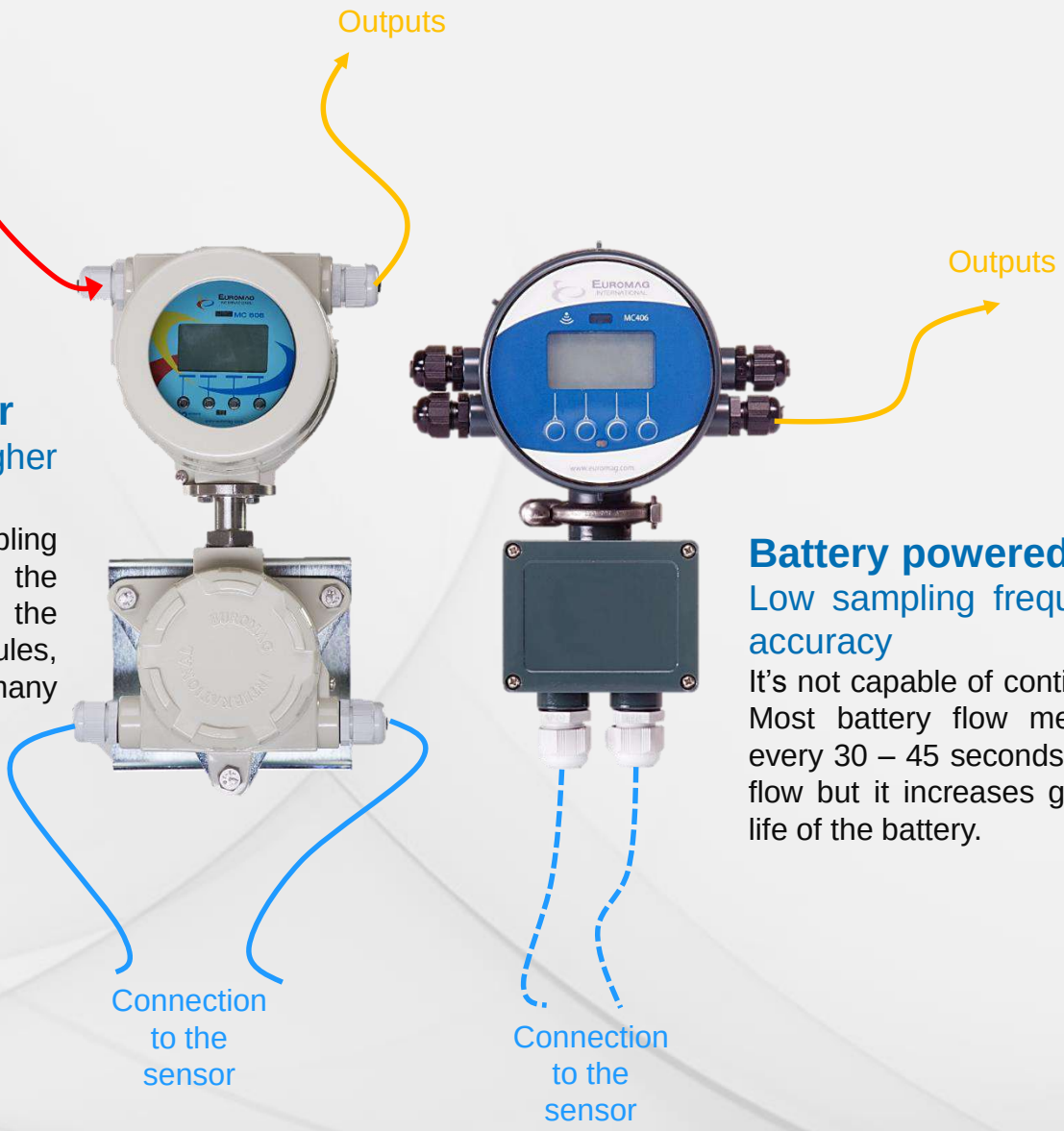
Block Diagram



The converter is made of three main blocks:

1. Coils supply block
2. Signal amplifier block
3. Signal processing block

Converter types and features. Secondary element



Mains powered converter

High sampling frequency = higher accuracy

It is capable of continuous sampling because it is connected to the electricity all the time. It allows the flowmeter to include add-on modules, external communications and many outputs.

Battery powered converter

Low sampling frequency = lower accuracy

It's not capable of continuous sampling. Most battery flow meter will sample every 30 – 45 seconds meaning loss of flow but it increases greatly the useful life of the battery.

MC608 A converter

MC608 A features

Power supply: Mains (electricity)

Versions: High Voltage (90-264 VAC) or Low

Voltage (12-24 VAC/DC)

Sensor sizes: up to DN2000 mm

Case: Aluminum

Class: IP68

Installation: Compact or Separate (up to 100 m)

Signals I/O:

- Analogue output 4-20 mA
- Pulse output
- Hart protocol (optional)
- Programmable output
- Active frequency digital output 0-10 kHz
- GSM/GRPS

Display: Graphic LCD

Options:

- Panel Version (MC608 P)
- Stainless steel case (MC608 I)

The Low Voltage version includes an internal electrical transformer to adjust a high voltage to the correct voltage.

Mains supply only

Different power sources though

The MC608 family is unique as it is a mains, battery and hybrid powered meter

Many outputs & communications

Analogue output, pulse output, Hart, GSM, etc.

MC608 B converter

MC608 B features

Power supply: Battery powered (6 years of useful life with factory settings)

Versions: 12/24 VAC or DC input

Sensor sizes: up to DN600 mm (full bore)

Case: Aluminum

Class: IP68

Installation: Compact or Separate (up to 30 m)

Signals I/O:

- Analogue output 4-20 mA
- Pulse output
- Programmable output (with 24 Vdc power supply)
- Active frequency digital output 0-10 kHz (with 24 Vdc power supply)

Display: Graphic LCD display

Low sampling frequency

The MC608 B versions reduces the sampling frequency to increase the life battery

MC608 R converter

MC608 R features

Power supply: Hybrid (Rechargeable battery and mains)

Versions: 12/24 VAC or DC input

Sensor sizes: up to DN600 mm (full bore)

Case: Aluminum

Class: IP68

Installation: Compact or Separate (up to 30 m)

Signals I/O:

- Analogue output 4-20 mA (Only in recharge mode)
- Pulse output
- Programmable output (Only in recharge mode)
- Active frequency digital output 0-10 kHz (Only in recharge mode)

Display: Graphic LCD display

Mains + battery back-up

To ensure continuous operation
Capabilities of being a powered with battery backup. It will automatically switch from power mode operation with continuous sampling to battery mode on loss of power and vice-versa

MC406 converter

Newest high-efficiency battery powered converter

MID-OIML R49 certified
Combined with MUT 2300 sensor the MC406 is capable of reading very low velocities (0.015 m/s)

Highest sample rate vs batter life on the market

MID approved

OIML approved

GSM ready

NOTE:

GSM on MC406 pending Certification.

COMING SOON!!!

MC406 features

Power supply: Lithium battery powered (10 years of useful life with factory settings)

Versions: 12/24 VAC or DC input

Sensor sizes: up to DN600 mm (full bore)

Case: Polycarbonate

Class: IP67 / IP68

Installation: Compact or Separate (up to 30 m)

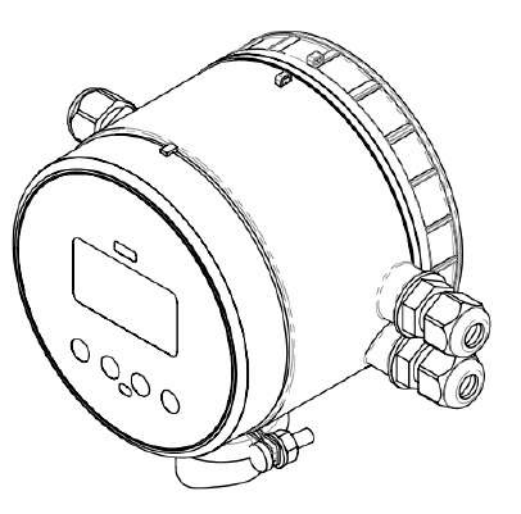
Signals I/O: 2 passive outputs (MOS)

Display: Graphic LCD display

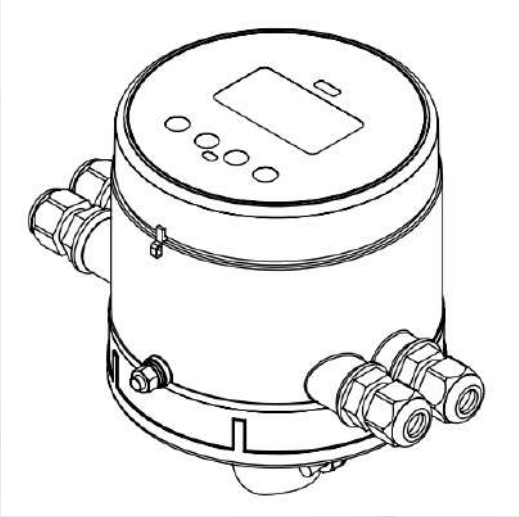
Flow velocity range: 0,015 m/s up to 10 m/s

INSTALLATION

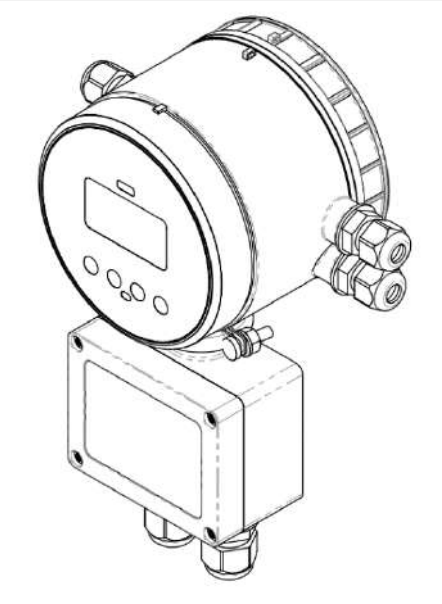
- Compact: horizontal or vertical (typically pit installations).
- Separate (Remote): up to 30 meters of cable are supplied from factory.



Horizontal

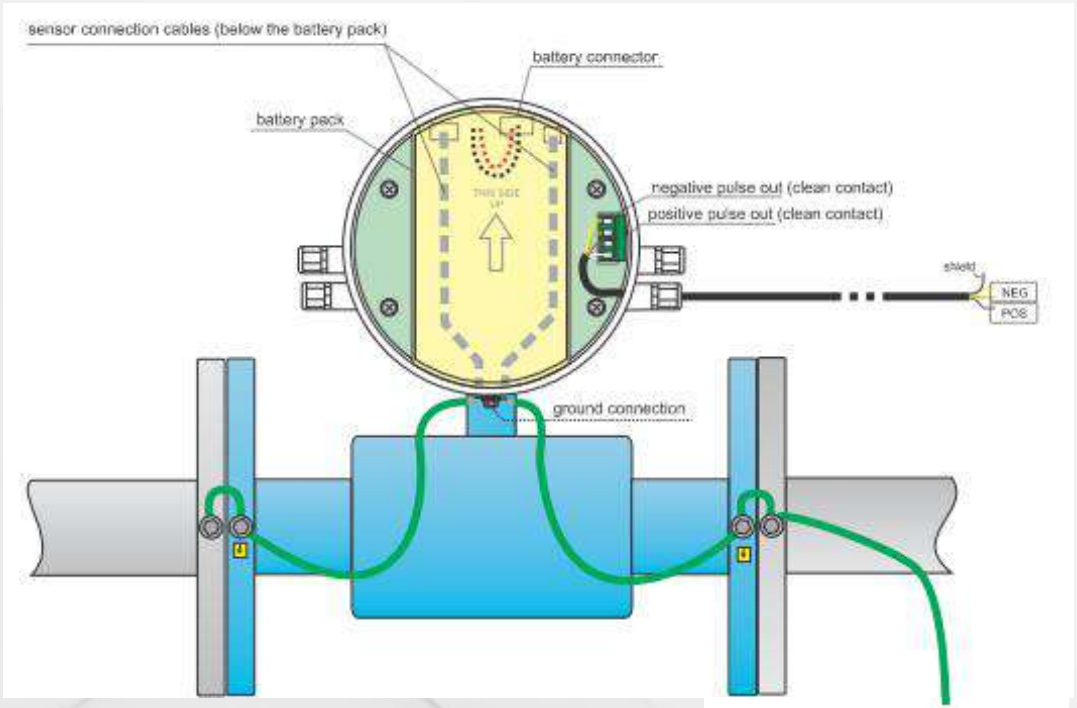


Vertical



Separate

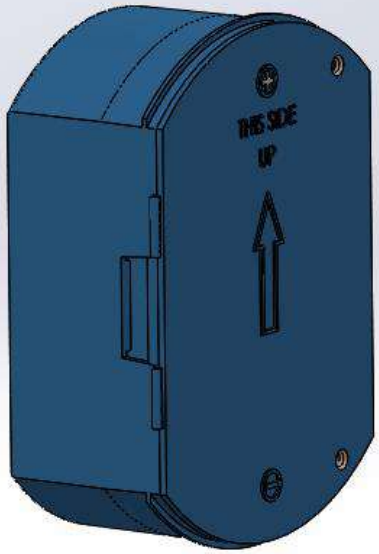
INSTALLATION



CONVERTER BATTERY

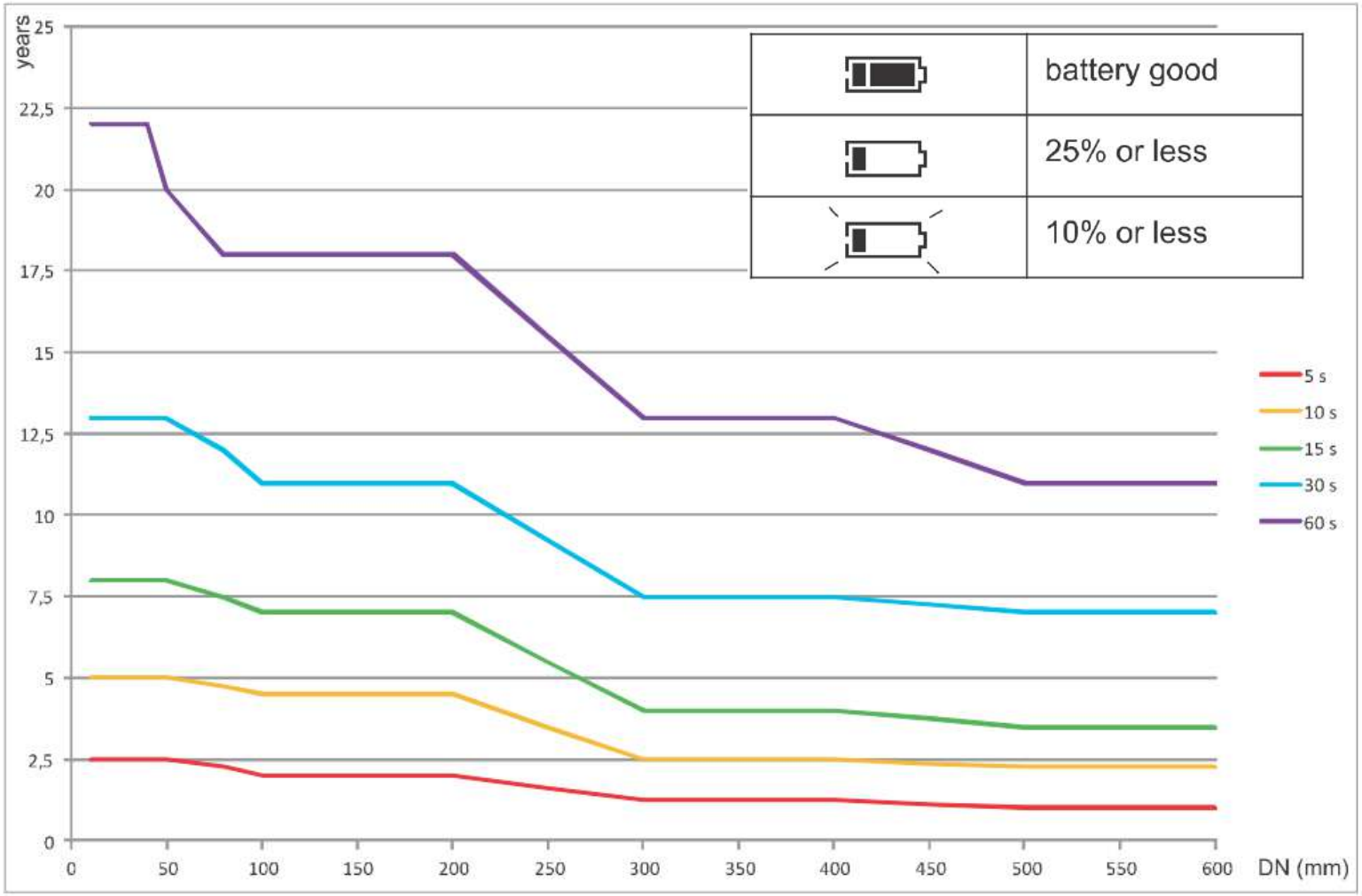
MC 406 BATTERY

2 x D size Litium
3.7V 38Ah



MC 406 BATTERY

Expected battery life (years) VS sensor diameter and sampling time



Battery version MC608B

- MC608B/R:

1. Independent functioning without external power source.
2. Can be used in remote systems where power is not available.
3. Suitable for slow process where the flow rate change slowly, waterworks, irrigation systems etc.

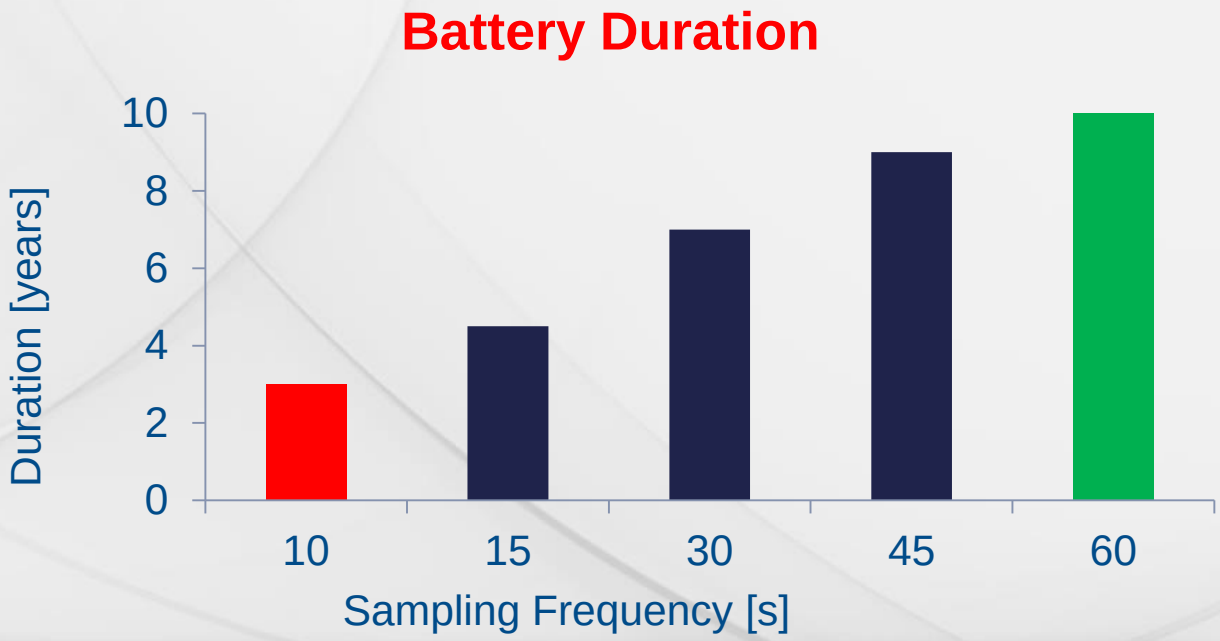
- Differences from MC608A version :

1. “Non continuous” sampling, at time intervals (minimum every 10sec).
2. Limited I/O functionality, pulse output only.
3. Limited complatibility with all sensors , max size DN600.
4. Works mainly in "sleep“ mode, needs a “wake up" to access data.

Battery version MC608B

- Battery life depends on:

1. Sampling frequency
2. Sensor size
3. Numbers of “wake up"
4. Ambient temperature



Rechargeable (Hybrid) version MC608R

➢ MC608R:

- Includes a rechargeable battery pack
- A solar panel of about 10 Watt

➢ Hybrid:

- With sun exposure the converter goes into "continuos“ sampling, like MC608A.
- Batteries will recharge.
- Without sun, or at night, it goes into “interval” sampling mode, like MC608B but up to 5 times faster (minimun interval = 2s)

➢ Battery life:

- About one month from last recharge (one month without sun!)
- Average battery life: 10 years.

Typical applications and some limitations

A must:

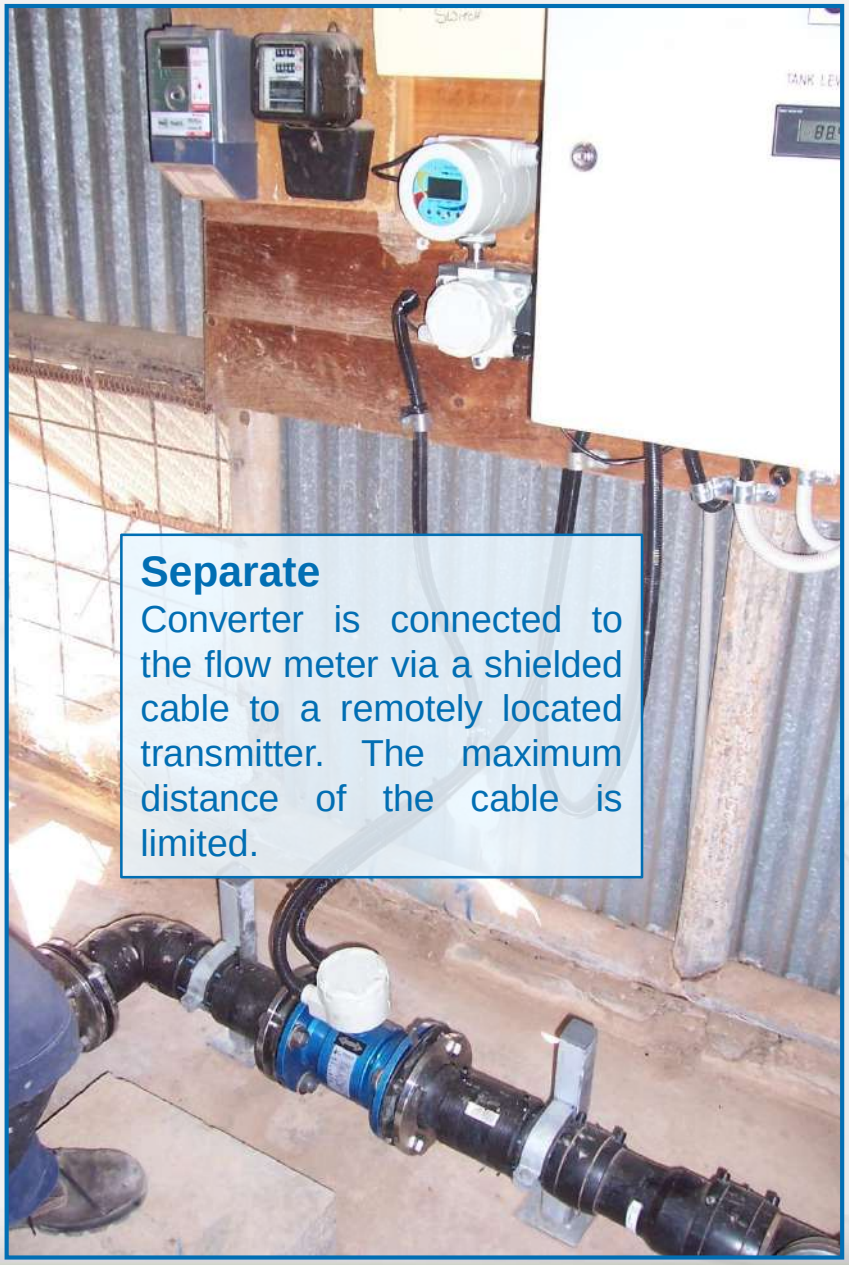
- **Liquid shall be conductive** (min. 5µS/cm) **or liquid slurry.**
- **Pipeline completely full and pressurized**

Typical applications:

Waterworks, Irrigation, Sewage, Mining and Industry

Some limitations: Not conductive liquids: oils, hydrocarbons, fats, demineralized water, etc.

Sensor & Converter. Two different configurations

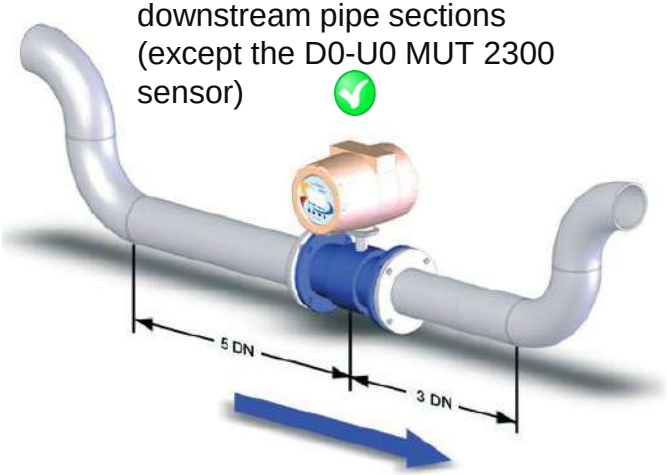


Separate
Converter is connected to the flow meter via a shielded cable to a remotely located transmitter. The maximum distance of the cable is limited.

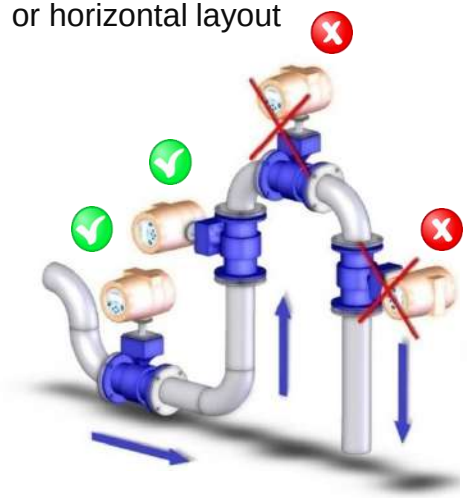
Compact
Converter mounted directly on the electromagnetic flow meter.

INSTALLATION Some recommendations

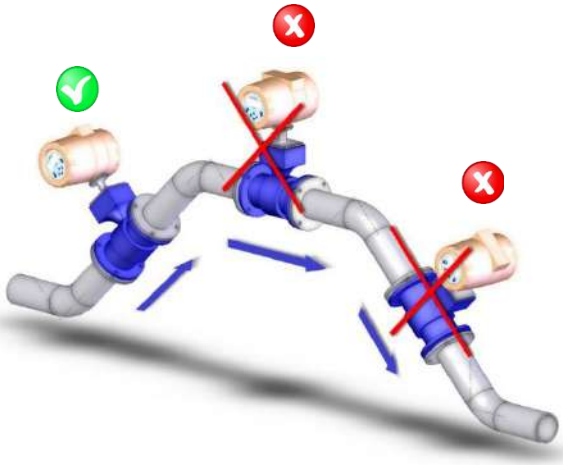
Normally, flowmeter needs straight upstream and downstream pipe sections (except the D0-U0 MUT 2300 sensor)

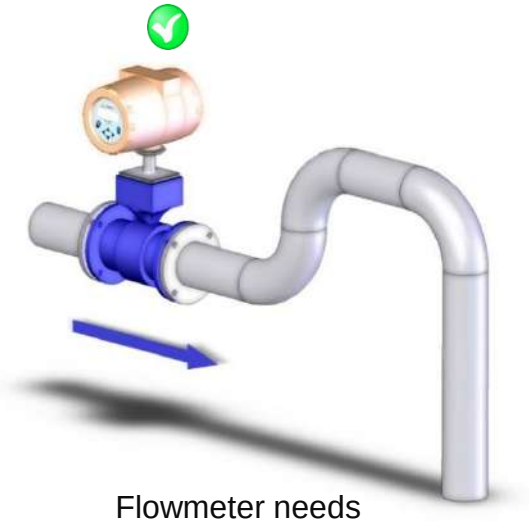


Magmeter have same accuracy in either vertical or horizontal layout



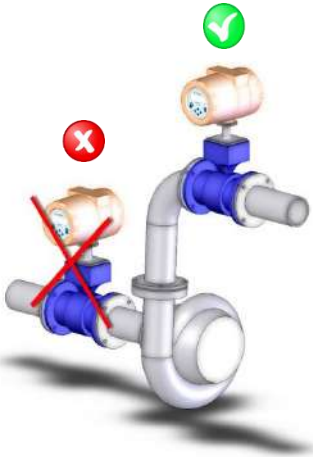
Flowmeter needs to be full all the time



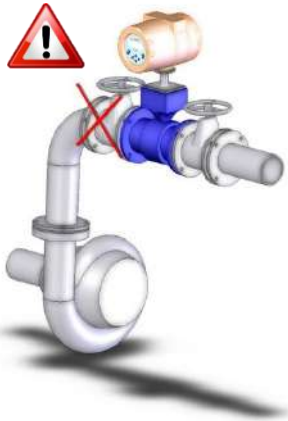


Flowmeter needs to be full all the time

Must avoid this layout because magmeter could be depressurized

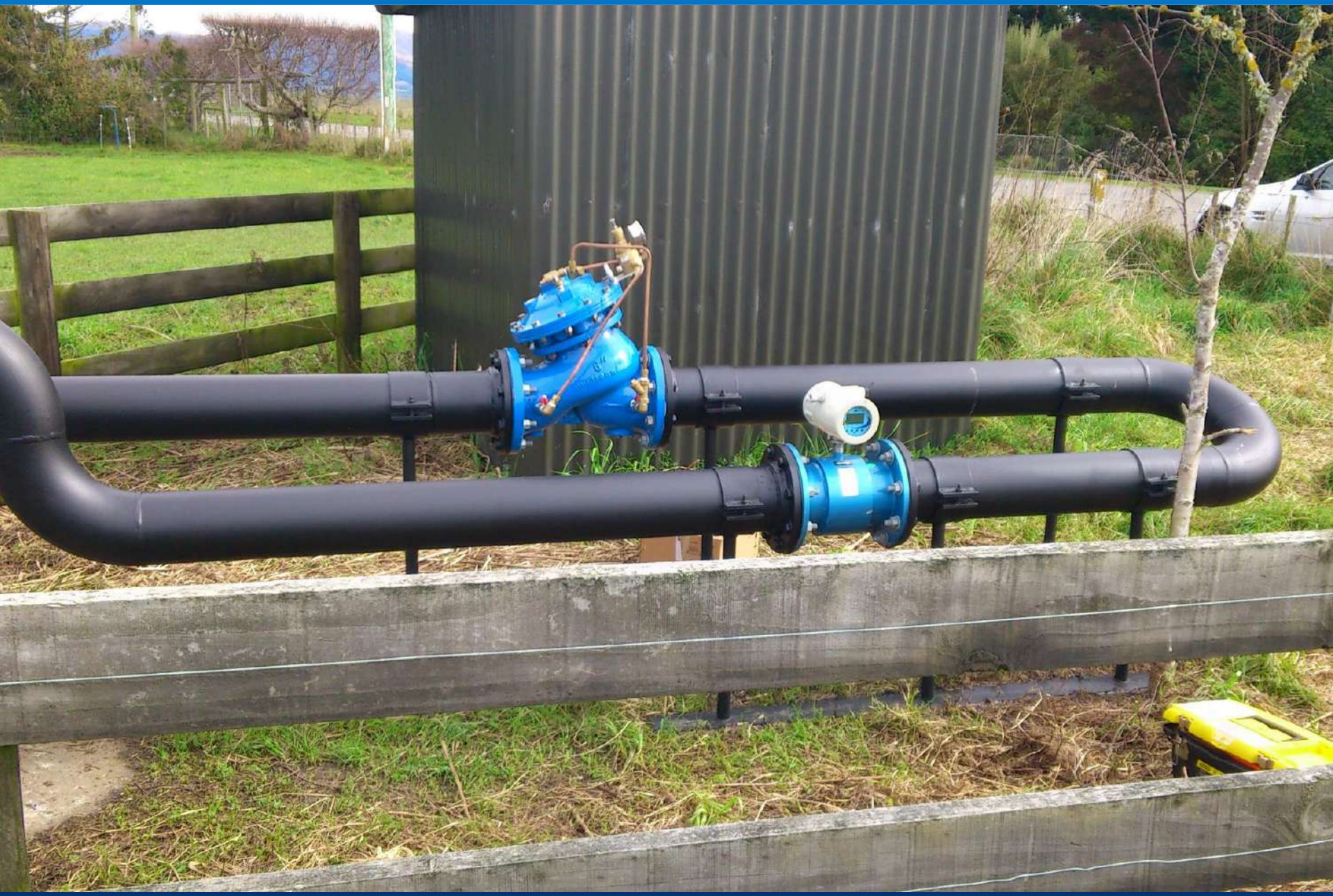


Better downstream side of the pumps



Must respect the straight sections

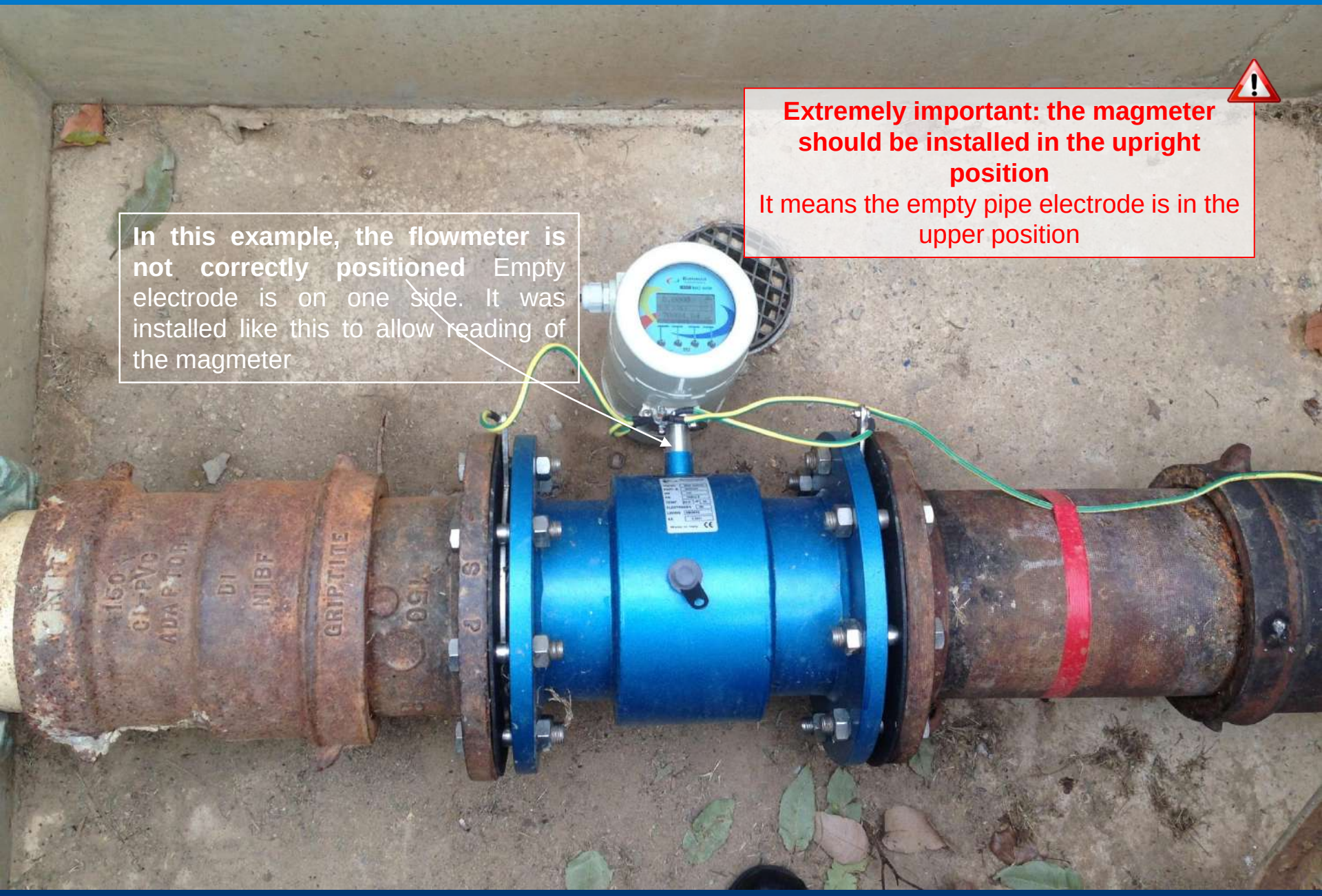
INSTALLATION Some good examples



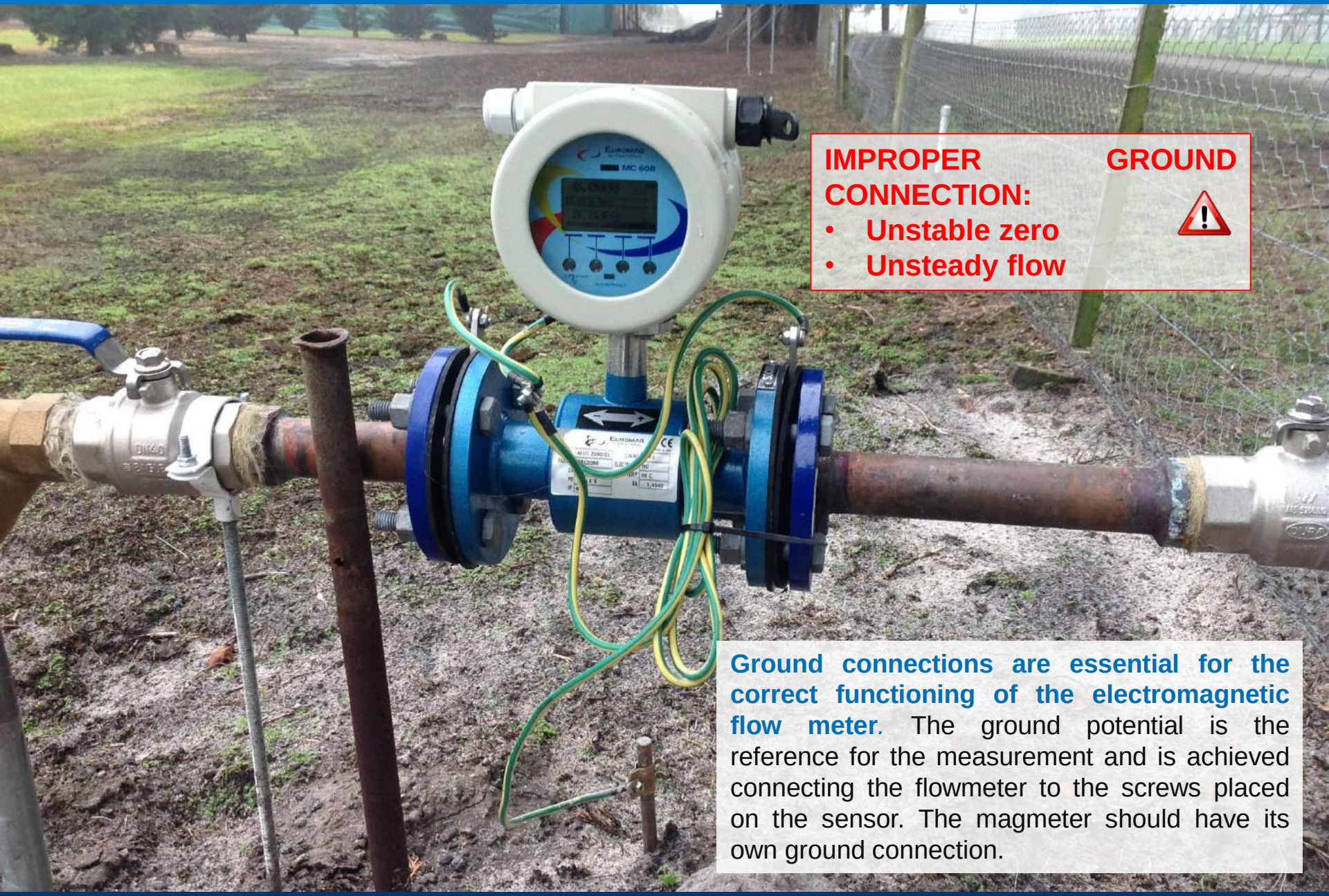
INSTALLATION Some good examples

INSTALLATION Some good examples

INSTALLATION Some bad examples



GROUNDING The sensor must be grounded



IMPROPER GROUND CONNECTION:

- **Unstable zero**
- **Unsteady flow**

Ground connections are essential for the correct functioning of the electromagnetic flow meter. The ground potential is the reference for the measurement and is achieved connecting the flowmeter to the screws placed on the sensor. The magmeter should have its own ground connection.

GROUND CONNECTIONS

QUESTION

✓Steady flow
✓Full pipe
✓The flowmeter shows a variable flowrate

WHY?

This is the typical effect of an
incorrect ground connection

The ground potential is the reference parameter for the measurement;

If not defined – no connection

If unstable – bad ground position

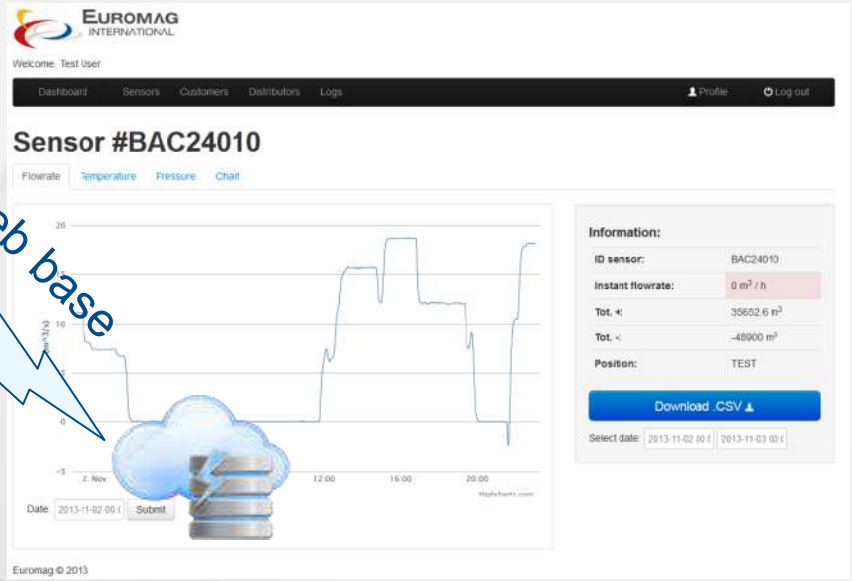
It is not possible to identify the condition of a no-flow, what we usually call
ZERO

GSM / GPRS INTEGRATED SYSTEM

REMOTE DATA MONITORING & STORE

sms

web base

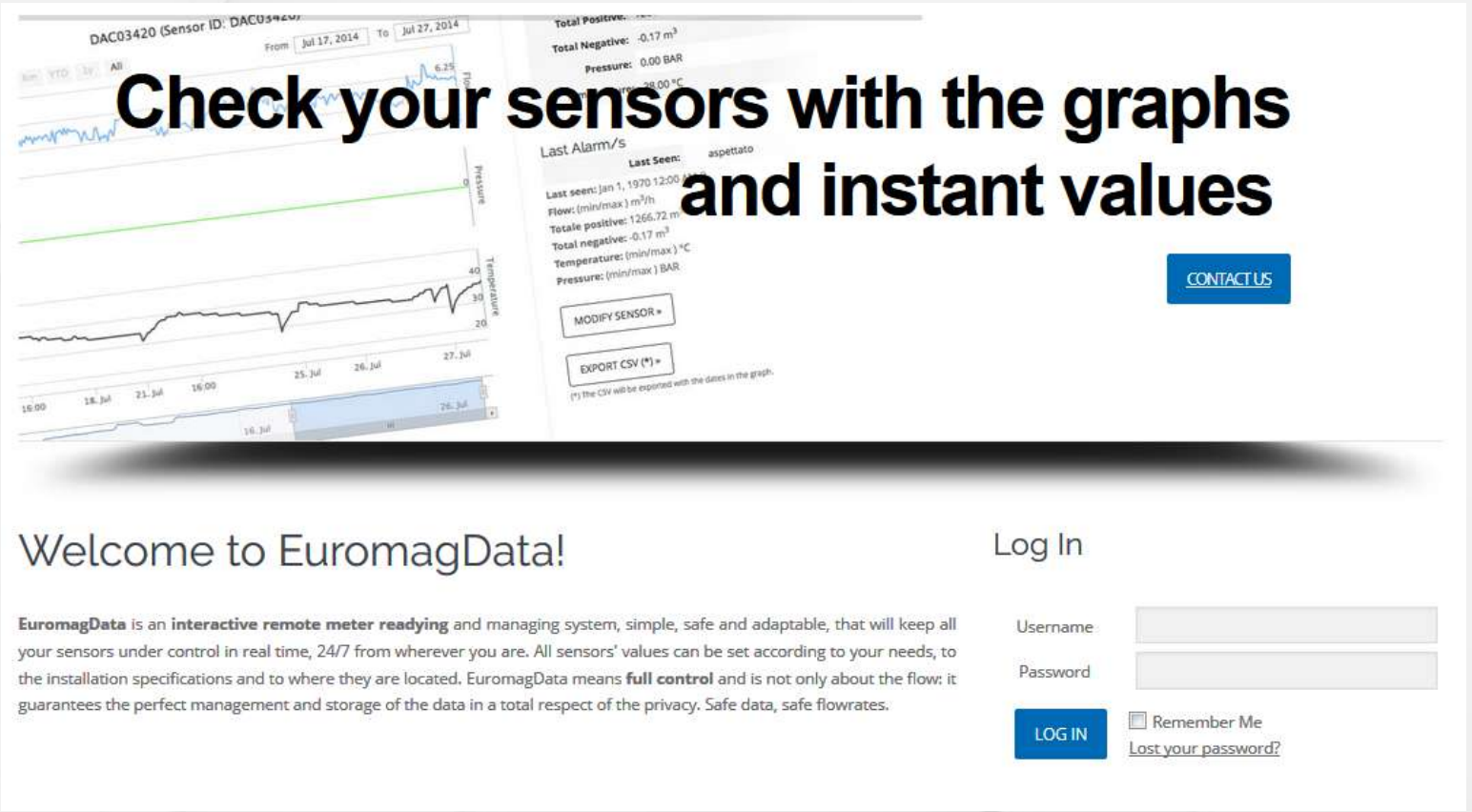


e-mail

GSM / GPRS INTEGRATED SYSTEM

WEB BASE MONITORING

http://www.euromagdata.com/



GSM / GPRS INTEGRATED SYSTEM

SENSOR LIST

Sensors

Search sensor: Type and hit enter...

Name	Sensor ID	Last seen (interval)	Flow (min/max) m^3/h	Pressure (min/max) BAR	Temperature (min/max) °C	Operations
BAC01111	BAC01111	(disabled)	0 (disabled)	0 (disabled)	0 (disabled)	EDIT SHOW
BAC12345	BAC12345	(disabled)	0 (disabled)	0 (disabled)	0 (disabled)	EDIT SHOW
BAC20000	BAC20000	(disabled)	0 (disabled)	0 (disabled)	0 (disabled)	EDIT SHOW
BAC20860	BAC20860	(disabled)	0 (disabled)	0 (disabled)	0 (disabled)	EDIT SHOW

GSM / GPRS INTEGRATED SYSTEM

FLOWRATE

(Sensor ID: IBG03280)

Sensor graph | Sensor data

Last data

Date:	Monday Jan 22, 2018 05:25 AM
Flow:	0.00 m^3/h
Total Positive:	8375.52 m^3
Total Negative:	-0.00 m^3
Pressure:	0.00 BAR
Temperature:	0.00 °C

Alarm(s) in last upload

(96 rows on Jan 22, 2018 03:10 AM)

EDIT SENSOR

EXPORT CSV (*)

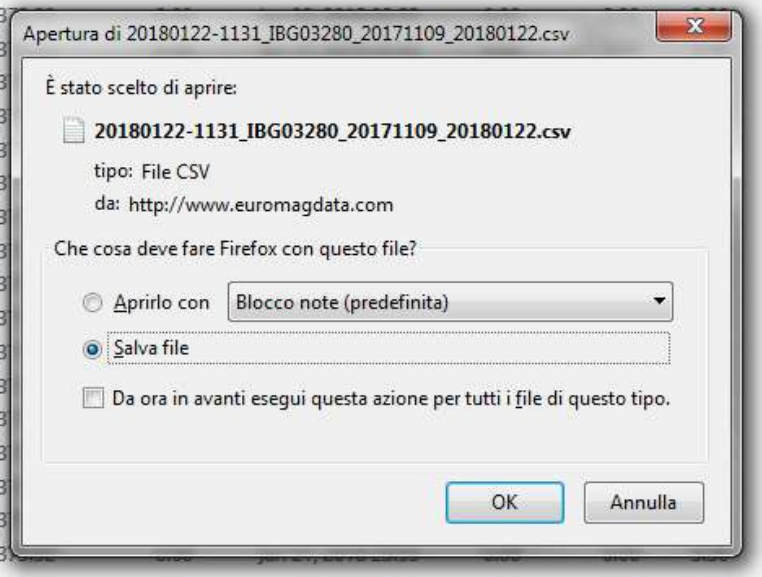
(*) The CSV will be exported with the dates in the graph.

DOWNLOAD .CSV DATA

(Sensor ID: IBG03280)

Sensor graph | Sensor data

Log ID	Flow (m^3/h)	Total positive (m^3)	Total negative (m^3)	Date time	Temperature (° C)	Pressure (BAR)	Voltage (V)	Error code
14662706	0.00	8375.52	-0.00	Jan 22, 2018 05:25	0.00	0.00	3.30	0
14662705	0.00	8375.52	-0.00	Jan 22, 2018 05:10	0.00	0.00	3.30	0
14662704	0.00	8375.52	-0.00	Jan 22, 2018 04:55	0.00	0.00	3.30	0
14662703	0.00	8375.52	-0.00	Jan 22, 2018 04:40	0.00	0.00	3.30	0
14662702	0.00	8375.52	-0.00	Jan 22, 2018 04:25	0.00	0.00	3.30	0
14662701	0.00	8375.52	-0.00	Jan 22, 2018 04:10	0.00	0.00	3.30	0
14662700	0.00	83						0
14662699	0.00	83						0
14662698	0.00	83						0
14662697	0.00	83						0
14662696	0.00	83						0
14662695	0.00	83						0
14662694	0.00	83						0
14662693	0.00	83						0
14662692	0.00	83						0
14662691	0.00	83						0
14662690	0.00	83						0
14662689	0.00	83						0
14662688	0.00	83						0
14662687	0.00	83						0
14662686	0.00	83						0
14662685	0.00	83						0
14662684	0.00	83						0



Last data

Date:	Monday Jan 22, 2018 05:25 AM
Flow:	0.00 m^3/h
Total Positive:	8375.52 m^3
Total Negative:	-0.00 m^3
Pressure:	0.00 BAR
Temperature:	0.00 °C

Alarm(s) in last upload

(96 rows on Jan 22, 2018 03:10 AM)

EDIT SENSOR

EXPORT CSV (*)

(*) The CSV will be exported with the dates in the graph.

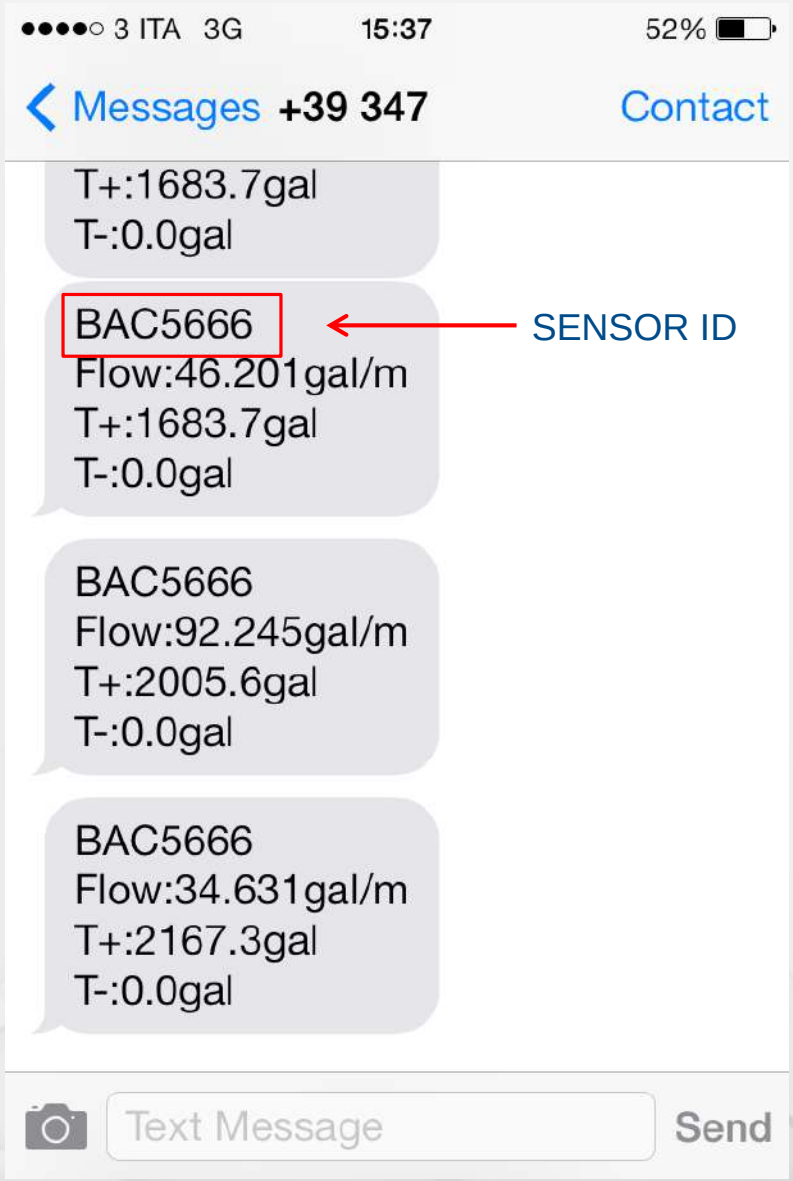
GSM / GPRS INTEGRATED SYSTEM

DOWNLOAD .CSV DATA

	C	D	E	F	G	H	I	J	K	L
1	probe_id	flow	total_positive	total_negative	date_time	temperature	voltage	error_code	exp1	exp
2	BAC24010	726.903	35219.1	-48900	04/11/2013 00:00	40	3.6	0	0	7.0
3	BAC24010	688.564	35219.2	-48900	04/11/2013 00:01	40	3.6	0	0	7.0
4	BAC24010	688.564	35219.3	-48900	04/11/2013 00:02	40	3.6	0	0	7.0
5	BAC24010	64.793	35219.4	-48900	04/11/2013 00:03	40	3.6	0	0	7.0
6	BAC24010	64.793	35219.5	-48900	04/11/2013 00:04	40	3.6	0	0	7.0
7	BAC24010	620.874	35219.6	-48900	04/11/2013 00:05	40	3.6	0	0	7.0
8	BAC24010	620.874	35219.7	-48900	04/11/2013 00:06	40	3.6	0	0	7.0
9	BAC24010	611.568	35219.8	-48900	04/11/2013 00:07	40	3.6	0	0	7.0
10	BAC24010	611.568	35219.9	-48900	04/11/2013 00:08	40	3.6	0	0	7.0
11	BAC24010	624.042	35220	-48900	04/11/2013 00:09	40	3.6	0	0	7.0
12	BAC24010	624.042	35220.1	-48900	04/11/2013 00:10	40	3.6	0	0	7.0
13	BAC24010	638.868	35220.3	-48900	04/11/2013 00:11	40	3.6	0	0	7.0
14	BAC24010	638.868	35220.4	-48900	04/11/2013 00:12	40	3.6	0	0	7.0
15	BAC24010	641.507	35220.5	-48900	04/11/2013 00:13	40	3.6	0	0	7.0
16	BAC24010	641.507	35220.6	-48900	04/11/2013 00:14	40	3.6	0	0	7.0
17	BAC24010	646.721	35220.7	-48900	04/11/2013 00:15	40	3.6	0	0	7.0
18	BAC24010	646.721	35220.8	-48900	04/11/2013 00:16	40	3.6	0	0	7.0
19	BAC24010	660.661	35220.9	-48900	04/11/2013 00:17	40	3.6	0	0	7.0
20	BAC24010	660.661	35221	-48900	04/11/2013 00:18	40	3.6	0	0	7.0
21	BAC24010	671.315	35221.1	-48900	04/11/2013 00:19	40	3.6	0	0	7.0
22	BAC24010	671.315	35221.2	-48900	04/11/2013 00:20	40	3.6	0	0	7.0
23	BAC24010	690.174	35221.3	-48900	04/11/2013 00:21	40	3.6	0	0	7.0
24	BAC24010	690.174	35221.5	-48900	04/11/2013 00:22	40	3.6	0	0	7.0
25	BAC24010	76.283	35221.6	-48900	04/11/2013 00:23	40	3.6	0	0	7.0

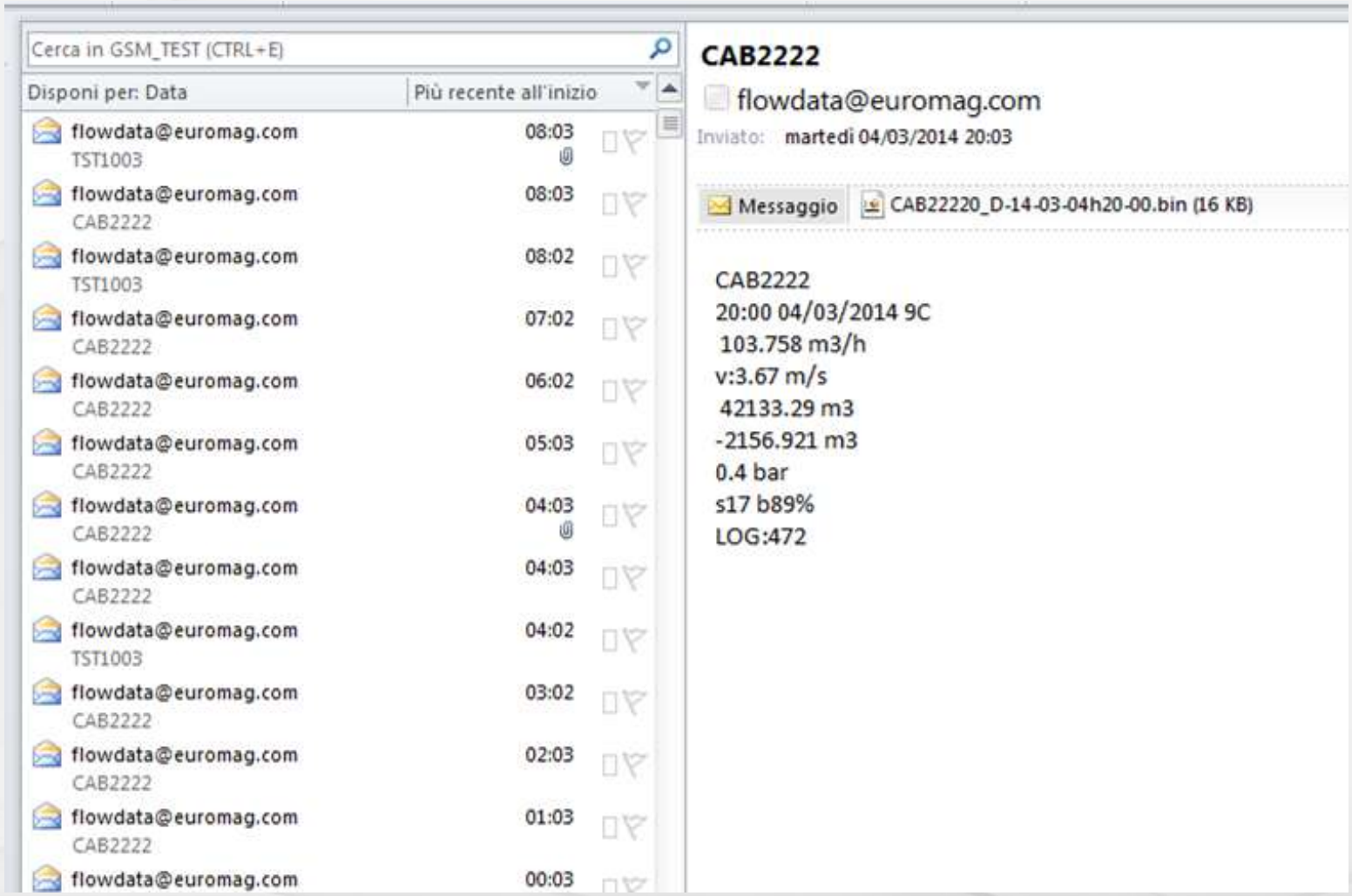
GSM / GPRS INTEGRATED SYSTEM

SMS DATA



GSM / GPRS INTEGRATED SYSTEM

E-MAIL DATA



MODEM SPECIFICATION
HE910 D

Product	Operating Bands 3G [2]	Frequency Bands [MHz]	Throughput DL/UL [Mbps]	Voice	GPS
HE910-D	B5, B8, B2, B1, B4	800/850, 900, AWS1700, 1900, 2100	21/5.7	N	N

HE910 D is a quad-band GSM/GPRS/EDGE.
REGIONS: **WORLD-WIDE**

- **Europe, Australia, New Zealand, Brazil, North America…**

FIELD VERIFICATOR

Potable unit used as a diagnostics and condition-monitoring tool, both for sensors and converters.

It can check on-site meter's performance without stopping the flow.

Features

- Simulates the electromagnetic sensor and captures the converter's measure through RS485 interface
- Measures the converter's excitation current
- Stores the converter's settings on netbook as a reference for future tests or alignment of the converter
- Transfers calibration factor between converters allowing minimum error
- Performs a functional test on converter's I/O
- Calibrates the 4-20 mA output
- Verifies sensor's integrity through a dedicated motherboard

FIELD VERIFICATOR

Requirements

• Operation with high voltage 110-240Vac and rechargeable built in battery Ni-Mh (dedicated circuit)

• Data saving and storage through dedicated hub

• Crushproof, watertight, shockproof case

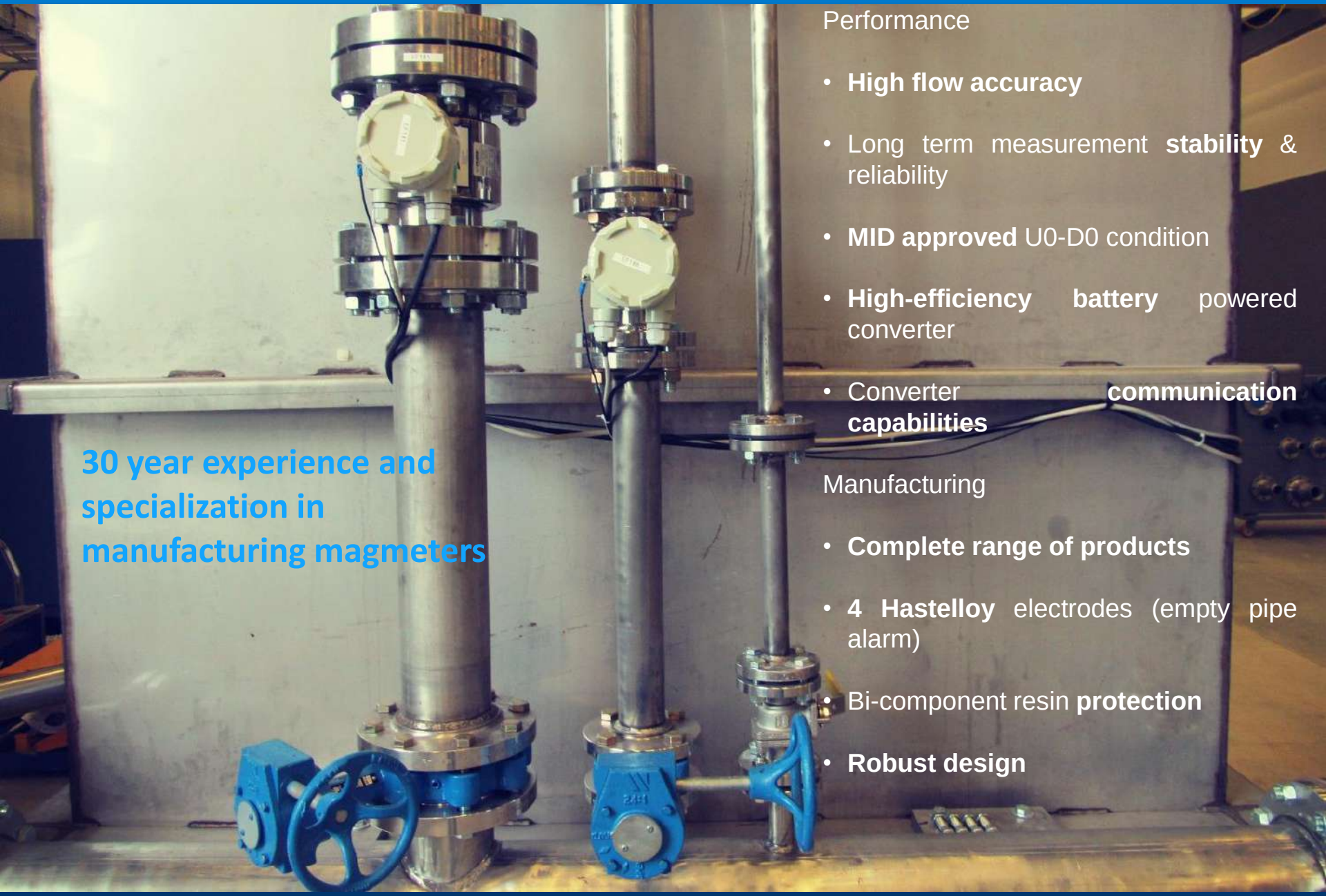
Main qualities

• Check on-site of meter's performance without the need to stop the flow

• Totally automated

• No extra cost for installation and removal of the Flowmeter

Euromag key selling points



30 year experience and specialization in manufacturing magmeters

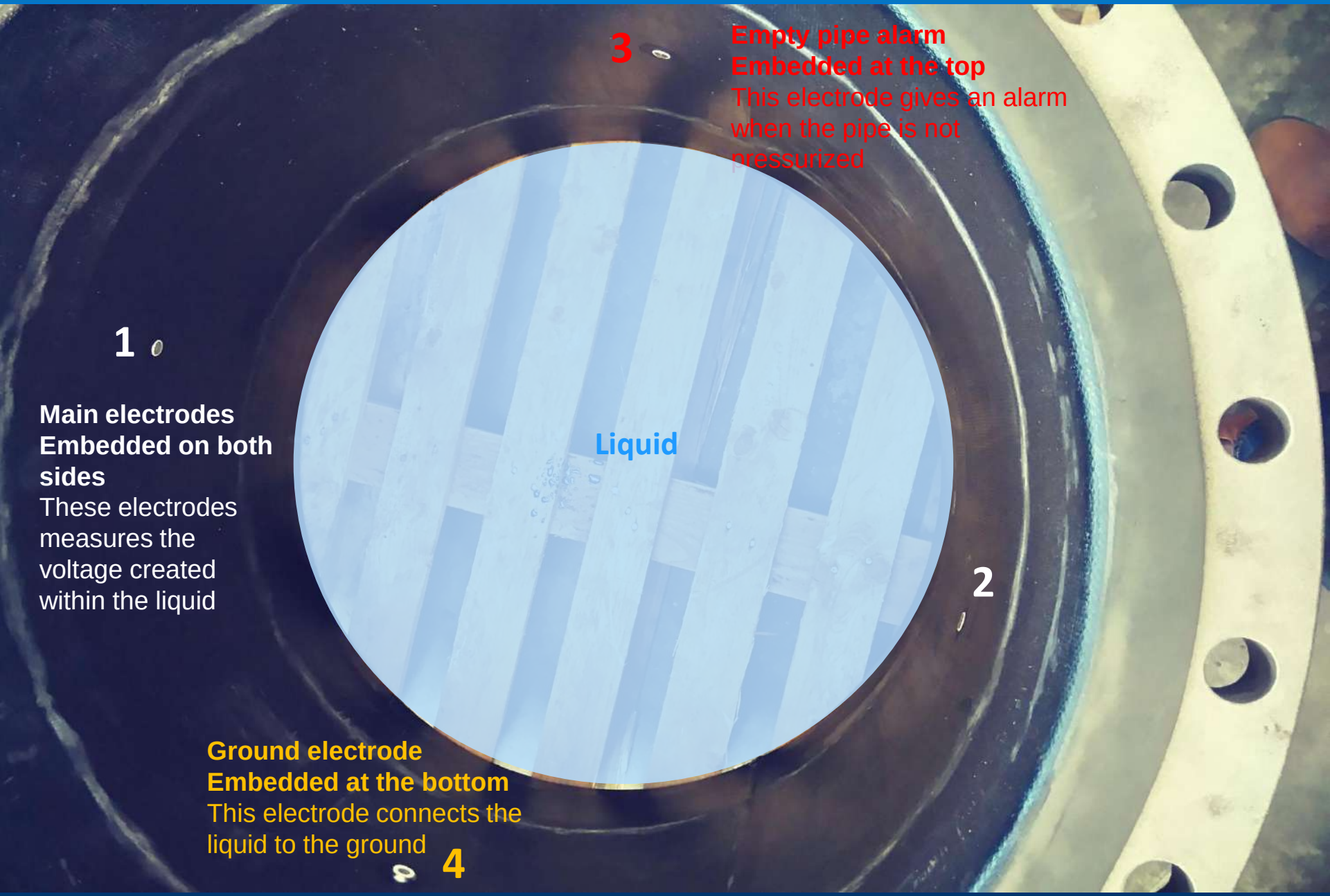
Performance

- **High flow accuracy**
- Long term measurement **stability** & reliability
- **MID approved** U0-D0 condition
- **High-efficiency battery** powered converter
- Converter **communication capabilities**

Manufacturing

- **Complete range of products**
- **4 Hastelloy** electrodes (empty pipe alarm)
- Bi-component resin **protection**
- **Robust design**

4 Hastelloy electrodes (empty pipe alarm)



Bi-component resin protection

The housing and connection box is filled up with a bi-component resin

It guaranties the isolation of all electrical connections and doesn't allow them to move internally

THANK YOU