

# BERMAD Meters

Electromagnetic flowmeters



## MC406 CONVERTER

User and  
maintenance manual



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## 1 INTRODUCTION



**IMPORTANT WARNING!** It is very important that all the staff operating the equipment have read the included the instructions and indications provided in this manual and that follows them before using the equipment itself the manufacturer does not assume any liability for the consequences arising from improper use by the operator.

The operator is responsible for the suitability of the device for the specific purpose. Inadequate installation and use of the devices (systems) voids the warranty.

- The manufacturer will not be liable for any kind of damage resulting from the use of its products, including, but not limited to those deemed direct, indirect, incidental, punitive and consequential. The installation, connection, commissioning and maintenance must be performed by staff specifically qualified and authorized for that purpose.
- The installation personnel must ensure that the measuring system is correctly connected in accordance with the wiring diagram.

For applications that require high working pressures or substances that may be hazardous to the people, the environment, equipment or anything else if a pipe breakage occurs, BERMAD recommends, that before installing the sensor the operator takes the appropriate precautions such as precautions such as the correct location, protection or the mounting of a guard or safety valve. The device contains live electrical components, thus the installation, monitoring and maintenance must be carried out by qualified and experienced staff fully aware of all the necessary precautions. Before opening any inner part, please disconnect the power supply. The flow meter consists of metal and plastic parts, all of which must be in compliance with local rules and requirements concerning waste disposal.

### 1.1 MANUFACTURER'S NOTICE

- While designing the device stresses and loads possibly caused by earthquakes, traffic, strong winds and fire damage were not taken into account.
- Do not install the device so that it acts as a focus for pipeline stresses. In the configuration of the device please take into account any external loads.
- During operation do not exceed the pressure and/or temperature ratings indicated on the nameplate or in this Operating Manual.

### 1.2 PACKAGING CHECK

At the time of purchase and / or receipt of the product, the buyer is strongly invited to check the quality of the packaging which must be intact, free of obvious signs of dents and completely and correctly closed.

When opening the packaging, also check that the product in regards of quality and verify all components / accessories as reported in the package.

### 1.3 PRELIMINARY NOTES

The main parts that make up the electromagnetic flow meter are:

- The sensor - is installed in the pipes with the help of flanges or threaded connections.
- The converter - can be installed on the sensor (in the compact version) or in its vicinity (in the remote version) connected by two cables.


Electromagnetic flow meters have many important advantages over their mechanical counterparts, which include among others: exceptional long-term stability, maximum process reliability, zero maintenance. As a result, these sensors can provide accurate and reliable measurements for many years.

See the following paragraphs for more detailed indications on correct use and installation.

### 1.4 PRODUCT IDENTIFICATION

An adhesive identification plate is attached to each MC406 Converter produced by BERMAD on which the following are reported.

- Model: sensor and converter model
- CE conformity mark
- S/N: serial number that identifies the converter and the sensor
- Y: year of construction
- Size: nominal diameter, standard and nominal pressure flanges
- Q3: nominal flow rate and ratio R (Qnom / Qmin)
- Power Supply: supply voltage and / or battery
- MAP: instrument nominal pressure
- Press. loss class: max pressure drop class in the sensor
- Env. class: environmental class
- EMC class: Electromagnetic Compatibility class
- T: totalizer that cannot be reset P: resettable partial totalizer

		Via Della Tecnica 20 35035 Mestrino (PD) - Italy Made in Italy	
<b>MUT 2200/EL/MC406M</b>		<b>CE M19 0122 T10713</b>	
<b>S/N</b>	LAC1073 LMM1140	<b>MAP</b>	16 bar
<b>Y</b>	2019	<b>Press. loss. class</b>	Δp10
<b>Size</b>	DN65 EN1092-1 PN16	<b>Env. Class</b>	M1,0
<b>Q3</b>	63 m <sup>3</sup> /h R160	<b>EMC class</b>	E1
<b>Power Supply</b>	12-24Vdc Rep. Battery 02/2024	<b>T: non resettable P: partial (resettable)</b>	

**THE IDENTIFICATION PLATE MUST NOT BE REMOVED, DAMAGED OR IMPAIRED. IT MUST ALSO BE KEPT CLEAN FROM DIRT AND MISCELLANEOUS ADHESIONS AS THE DATA CONTAINED IN IT REPRESENTS THE ONLY SAFE AND UNIQUE WAY TO RECOGNIZE THE TYPE OF CONVERTER IN YOUR POSSESSION WHICH IS INFORMATION NEEDED TO FILL IN THE REPAIR REQUEST FORM ATTACHED IN THIS MANUAL.**

## 2 PRODUCT DESCRIPTION

### 2.1 GENERAL DESCRIPTION

MC406 is an electronic converter that, paired with an BERMAD electromagnetic sensor, is able to offer high precision and stability in compact dimensions. The measured flow rate is displayed on the LCD screen together with one of the 4 totalizers available; other information and some basic settings are directly accessible using the 4-button interface.

The two independent positive and negative pulse outputs allow connection with any external meter (max 30 V ac or dc / 100 mA). The required power supply is between 12 and 24 V DC and a battery pack can be connected to attain uninterrupted service even in the event of a power failure. A GSM module can also be installed to allow remote transmission of measurements \*

### 2.2 COUPLING

The maximum diameter of the sensor that can be used with this converter is 1000 mm; backup battery life is affected by the size of the sensor.

The flow meter can be ordered both in a compact and separate version, with a maximum length of 30m cable.

### 2.3 MEASUREMENT CHARACTERISTICS

Flow speed range: from 0.015 m/s to 10 m/s

Liquid conductivity > = 20uS / cm

Sampling: 3.125Hz nominal powered unit (depends on the diameter); battery mode (low power): from 1/5Hz at 1/60Hz (default 1/15Hz)

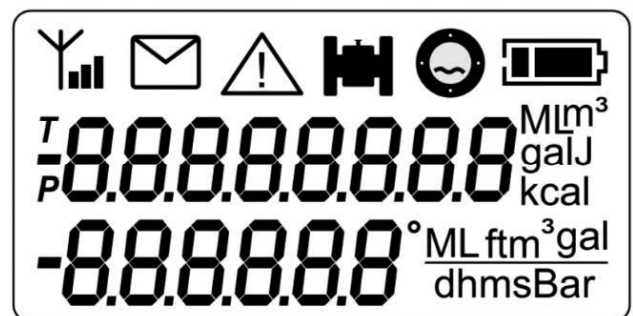
### 2.4 DATA STORAGE

All parameters, totalizers and the register are stored in a non-volatile memory.

### 2.5 DISPLAY

The LCD can display an 8 and a 6-digit number plus different information icons, allowing the user to view different information and set many parameters. The details of what can be shown:

- Instant flow
- Positive totalizer (T+)
- Negative totalizer (T-)
- Partial Positive (P+)
- Partial negative (N-)
- Date and time
- Converter temperature
- Code and value of the corresponding parameter



\* the data transmitted remotely are not considered legally relevant and have the sole purpose of providing one remote viewing. The integrity and correctness of the data transmitted are not covered by the MID certification.

## 2.6 DATA SAFETY

Lithium batteries are primary energy sources with high energy content, and are designed to satisfy the highest possible safety standards. However, they can pose a potential hazard if are subject to bad electrical or mechanical use. In many cases, this is associated with a production of excessive heat, in which the increased internal pressure could cause the cell to break. The following precautions should therefore be observed when handling and using lithium batteries fundamental:

- Do not short circuit, charge, overcharge or connect to incorrect polarity
- Do not expose the battery to temperatures higher than those specified or incinerate it
- Do not crush, puncture or open cells or disassemble battery packs
- Do not solder or braze on the battery body or battery packs
- Do not expose the contents to water

Lithium batteries are regulated under the United Nations Model Regulations on Transport of Dangerous goods (United Nations model rules on the transport of dangerous goods), UN ST/SGAC document. 10-1, 12th edition updated, 2001. The UN document n. 3091 class 9 covers lithium batteries packed with equipment or within it. The UN document no. 3090 class 9 covers the transport of stand-alone batteries.

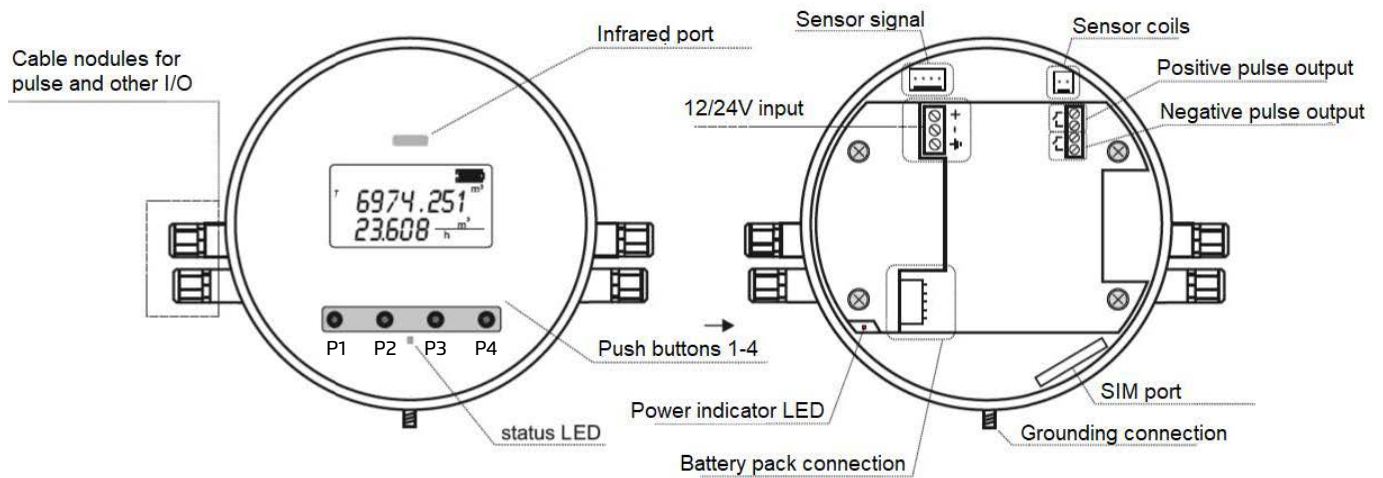
The following basic precautions should therefore be followed when transporting lithium batteries:

- Transport only in special packages with special shipping labels and documents
- Use caution when handling, transporting and packing to avoid shorting the batteries.
- The gross mass of the package must be limited according to the type of transport. In general, a gross mass of less than 5 kg is acceptable for all forms of transport.
- The batteries comply with the requirements stated in "UN Manual of tests and criteria, Part III, subsection 38.3" for transport by air and in accordance with ADR regulations for transport by truck / ship.




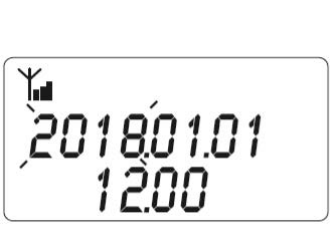



REMOVE THE BATTERY FROM THE TRANSMITTER BEFORE SENDING THE FLOWMETER TO BERMAD IN THE EVENT OF MAINTENANCE OR INTERVENTION IN WARRANTY

### 3 CONVERTER



#### 3.1 SYSTEM START

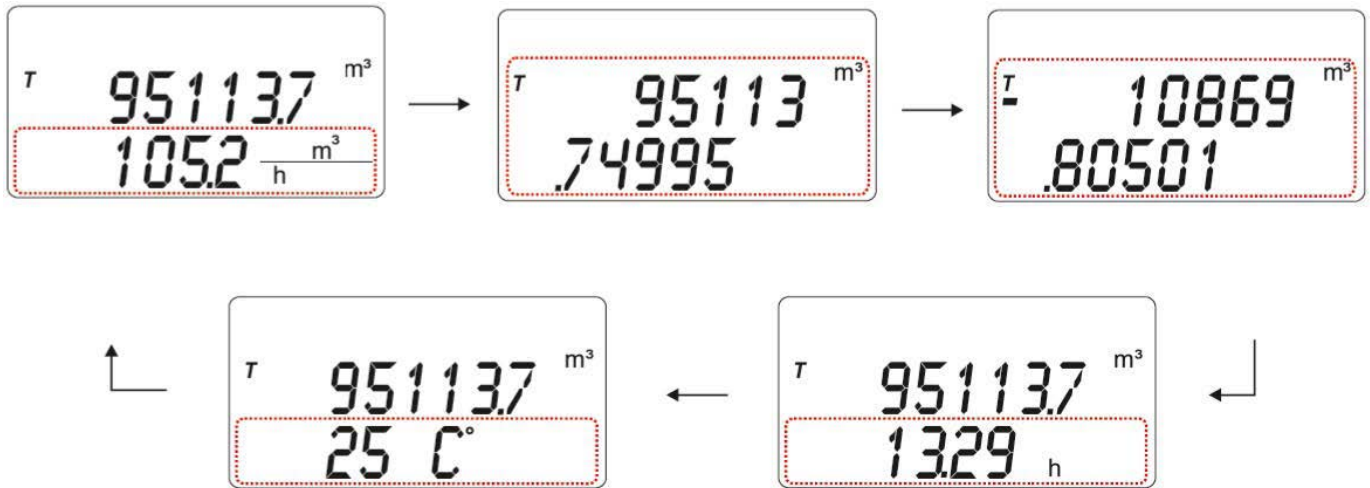
<p><b>BOOTLOADER VERSION AND CHECKSUM</b></p> <p>The bootloader is a separate software required to download new firmware to the converter.</p>	
<p><b>FIRMWARE VERSION AND CHECKSUM</b></p> <p>This refers to the main firmware</p>	
<p><b>BATTERY REPLACEMENT NOTIFICATION</b></p> <p>If the unit is powered by a new battery pack, it is necessary to select "YES" by pressing P4 to reset the battery energy meter; if the unit has just been disconnected and turned back on with the same battery pack, the correct selection is "NO" (P1).</p>	
<p><b>DATE AND TIME SETTING</b></p> <p>Check and if necessary, adjust the date and time</p> <p>The flashing value is the one that can be adjusted using P3 / P4.</p> <p>P2 selects the next value in the sequence: year&gt; month&gt; day&gt; hour&gt; minute.</p> <p>After selecting the last value, a further press of P2 confirms the value and go to the next screen</p> <p>P1 confirms the current settings and exits</p>	
<p><b>MAIN DISPLAY SCREEN</b></p> <p>The converter is now ready.</p> <p>The positive totalizer appears on the first line and the instantaneous flow rate on the second</p> <p>The current technical unit is shown on the right side.</p>	

### 3.2 USER INTERFACE

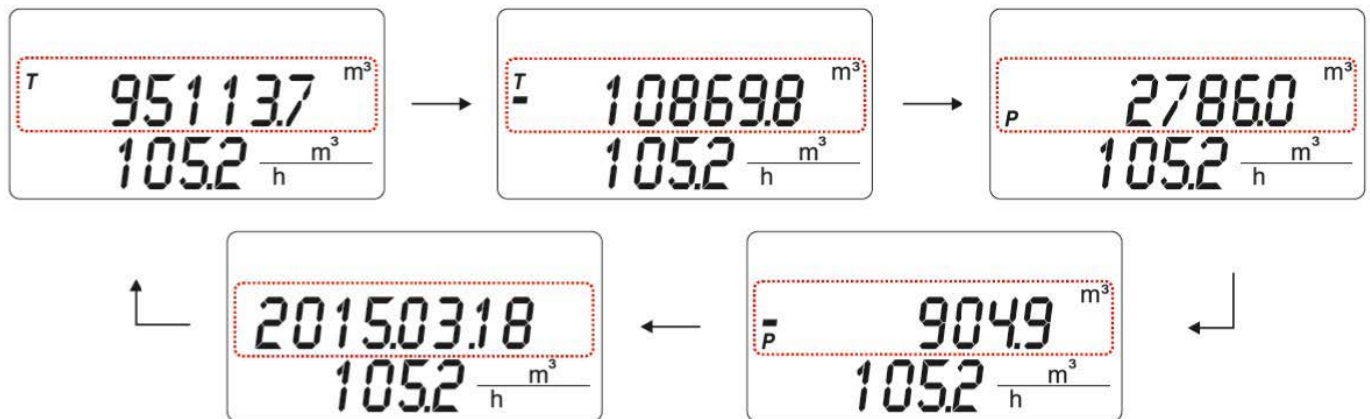
Starting from the main display screen (flow rate and total positive total), the 4 buttons can be used to perform various operations. In detail:

Scroll through the display options of the first and second lines

P3: scrolls the instantaneous flow rate, T+ in maximum resolution, T- in maximum resolution, the time and the board temperature



P4: scrolls the totalizers (reduced resolution) and the date in this order: T +> T-> P +> P-> date



P2: scrolls the number of active alarms (first row) / total alarms (second row) In a normal working condition no alarms will be signaled.

The LCD display shows the text "noErrors" in a monospaced font.

If one (or more) alarm condition is registered, it will be scrolled

The diagram shows two LCD displays connected by a right-pointing arrow. The first display shows "Err.102" on the top line and "01-02" on the bottom line. The second display shows "Err.103" on the top line and "02-02" on the bottom line.

P1: entering the password to access the function selection (the preset value is 000000)

The LCD display shows the text "ACCESS" on the top line and "0-----" on the bottom line.

To increase / decrease the current value of the digit use P4 / P3; go to the next digit with P2. When the last digit is entered, a further press of P2 will unlock access to the function selection if the entered password is correct, otherwise the figure will return to the first one

The LCD display shows the text "F SEL" on the top line and "09" on the bottom line.

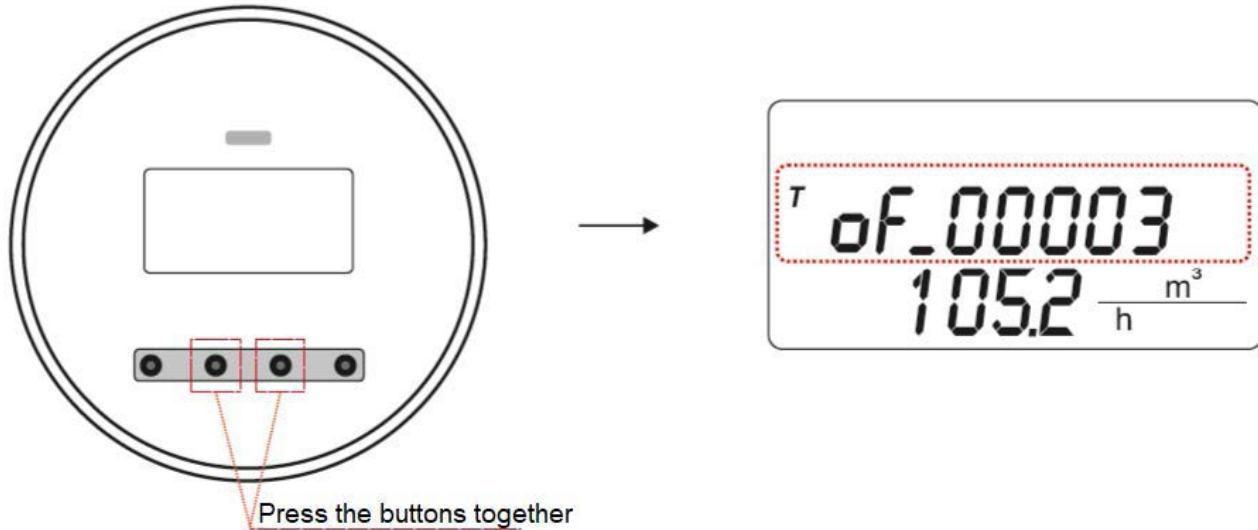
Function selection code: each value corresponds to a menu or parameter set function (see FUNCTIONS); for selecting the function code use P4 / P3; to enter the selected code use P2 Pressing P1 returns to the main screen.

The LCD display shows the text "F09" on the bottom line and "5" on the top right of the display area.

Within a specific function, the functionality of the buttons may be different (see FUNCTIONS); in this example, P4/P3 increases and decreases the value of the parameter shown on the first line, P2 confirms the value and returns when the function is selected, P1 stops the operation and returns to the main screen

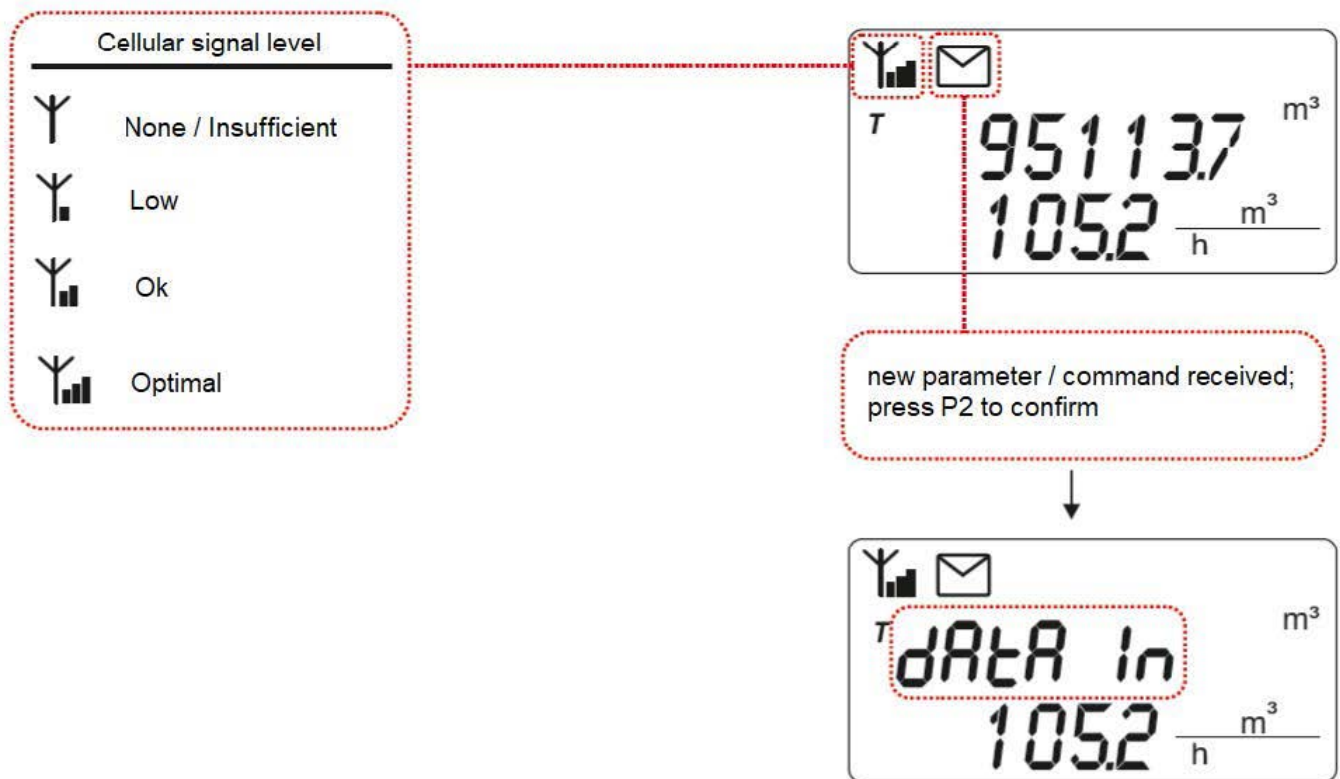
### 3.3 DISPLAY OF THE TOTALIZER OVERFLOW COUNTER

If the totalizers reach the saturation value of the display, they perform the rollover and continue to count; pressing P2 and P3 together while one of the four totalizers is displayed will show its overflow counter



### 3.4 CELULAR COMMUNICATION\*

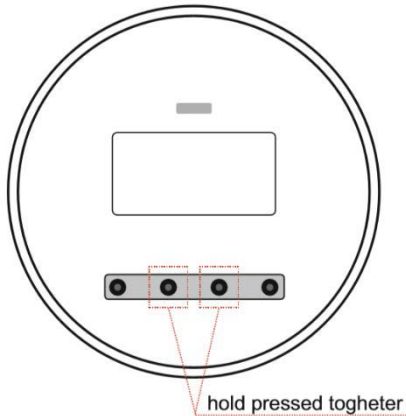
Some basic information on cellular activity is shown directly on the MC406 display; Here are the details:



\* available only if optional cellular hardware is installed

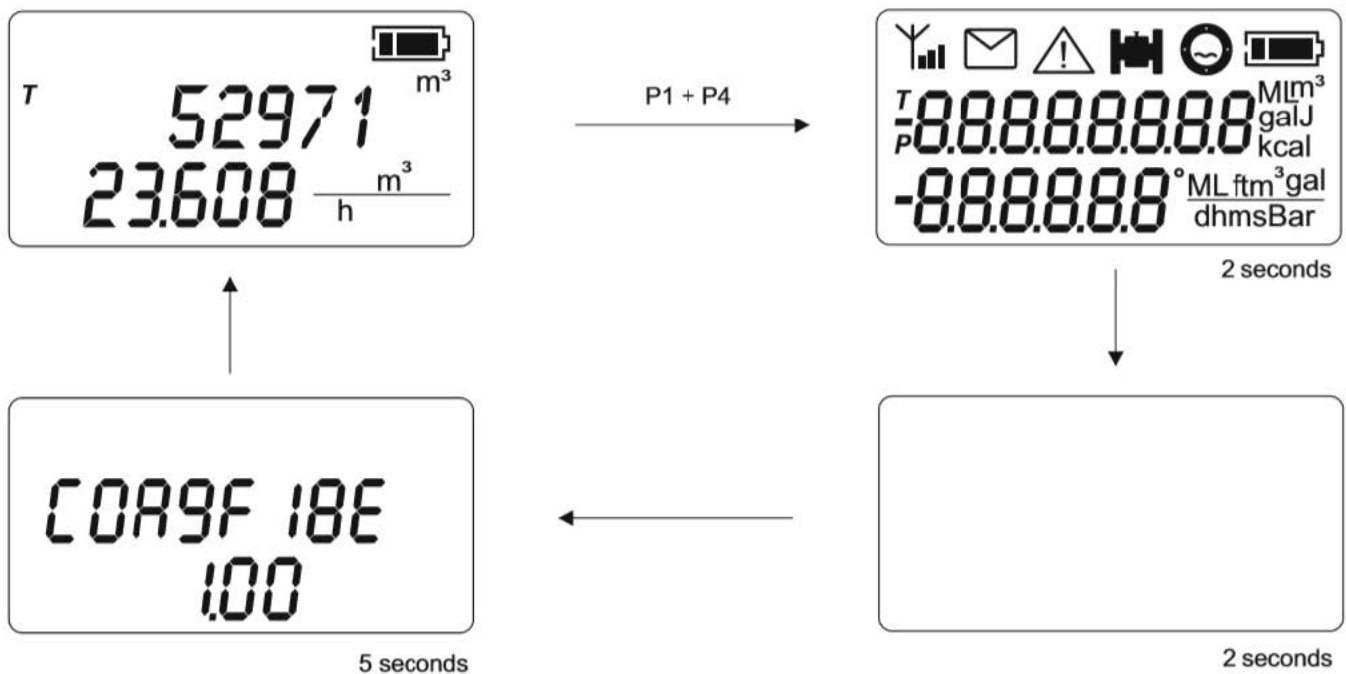
### 3.5 FIRST ACTIVATION

Depending on the instrument configuration, the converter can be shipped with the battery pack disconnected or already connected. If disconnected: the unit is automatically operational once connected (see page 11) If already connected: the unit is hibernated and must be activated. To activate a hibernated unit, the P2 and P3 keys must be kept pressed for 5 seconds



### 3.6 DISPLAY TEST

The integrity of the LCD display can be checked by pressing P1 and P4 together from the current measurement screen; all segments of the display will be activated and deleted in sequence. In addition, the version and revision are displayed bootloader revision (VV.RR b) / firmware version and revision (VV.RR f) and the corresponding checksum. To the completed, the previous measurement screen will be restored.



### 3.7 FUNCTIONS

Below is a list of all the functions accessible from the user interface.

 read only  
 editable

FUNC	DESCRIPTION	ACTION P1	ACTION P2	ACTION P3	ACTION P4	MIN VALUE	MAX VALUE	NOTES
01	Instant flowrate unit	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	1	6	1=m;2=m3;3=L;4=ML;5=ft3;6=gal;7=BBL. Setting 1 (meters) the time base is automatically set to 1 second
02	Time base unit	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	1	4	1=s;2=m;3=h;4=d
03	Counter unit	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	1	4	1=m3;2=L;3=ML;4=gal;5=BBL;6=Aft;7=Ain
04	Zero calibration	Back to main screen	Cancel operation + return to function selection	No action	Start calibration	-	-	The display shows the time left to complete the operation. At the end of the operation, the main screen is displayed.
05	Ka factor	Back to main screen	Return to function selection	Back to main screen	Back to main screen	-10.0	10.0	
06	Sensor diameter	Back to main screen	Return to function selection	Back to main screen	Back to main screen	1	4000	The parameter is electrically blocked; read only
07	Pulse volume	Back to main screen	Return to function selection	Back to main screen	Back to main screen	1	10000	The parameter is electrically blocked; read only
08	Pulse technical unit	Back to main screen	Return to function selection	Back to main screen	Back to main screen	1	4	1=mL;2=L;3=m3;4=gal
09	Pulse duration	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	5	500	Expressed in ms (seconds / 1000)
10	Measurement frequency	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	5	60	Interval between two measurements [s]
11	Date and time	Back to the previous field; if in years setting field, back to main screen	Forward to the next field; if in minutes setting field, back to main screen	Decrease value	Increase value	2015/01/01 00:00	2099/31/12 23:59	
12	Damping	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	2	100	Number of samples averaged
13	Bypass	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	2	95	Bypass filter threshold, % of full scale
14	Peak cut	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	1	90	Pulse suppression filter threshold,% of full scale
15	Cut off	Back to main screen	Confirm + return to function selection	Back to main screen	Back to main screen	0.00	10.00	[m/s] - the parameter is electrically locked

FUNC	DESCRIPTION	ACTION P1	ACTION P2	ACTION P3	ACTION P4	MIN VALUE	MAX VALUE	NOTES
16	Flowrate display digits	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	0		Number of decimal digits of the instant flow shown on the display
17	Totalizers display digits	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	0	4	Number of decimal places of the totalizers
18	Empty pipe threshold	Back to main screen	Confirm + return to function selection	Decrease value Increase value	200	5000		
19	Full scale	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	1.0	10.00	Full scale expressed in m/s (not connected to the diameter value)
20	Partial positive totalizer reset	Back to main screen	Return to function selection	No action	Partial positive tot. reset (Must be hold pressed for 5 seconds)	No action	No action	The display shows the positive partial totalizer
21	Partial negative totalizer reset	Back to main screen	Return to function selection	No action	Partial negative tot. reset (Must be hold pressed for 5 seconds)	No action	No action	The display shows the negative partial totalizer
22	Firmware version	Back to main screen	Return to function selection	No action	No action	-	-	Show the current version. Firmware revision
23	Firmware checksum	Back to main screen	Return to function selection	No action	No action	-	-	Shows the installed firmware CRC32
24	Empty pipe detection mode	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	0	3	0: Disabled; 1: Enabled on the fourth electrode; 2: Enabled on the measuring electrodes; 3: Enabled on both
25	Password setup	Back to main screen	Forward to the next digit, confirm and return	Decrease value	Increase value	000000	999999	
26	Bootloader version	Back to main screen	Return to function selection	No action	No action	-	-	Shows the current version. Revision of the bootloader
27	Bootloader checksum	Back to main screen	Return to function selection	No action	No action	-	-	Show the current bootloader CRC32
28	Line frequency	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	0	1	Set the frequency of the power supply 0: 50 Hz 1: 60 Hz
29	Load user parameters	Back to main screen	Return to function selection	Decrease value	(Long press) load user parameters	-	-	Replaces the parameters of the instrument with those saved as user copy
30	Save user parameters	Back to main screen	Return to function selection	Decrease value	(Long press) save user parameters	-	-	Save the instrument parameters as a user copy




FUNC	DESCRIPTION	ACTION P1	ACTION P2	ACTION P3	ACTION P4	MIN VALUE	MAX VALUE	NOTES
31	Load factory parameters	Back to main screen	Return to function selection	Decrease value	(Long press) load factory parameters	-	-	It replaces the parameters of the instrument with the factory ones
32	Damping in low power mode	Back to main screen	Confirm + return to function selection	Decrease value	Increase value	1	100	Number of samples to be averaged over
33	Auto power off	Back to main screen	Return to function selection	Decrease value	Increase value	0	7	Shutdown time 0=20s;1=1 min;2=3
34	Sensor offset	Back to main screen	Return to function selection	No action	No action	-99999999	99999999	Shows the offset of the paired sensor
35	Log of firmware download attempts	Back to main screen	Return to function selection	Show previous record	Show next record	Oldest registry (0)	Last registry available	Show log of firmware download attempts (see section)
36	Service code	Non accessible	Non accessible	Non accessible	accessible	Non accessible	Non accessible	Function not accessible; an attempt to access will show "denied" on the screen
37	Negative pulse output configuration	Back to main screen	Return to function selection	Decrease value	Increase value	0	3	0: Negative flow; 1: Positive Flow; 2: Net Positive flow; 3: Error report
38	Selection of the measurement to map on 4-20mA output	Back to main screen	Return to function selection	Decrease value	Increase value	0	4	0: Flow; 1: Full scale percent; 2: Pressure; 3: Temperature T1 4: Temperature T2
39	Measurement value to be mapped on 4mA output	Back to main screen	Return to function selection	Decrease value	Increase value	0	1000	Measurement value to be mapped on 4mA output (enabled only with 4-20mA card)
40	Measurement value to be mapped on 20mA output	Back to main screen	Return to function selection	Decrease value	Increase value	0	1000	Measurement value to be mapped on 20mA output (enabled only with 4-20mA card)
41	Flow send	Back to main screen	Return to function selection	Decrease value	Increase value	0	1	0: signals error in case of reverse flow
42	Flow simulation	Back to main screen	Return to function selection	Decrease value	Increase value	0	1	0: flow simulation disabled 1: flow simulation enabled (enabled only with 4-20mA card)
43	Flow simulation value	Back to main screen	Return to function selection	Decrease value	Increase value	0	1000	Value of the flow to be simulated. (enabled only with 4-20mA card)
44	Bluetooth access interval	Back to main screen	Return to function selection	Decrease value	Increase value	0	9	0: Always off; 1: On every 30 sec; 2: On every 60 sec; 3: On every 2 min; 4: On every 5 min; 5: On every 10 min; 6: On every 15 min; 7: On every 30 min; 8: On every 60 min; 9: Always on (Enabled only with Bluetooth-Modbus card)
45	Bluetooth access duration	Back to main screen	Return to function selection	Decrease value	Increase value	3	30	Duration in seconds of the Bluetooth access (enabled only with Bluetooth-Modbus card installed)

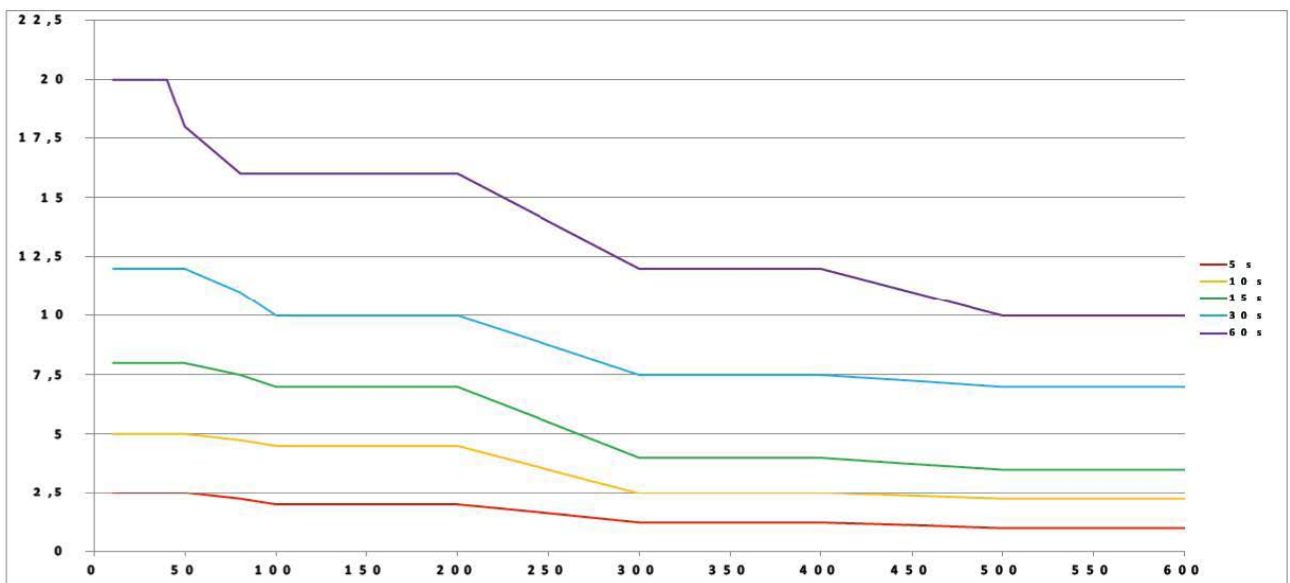
FUNC	DESCRIPTION	ACTION P1	ACTION P2	ACTION P3	ACTION P4	MIN VALUE	MAX VALUE	NOTES
46	MODBUS access interval	Back to main screen	Return to function selection	Decrease value	Increase value	0	12	0: Always off; 1: On every 5 sec; 2: On every 10 sec; 3: On every 15 sec; 4: On every 30 sec; 5: On every 1 min; 6: On every 2 min; 7: On every 5 min; 8: On every 10 min; 9: On every 15 min; 10: On every 30 min; 11: On every 60 min; 12: Always on; (enabled only with Bluetooth-Modbus card installed)
47	MODBUS access duration	Back to main screen	Return to function selection	Decrease value	Increase value	1	30	Duration in seconds of the Modbus access (enabled only with Bluetooth-Modbus card installed)
48	MODBUS baud rate	Back to main screen	Return to function selection	Decrease value	Increase value	0	6	Baudrate Modbus 0: 2400; 1: 4800; 2: 9600; 3: 19200; 4: 38400; 5: 57600; 6: 115200 (default) (enabled only with Bluetooth-Modbus card installed)
49	Number of MODBUS bits	Back to main screen	Return to function selection	Decrease value	Increase value	0	1	Number of modbus bits 0: 8 data bits 1: 7 data bits
50	MODBUS parity	Back to main screen	Return to function selection	Decrease value	Increase value	0	2	MODBUS parity 0: None 1: Odd
51	MODBUS stop bit	Back to main screen	Return to function selection	Decrease value	Increase value	0	1	MODBUS stopbit 0: 1 bit stop 1: 2 bit stop (enabled only with Bluetooth-Modbus card installed)
52	MODBUS address	Back to main screen	Return to function selection	Decrease value	Increase value	0	255	MODBUS address (enabled only with Bluetooth-Modbus card installed)
53	MODBUS byte-order	Back to main screen	Return to function selection	Decrease value	Increase value	1	5	MODBUS byte order 0: little endian 1: big endian 2: little endian byte swap
54	MODBUS map	Back to main screen	Return to function selection	Decrease value	Increase value	0	1	0 = Euromag 1 = Sofrel LS-Flow (enabled only with Bluetooth- Modbus board)
55	MODBUS test mode (Modbus power on for 5 minutes only for battery powered models and Bluetooth / modbus board opto isolated)	Back to main screen	Return to function selection	Decrease value	Increase value	0	1	0: disabled 1: enabled (enabled only with Bluetooth- Modbus board)

FUNC	DESCRIPTION	ACTION P1	ACTION P2	ACTION P3	ACTION P4	MIN VALUE	MAX VALUE	NOTES
56	Bluetooth-Modbus board firmware version	Back to main screen	Return to function selection	Version reading	Version reading			(enabled only with Bluetooth-Modbus board) Display hardware and firmware version of Bluetooth / modbus board Pressing button4 will be activate modbus synchronization procedure
57	Periodic refresh of Bluetooth/ Modbus configuration only for Bluetooth / modbus board non opto isolated or Bluetooth / modbus board opto isolated and main powered)	Back to main screen	Return to function selection	Decrease value	Increase value	0	255	Bluetooth-modbus board reconfiguration interval (expressed in hours) 0: disabled (default)
58	Modbus power safe mode only for Bluetooth / modbus board opto isolated	Back to main screen	Return to function selection	Decrease value	Increase value	0	2	If Modbus set as always on (F46=16), in the event of main power supply outage, Modbus is automatically switched off in order to preserve the battery duration 0: disabled 1: enabled 2: Modbus power off

## 4 BATTERY LIFE

The converter is supported by an optional lithium battery pack and can operate for over 10 years in battery mode (depending on the configuration and working conditions). The residual life comes estimated by calculating the use of energy for the duration of the tool, so when the battery is replaced it is necessary reset the battery usage counter. The ignition the unit automatically takes the user to a screen selection (see SYSTEM START). Frequently waking up the unit or entering very long shutdown times (feature 33) can shorten the expected battery life.

	<b>BATTERY CHARGED</b>
	<b>25% OR LESS</b>
	<b>10% OR LESS</b>

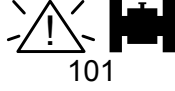

















Expected battery life (years) according to sensor diameter and sampling rate

## 5 SELF DIAGNOSTIC

In this paragraph you will find the alarm messages that can be shown on the display when the relative status icon appears. Each alarm message is accompanied by possible causes that generated it and the possible solutions to be applied in order to restore the correct functioning of the flow meter.

During the measuring process MC406 detects automatically if a fault condition occurs and eventually stops the measurement reporting an alarm indication on the display. The following table describes the various alarm conditions and the behaviour of the converter.

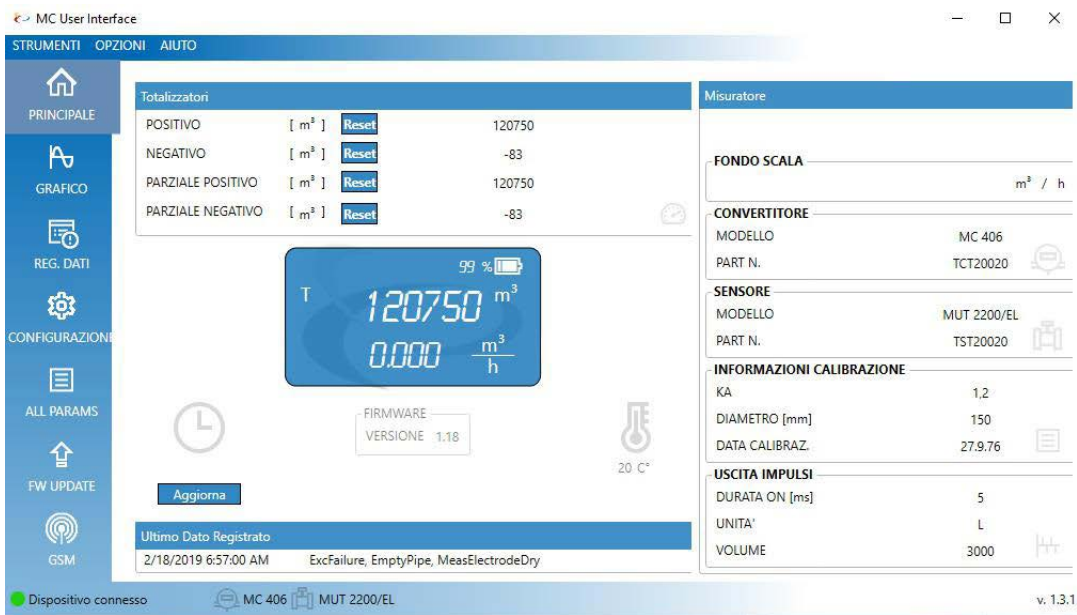
ANOMALY DETECTED	POSSIBLE CAUSE	CONVERTER BEHAVIOR	ICONS DISPLAYED AND CORRESPONDING ERROR CODE	POSSIBLE SOLUTIONS
Excitation failure	Damaged meter;	The measure is forced to 0 and the error condition is displayed and logged		Contact service center
Empty pipe detected / Invalid measure on the measuring electrodes	The sensor is at least half empty Air is injected and causes turbulence; air bubbles/pockets Liquid conductivity is too low An electric dispersion on the process is affecting the measure A high source of electromagnetic interference is affecting the measurement Incorrect grounding, on plastic pipe: grounding rings are missing, incorrect or damaged electrical connection to the sensor/ converter	The measure is forced to 0 and the error condition is displayed and logged; to save battery energy the coil excitation is stopped until the error condition goes off	 102 Detected by the empty pipe electrode 103 Detected on the measuring electrodes	Check if the sensor has been correctly installed and if there is air inside the pipe. Make sure that the sensor and converter are properly grounded. Check the absence of high electromagnetic noise sources, caused by inverters or other power equipment
Temperature exceeds the nominal converter working range	The environment temperature is over the working range The converter is exposed to direct sunlight	The error condition is displayed		Ensure adequate protection from sunlight
Wet electronic board	Water intake or a humidity condensation inside the converter case Battery compartment not properly closed.	The error condition is displayed		Contact service center
Supply voltage out of range	The battery pack is damaged or discharged A wrong power source is connected to the converter	The error condition is displayed		Replace the battery pack or connect the correct power source
High battery consumption due to wrong pulse output configuration	Detected high battery consumption due to a wrong pulse output configuration. The pulse output has been stopped	The error condition is displayed		Change the settings of the pulse volume and duration (see "4.3.2.1 Pulse output" page 30).
Pulses overlapping	The pulse settings are not compatible with the measured flowrate	The error condition is displayed		Change the settings of the pulse volume and duration (see "4.3.2.1 Pulse output" page 30).
4-20 mA error	Current loop opened. Connection problem between MC406 board and 4-20mA board Malfunction of 4-20ma board	The error condition is displayed		If 4-20 mA board isn't used, disable the error setting function F38 to 5

Bluetooth-RS485 board Error	Communication between MC406 main board and Bluetooth/modbus board is not working	The error condition is displayed	 600/601/602	Manually reset of Bluetooth/RS-485 board entering on function 56 , pressing Button4 and wait until "loading" message disappear. If the problem persists power reset the instrument, by disconnecting all power sources. If the problem persists contact service center.
Bluetooth-RS485 board Error	Bluetooth module configuration failed	The error condition is displayed	 604	Manually reset of Bluetooth/RS-485 board entering on function 56 , pressing Button4 and wait until "loading" message disappear. If the problem persists power reset the instrument, by disconnecting all power sources. If the problem persists contact service center
Bluetooth-RS485 board Error	Modbus synchronized communication failed	The error condition is displayed	 608	Check if modbus power on interval is equal to modbus master polling interval Check the modbus master is correctly working
Bluetooth-RS485 board Error	Main power failed and modbus configured as "always on" (F46)	In order to save battery life, RS485 "power-on" parameter is set to 9 (on every 15 minutes). On main power restoring, modbus "power-on" parameter is set to 16 (always on) automatically	 640	
A watchdog reset of Bluetooth-RS485 board was performed	A disturbance caused an unhandled behavior in the regular software execution of the Bluetooth-RS485 board	The error condition is displayed	 650	Manually reset of Bluetooth/RS-485 board entering on function 56 , pressing Button4 and wait until "loading" message disappear. If the problem persists contact service center
Firmware checksum differs from the expected value	The internal program memory has changed	The error condition is displayed and the program execution stopped	 801	Try to update the firmware
Parameters checksum differs from the expected value	The parameters data are corrupted	The error condition is displayed and the program execution stopped	 802	Restore to factory settings
A watchdog reset was performed	A disturbance caused an unhandled behavior in the regular software execution	The instrument was reset to restore the functionality; the alarm is cleared after it has been displayed	 901	If the problem persists contact service center

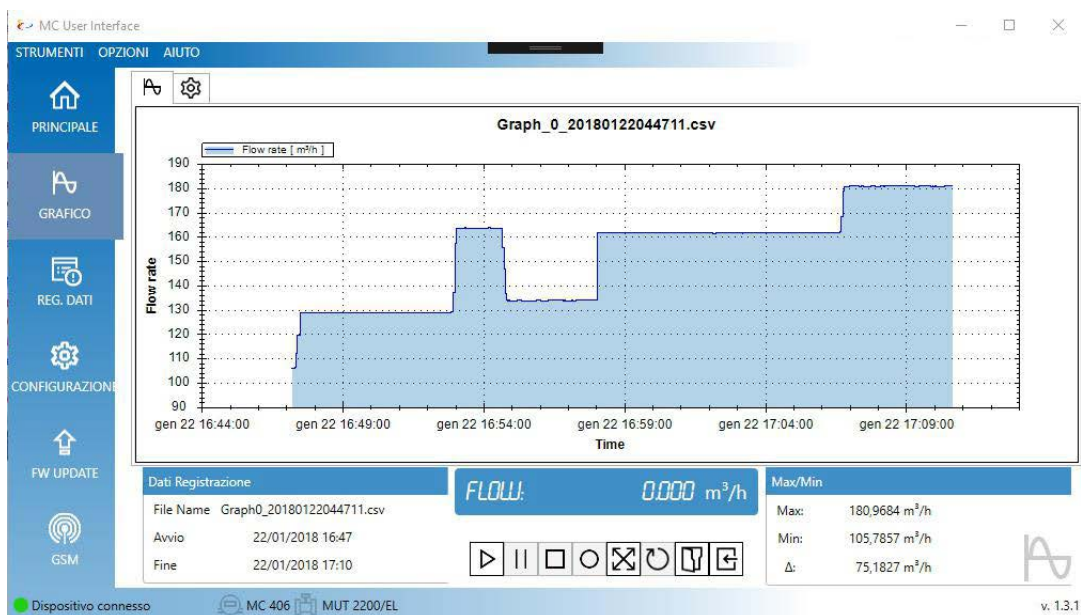
## 6 PC INTERFACE SOFTWARE

The supplied PC communication software is based on a proprietary protocol; its use is possible with the interface BERMAD IrComm (USB to infrared adapter) and allows you to:

- View live measurements in real time
- View all the parameters
- Modify the unprotected parameters
- Download the internal datalogger
- Update firmware



MAIN DASHBOARD - real live values and basic information



GRAPHIC - Recording of live measurements / Visualization

MC User Interface

STRUMENTI OPZIONI AIUTO

**Registro dati**

Numero di campioni 110260 Esporta Ultimi 1000 Esporta tutti Cancella tutti

Numero di riga	Data ed ora	Allarmi	Portata	Totale +	Totale -	Energia batteria	Tensione batteria	Temperatura cc
110259	2/15/2019 5:42:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110258	2/15/2019 5:27:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110257	2/15/2019 5:12:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110256	2/15/2019 4:57:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110255	2/15/2019 4:42:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110254	2/15/2019 4:27:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110253	2/15/2019 4:12:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110252	2/15/2019 3:57:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110251	2/15/2019 3:42:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	27
110250	2/15/2019 3:27:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110249	2/15/2019 3:12:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110248	2/15/2019 2:57:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.6	26
110247	2/15/2019 2:42:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26
110246	2/15/2019 2:27:00 PM	ExcFailure, EmptyPipe, MeasElectrodeDry	0	120750.5	-83.66214	99	3.5	26

Unità di Misura

Portata [ m<sup>3</sup>/h ]

Totale + / Totale - [ m<sup>3</sup> ] Altri campioni

Temperatura convertitore [ C° ]

Device connected MC 406 MUT 2200/EL v. 1.3.1

DATA LOG - Internal process log download and CSV file export

MC User Interface

STRUMENTI OPZIONI AIUTO

**Configurazione dei parametri del dispositivo**

- Opzioni di misura della portata
- Opzioni di visualizzazione
- Configurazione dell'acquisizione
- Filtraggi e Fondo Scala
- Uscita impulsi
- Rilevazione di tubo vuoto
- Timeout

Cambio password di accesso al menu

Password

Nuova Password

**Configurazione Misuratore**

Salva

Modifica

Carica

Opzioni di misura della portata

Opzioni di visualizzazione  Uscita impulsi

Configurazione dell'acquisizione  Rilevazione di tubo vuoto

Filtraggi e Fondo Scala  Timeout

**Imposta l'orologio del convertitore**

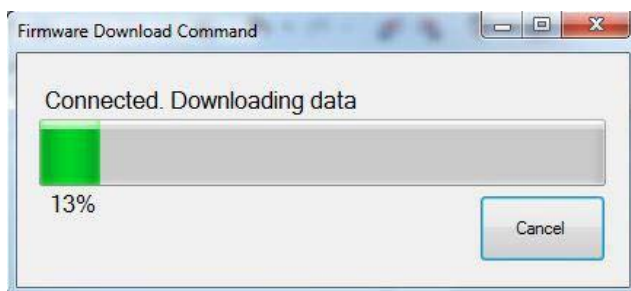
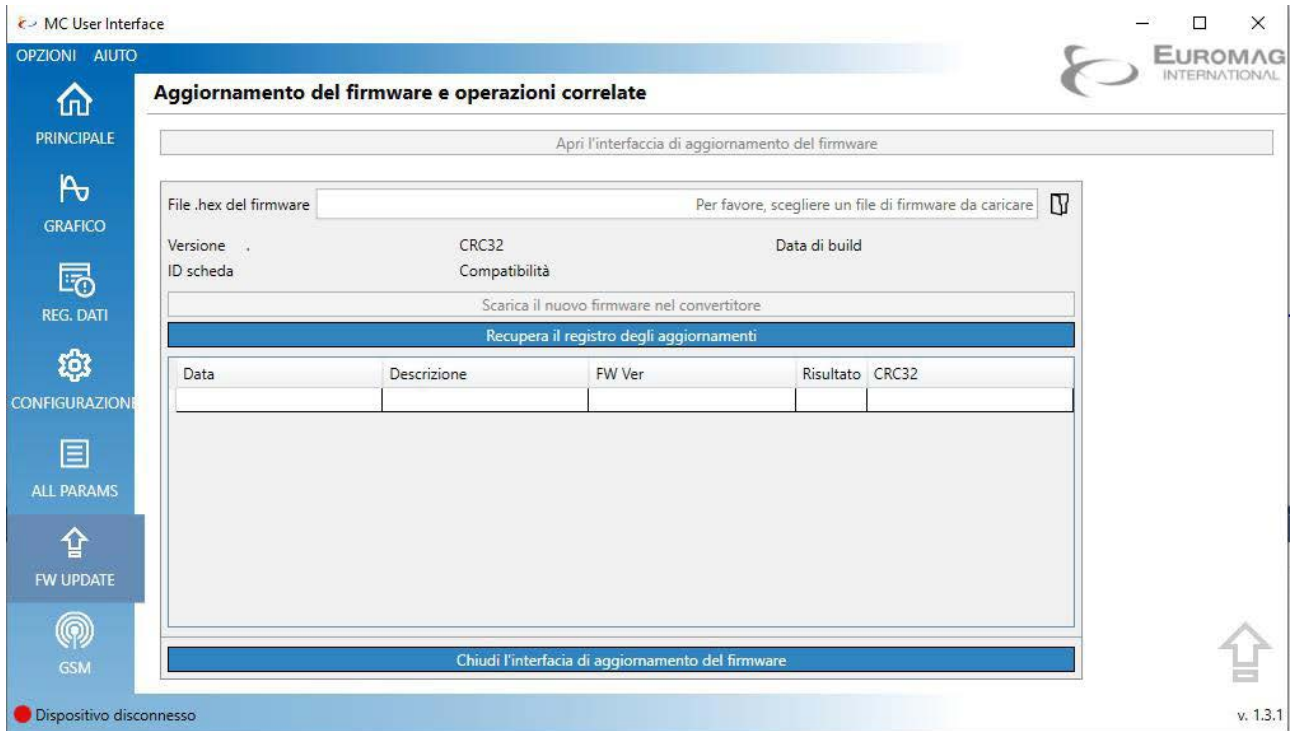
venerdì 15 febbraio 2019 17:12:07

Dispositivo connesso MC 406 MUT 2200/EL v. 1.3.1

CONFIGURATION - Parameter setting & configuration

## 6.1 FIRMWARE UPDATE

To update the converter with a newer firmware version, select the firmware .hex file and press "Download new firmware to converter". The progress of the firmware download is displayed while the instrument displays the sequence of internal operations. The previously installed firmware is saved in backup on a dedicated memory area, therefore in case of error during unloading, the converter will automatically restore normal functionality. During the operation the red LED turns on lights up when the FLASH memory is cleared or written. At the end of the update process, the unit will restart automatically.



Firmware update step

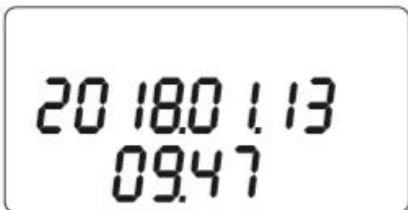
0	Firmware check installed	6	Checking the downloaded firmware
1	Awaiting download request	7	Firmware update installed
2	Download request received	8	Backup of the new firmware installed
3	Clear download memory	9	Update OK
4	Firmware download	10	Firmware reset installed (only during startup)
5	Checking the downloaded firmware	11	Firmware reset installed (after error during update)

## 6.2 LOG OF DOWNLOAD ATTEMPT

Any attempt to download the firmware is recorded in the internal memory. The log can store over 500 records: once completed, further downloads are not allowed. The download attempt log can be viewed on the converter display function 35 or by pressing P1 and P3 together on the main display screen; each log information scrolls automatically in 4 screens. P3 and P4 can be pressed at any time to go to the previous or next saved recording.



Screen 1: displays the record number and corresponding ID of the download.



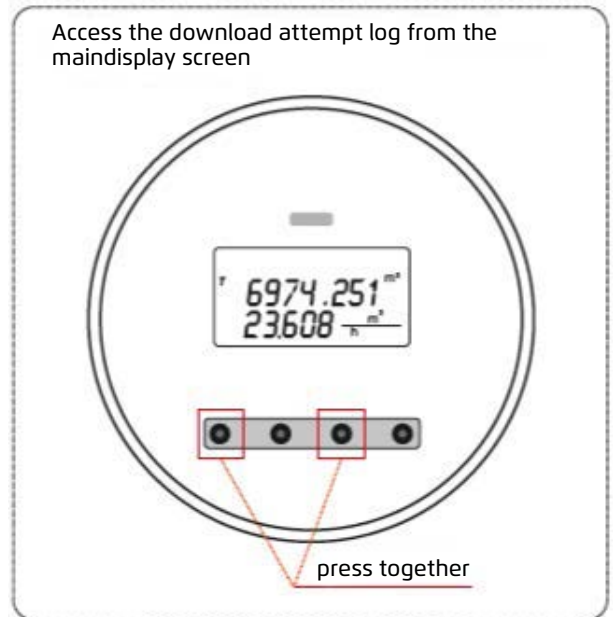
Screen 2: displays the date (YYYY.MM.DD) and the time the attempt was made.



Screen 3: shows if the attempt was successful (SUCCESS) or not (FAIL); the last completed step is also reported (see previous page).



Screen 4: shows the checksum and version of the firmware downloaded; if the operation was not successful, FFFFFFFF can be shown as a checksum.



Access the download attempt log from the main display screen

### ADDITIONAL INFORMATION DISPLAYED

In addition to the normal user interface screens, some additional information can be displayed.

“Safe EEPROM secured”: the calibration and measurement parameters saved in the EEPROM memory are protected from writing attempts.

The checksum of the firmware or EEPROM data (parameters and / or totalizers) The checksum of the firmware or EEPROM data (parameters and / or totalizers)



## 7 GSM

The GSM module is an expansion of the Mc406 electronic converter, which makes possible:

- Remote transmission of information available in the measuring instrument,
- Data reception for remote management of the instrument itself,
- Modification of some parameters
- Converter FW update

### 7.1 MAIN FEATURES

1. Fully autonomous operation The module works as a completely autonomous unit, similar to an external gsm data logger: at regular intervals (minimum 60 seconds) it acquires the measurement data from the MC406 and saves them in its internal Flash memory.

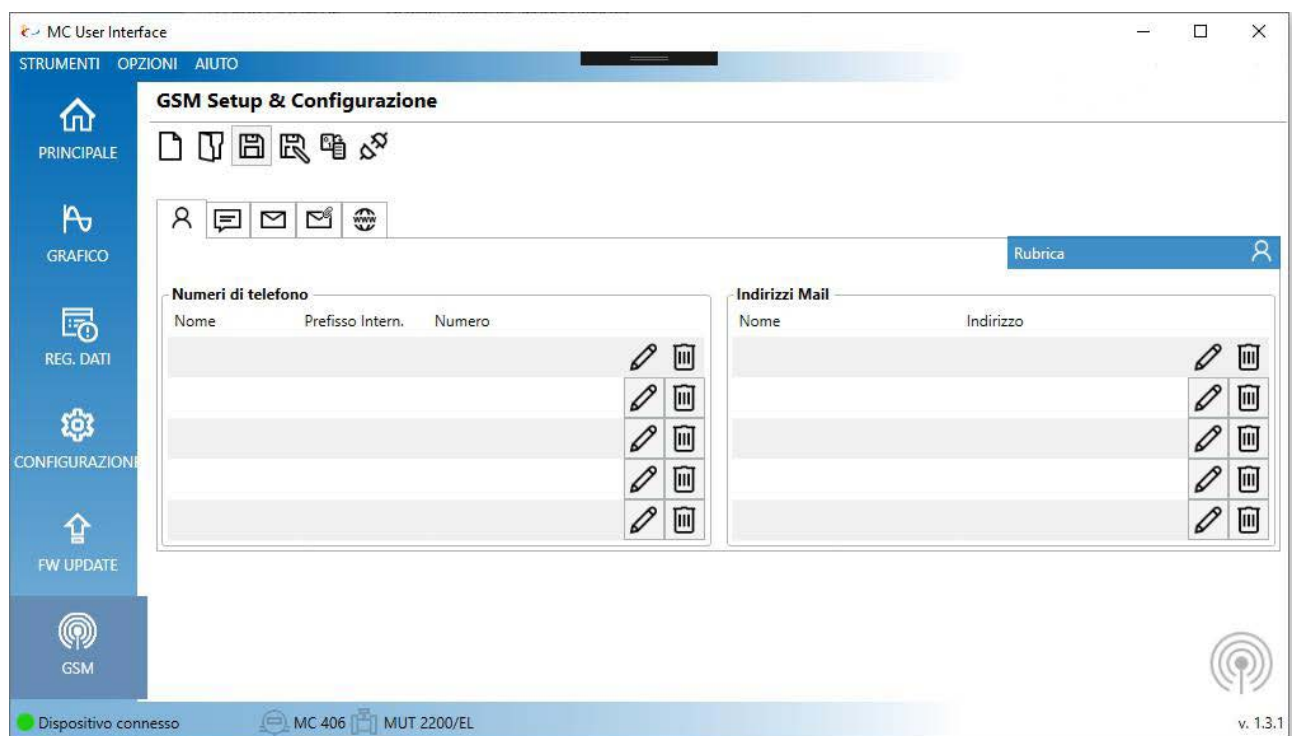
2. Battery powered Power is supplied via a battery pack with 2 batteries. Nominal battery life 5 years, with guaranteed minimum of 1 year regardless of module configuration.

3. Worldwide compatibility The internal modem (Telit HE910-GL) was chosen to guarantee worldwide operation at least for bands B5, B8, B2, B1, B4; Frequencies [MHz] 800/850, 900, AWS1700.1900,2100. Europe, Australia, New Zealand, Brazil, North America.

4. Data sending mode Sending measurement data includes the following modes; SMS, E-mail; Email with attachment (containing the latest log lines) and a binary file via ftp to the Euromagdata / BERMAD web portal. In case of problems, send e-mail and e-mail with attachment via web portal.

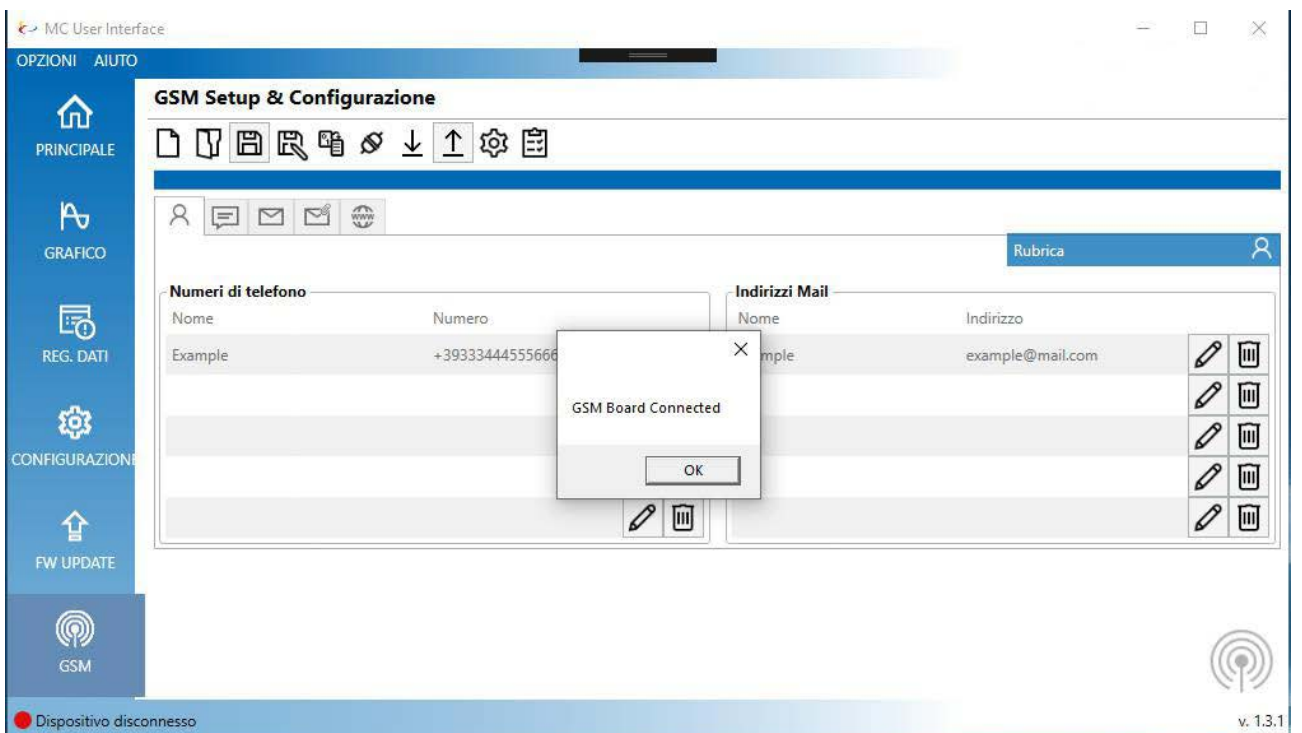
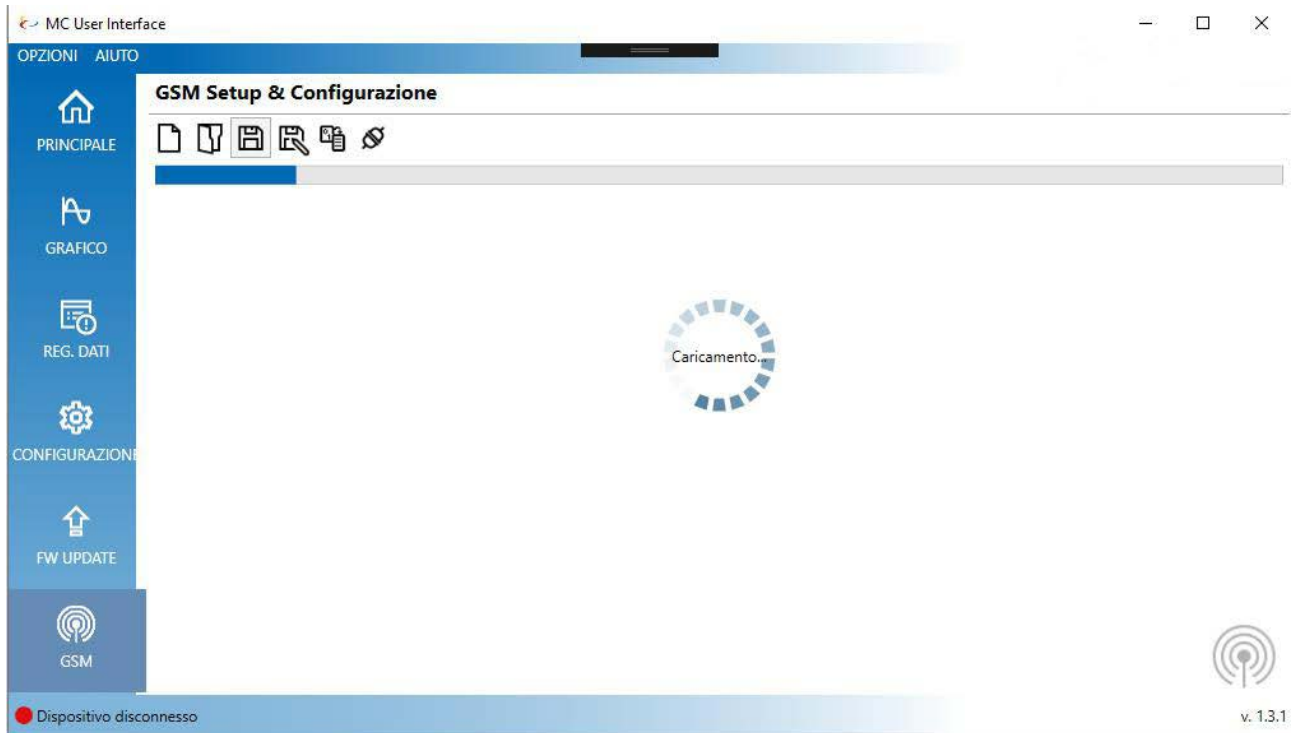
5. Data transmission interval The programmable data transmission interval is independent for each mode. The minimum interval is every hour. The management of sending and attempts in case of error is completely delegated to the module.

6. Parameter configuration The operating parameters are configured via the MC406 optical interface and via the MC User Interface software.



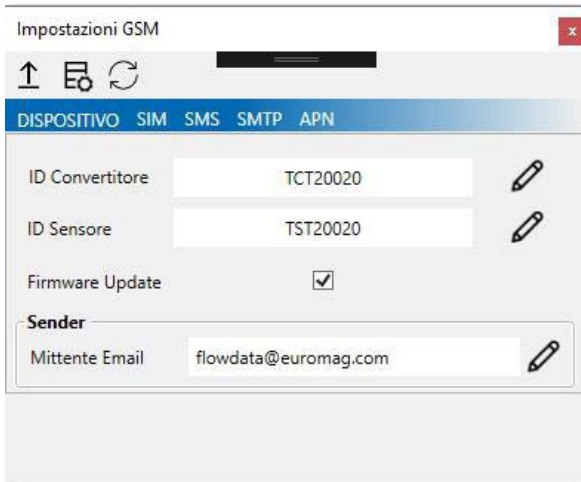
## 7.2 GSM CONNECTION

By pressing the button , the software starts communication with the GSM module and downloads all its parameters.



## 7.3 DEVICE SETTINGS

By pressing the button  it is possible to set all the communication parameters



Impostazioni GSM

↑ ⚙️ ↻

DISPOSITIVO SIM SMS SMTP APN

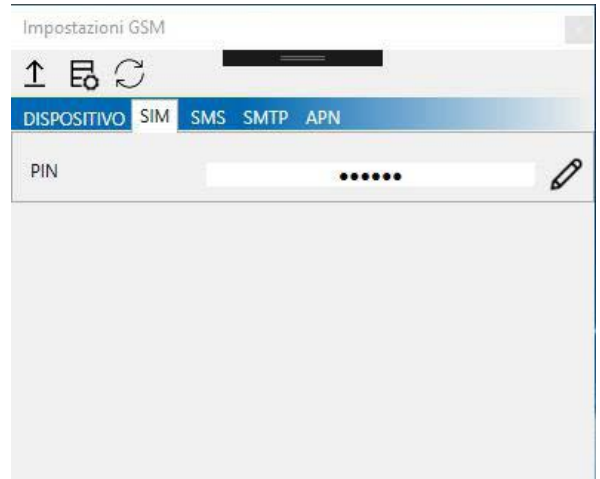
ID Convertitore TCT20020

ID Sensore TST20020

Firmware Update

Sender

Mittente Email flowdata@euromag.com

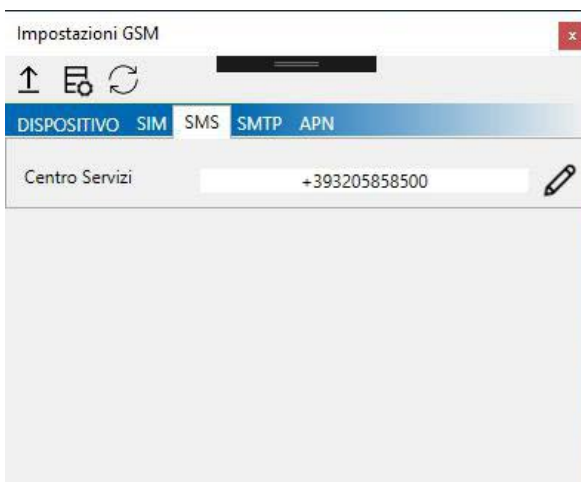


Impostazioni GSM

↑ ⚙️ ↻

DISPOSITIVO SIM SMS SMTP APN

PIN

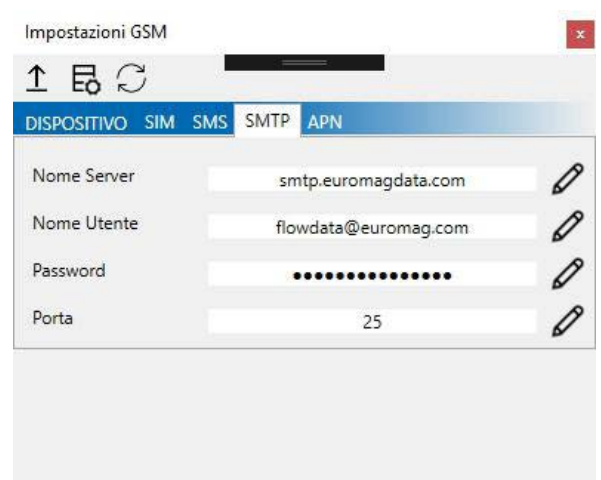


Impostazioni GSM

↑ ⚙️ ↻

DISPOSITIVO SIM SMS SMTP APN

Centro Servizi +393205858500



Impostazioni GSM

↑ ⚙️ ↻

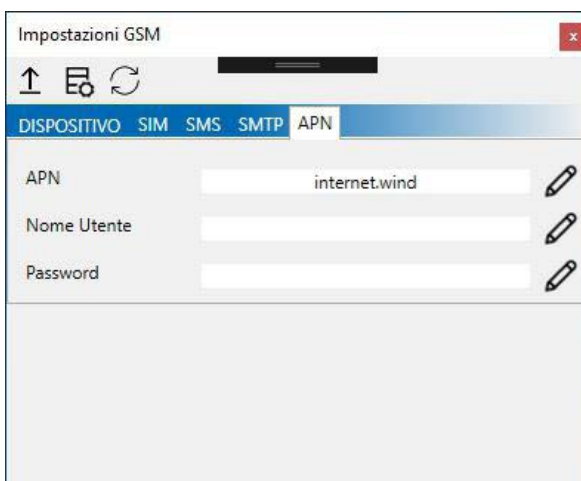
DISPOSITIVO SIM SMS SMTP APN

Nome Server smtp.euromagdata.com

Nome Utente flowdata@euromag.com

Password

Porta 25



Impostazioni GSM

↑ ⚙️ ↻

DISPOSITIVO SIM SMS SMTP APN

APN internet.wind

Nome Utente

Password

To save the data on the form, press the button 

**Without this operation, no data on the form will change.**

## 7.4 PHONE NUMBER AND EMAIL SETTINGS

Up to 5 mobile numbers / email addresses can be set.

## 7.5 SCHEDULING



The module has 4 independent programmers (SMS, e-mail, e-mail with attachment, data on Euromagdata / BERMAD) that the user can program.

For each scheduler it is possible to choose one of the four predefined types:

- Hourly interval (Send data/sms every hour)
- Daily per hour (Send data every day at a specified time)
- Day of the week (sends data every week at the selected day and time)
- Day of the month (Send data every month at the selected day and time)


You can also build a flexible schedule by choosing Day of the week, Day of the month and Time.

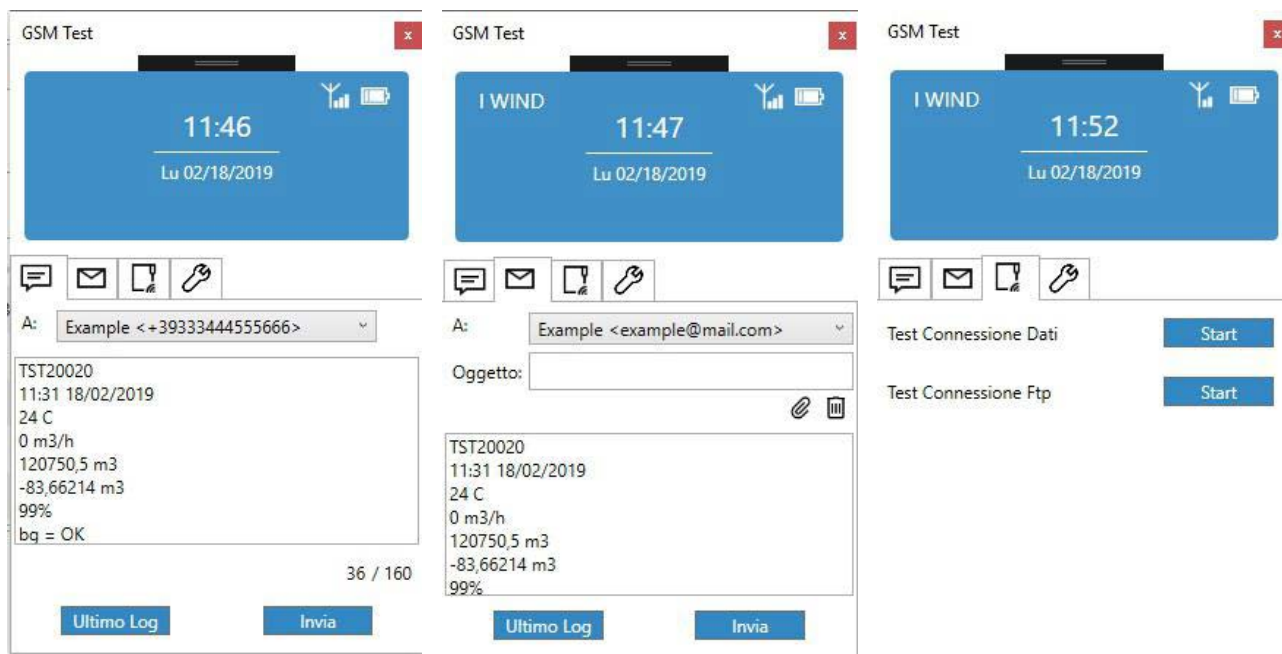
## 7.6 DATA SAVING

To save the data on the module it is necessary to save the configuration file (including the telephone / e-mail number and all the scheduler data) by pressing the button , then upload the file to the module by pressing the button .

**Without this operation, no data on the settings will change.**

## 7.7 TEST

By pressing the button , you can test all the functions of the GSM module



The figure displays three screenshots of the GSM Test application interface, each showing a different test function. Each screenshot has a blue header with the time and date (Lu 02/18/2019) and a status bar with signal and battery icons.

- SMS SEND TEST:** The header shows the time 11:46. The 'A:' field contains 'Example <+39333444555666>'. The test results show: TST20020, 11:31 18/02/2019, 24 C, 0 m3/h, 120750,5 m3, -83,66214 m3, 99%, and bq = OK. There are 'Ultimo Log' and 'Invia' buttons at the bottom.
- EMAIL SEND TEST:** The header shows the time 11:47. The 'A:' field contains 'Example <example@mail.com>'. The 'Oggetto:' field is empty. The test results show: TST20020, 11:31 18/02/2019, 24 C, 0 m3/h, 120750,5 m3, -83,66214 m3, 99%. There are 'Ultimo Log' and 'Invia' buttons at the bottom.
- DATA SITE CONNECTION TEST:** The header shows the time 11:52. It features two test options: 'Test Connessione Dati' and 'Test Connessione Ftp', each with a 'Start' button.

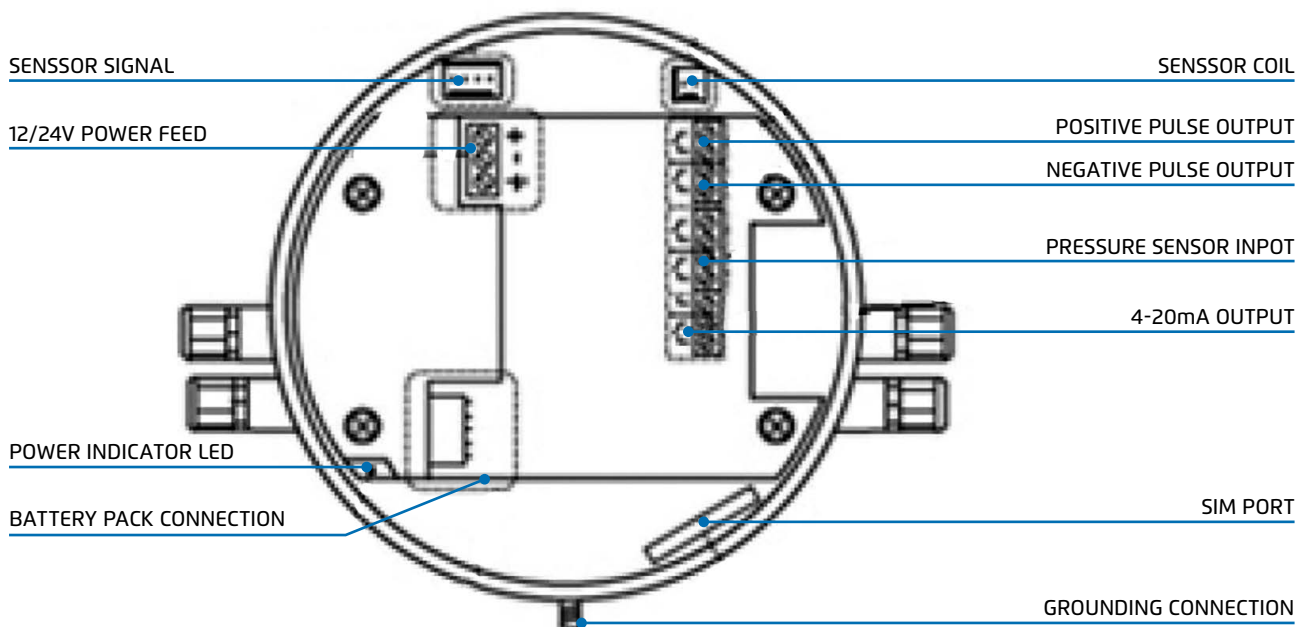
## 8 4-20mA OUTPUT MODULE

The 4-20 mA output module is an expansion of the MC406 electronic converter, which makes it possible to transmit one of the quantities measured on the 4-20mA line LOOP POWERED [Loop voltage 24Vdc; maximum impedance 800 ohms].

It is possible to map on this output:

- Instant flow rate
- Instantaneous flow rate as a percentage of the full scale
- Pressure
- Temperature T1
- Temperature T2

It is possible to select the flow rate value to be associated with 4 mA and that to associate with 20 mA.



It is possible to select the current values to be generated in case of Overload / Underload according to the standard NAMUR N43 (es. AO-LL = 3.8mA, AO-UL = 21.6 mA)

It is possible to manage error reporting via 4-20mA by selecting the current values to be generated in the event of:

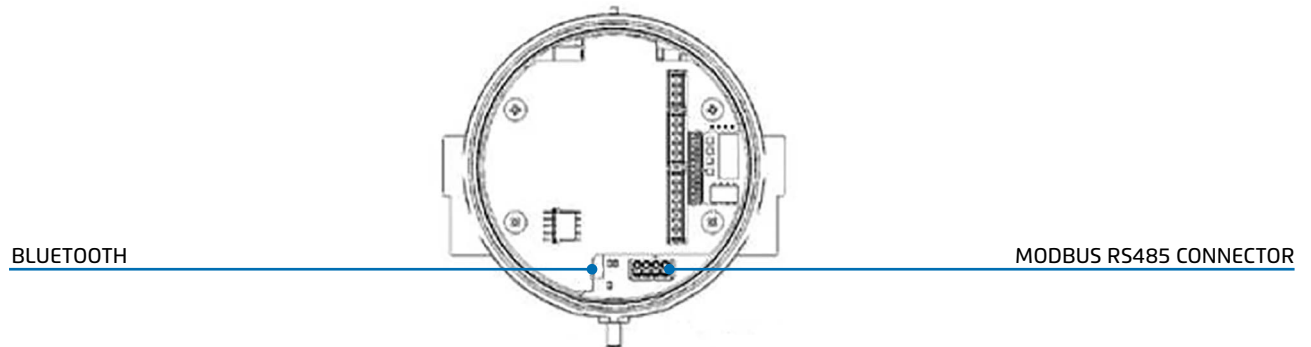
- Reverse flow
- Empty pipe
- Coil error
- Generic error

It is possible to activate the simulation mode, setting the flow rate value that the instrument detects and verifying the correctness of the 4-20mA signal generated by the module. This simulation has a maximum duration of 20 minutes, after which the meter returns to normal operation. During the simulation mode, the total counters are not increased

In case of malfunction of the module, the error code 501 will be displayed on the instrument display

## 9 BLUETOOTH – MODBUS MODULE

The Bluetooth - Modbus module is an expansion of the MC406 electronic converter, which makes it possible to communicate the instrument with a PC via Bluetooth and Modbus.



For communication on the PC side, a USB dongle will be provided to be connected to a USB socket on a computer with Windows operating system.

### 9.1 BLUETOOTH COMMUNICATION

Bluetooth is a device that consumes a lot of current so, to guarantee battery life, it will be activated periodically by MC406 in order to search for a possible connection request from a PC.

The periodicity of the ignition can be set from menu item 44.

The following values are available:

- 5 = Power on every 10 minutes
- 6 = Power on every 15 minutes
- 7 = Power on every 30 minutes
- 8 = Power on every 60 minutes
- 9 = Always powered
- 0 = Off
- 1 = Power on every 30 seconds
- 2 = Power on every 60 seconds
- 3 = Power on every 2 minutes
- 4 = Power on every 5 minutes

The switch-on duration is set by menu item 45, in a range between 3 and 30 sec.

For distances between MC406 and PC shorter than 1 meter, a switch-on duration of 3 seconds is recommended (default).

For distances between 2 and 4 meters, a switch-on time of 4 seconds is recommended.

For distances over 5 meters we recommend an ignition duration of 5 seconds or more.

The module activates the Bluetooth connection with the selected periodicity and for the set duration, in search of the PC. Once the connection with the PC is established, the Bluetooth module will remain on for a maximum of 15 minutes allowing configuration and/or data download operations using the User Interface software.

By simultaneously pressing the P1 and P4 keys (device reset) you can immediately activate the search for Bluetooth communication. This activation will last for a maximum of 30 seconds and then the device will re-search for the connection with the periodicity set in parameters 44 and 45.

The instruments are shipped by BERMAD with Bluetooth disabled.

It is therefore necessary to activate the Bluetooth connection at the first start by going to menu item 44 and selecting a value other than 0.

For a first function test and for the initial configuration of the device, it is recommended to set parameter 44 to 1 (switch on every 30 seconds)

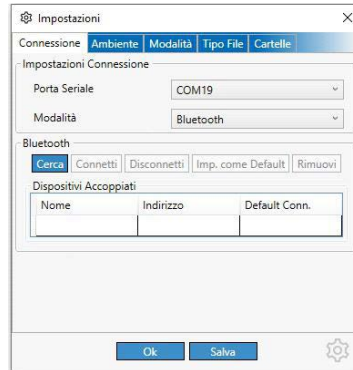
At the end of this phase it is necessary to set the Bluetooth to turn on every 10 minutes.

It is important to remember that the Bluetooth device has a high current consumption therefore, in order to preserve battery life, it is recommended to select a power-on interval of not less than 10 minutes.

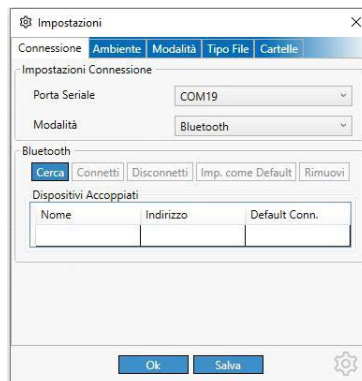
In case of selection of lower intervals, the instrument signals error 601

## 9.2 PC CONNECTION THROUGH SOFTWARE INTERFACE

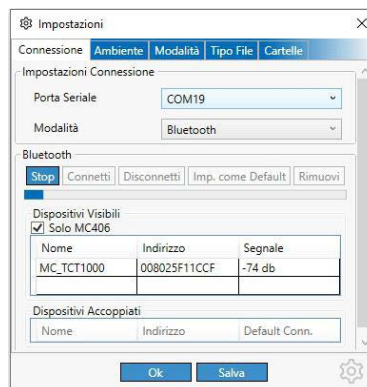
Communication between MC406 and PC (Windows) via Bluetooth is managed with the User Interface software, selecting Bluetooth instead of Icom according to the following procedure.



- Insert the USB dongle into a free USB slot, a COM communication port will be generated
- Open the User Interface software and select the menu item Options-> Settings-> Connection

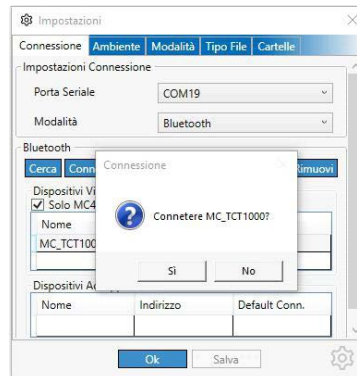


- Select the COM port corresponding to the USB dongle.
- Select Mode-> Bluetooth
- Click on "Search"

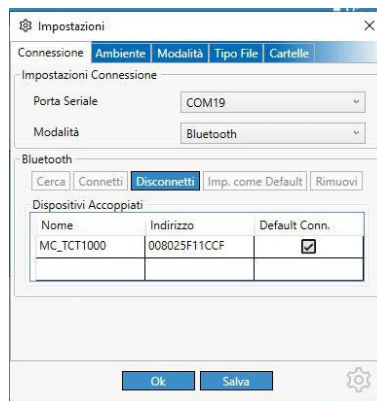


The software will start searching for visible devices nearby. If the flag on "MC406 only" is selected, only MC406 devices will be filtered, otherwise all visible Bluetooth devices will be displayed.

Once a device is found, click on the corresponding line. This will stop the search and connect to the device



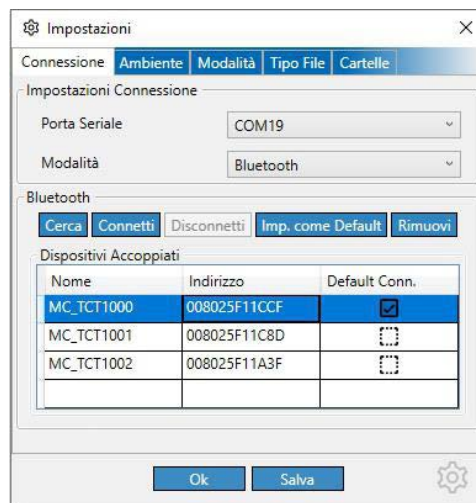
With the device connected, click on "Disconnect" to terminate the connection.



The next time you start, you can connect directly to the last paired device



If multiple devices are paired, you can select which one to use at startup. From the settings menu, select the device in the list of Paired Devices.



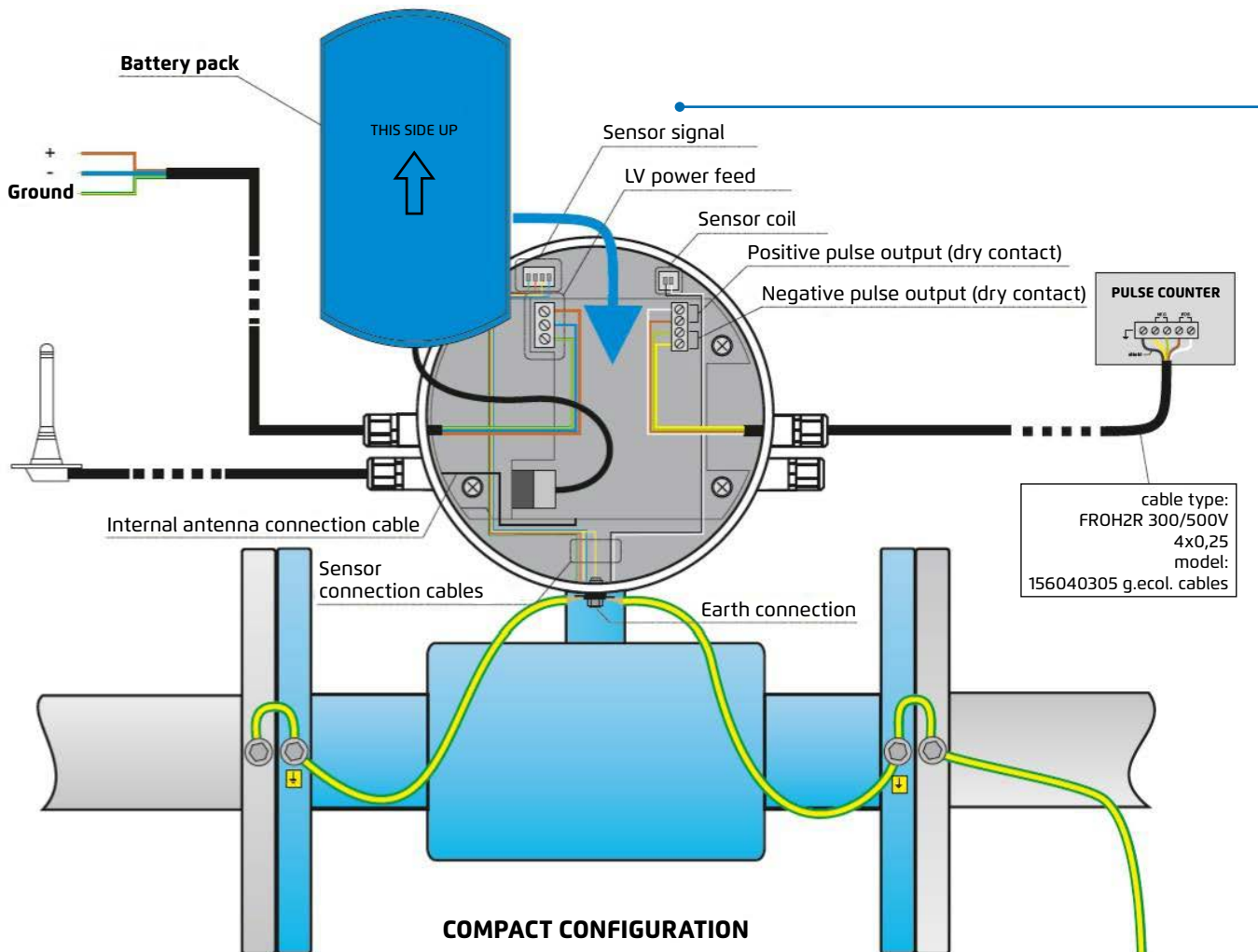
Click on "Connect" to connect the device.

Click on "Imp. Default" to set the device to connect at startup.

Click on "Remove" to remove it from the list.

## 10 CONVERTER INSTALLATION

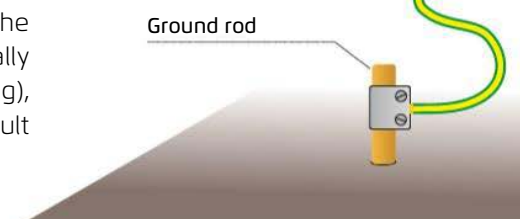
Once the meter has been installed, the pulse outputs can be wired; the maximum voltage allowed is 30 V ac or dc (no polarity attention is required). The clean electronic contacts can handle a current up to 100 mA. The battery pack must also be connected to the motherboard (if it is not shipped already connected). You must remove the battery pack, insert the connector and put it back in place. Observe the orientation of the package as shown (see the image below). At this point the allowed parameters can be viewed and adjusted.



### 10.1 GROUNDING RECOMMENDATION

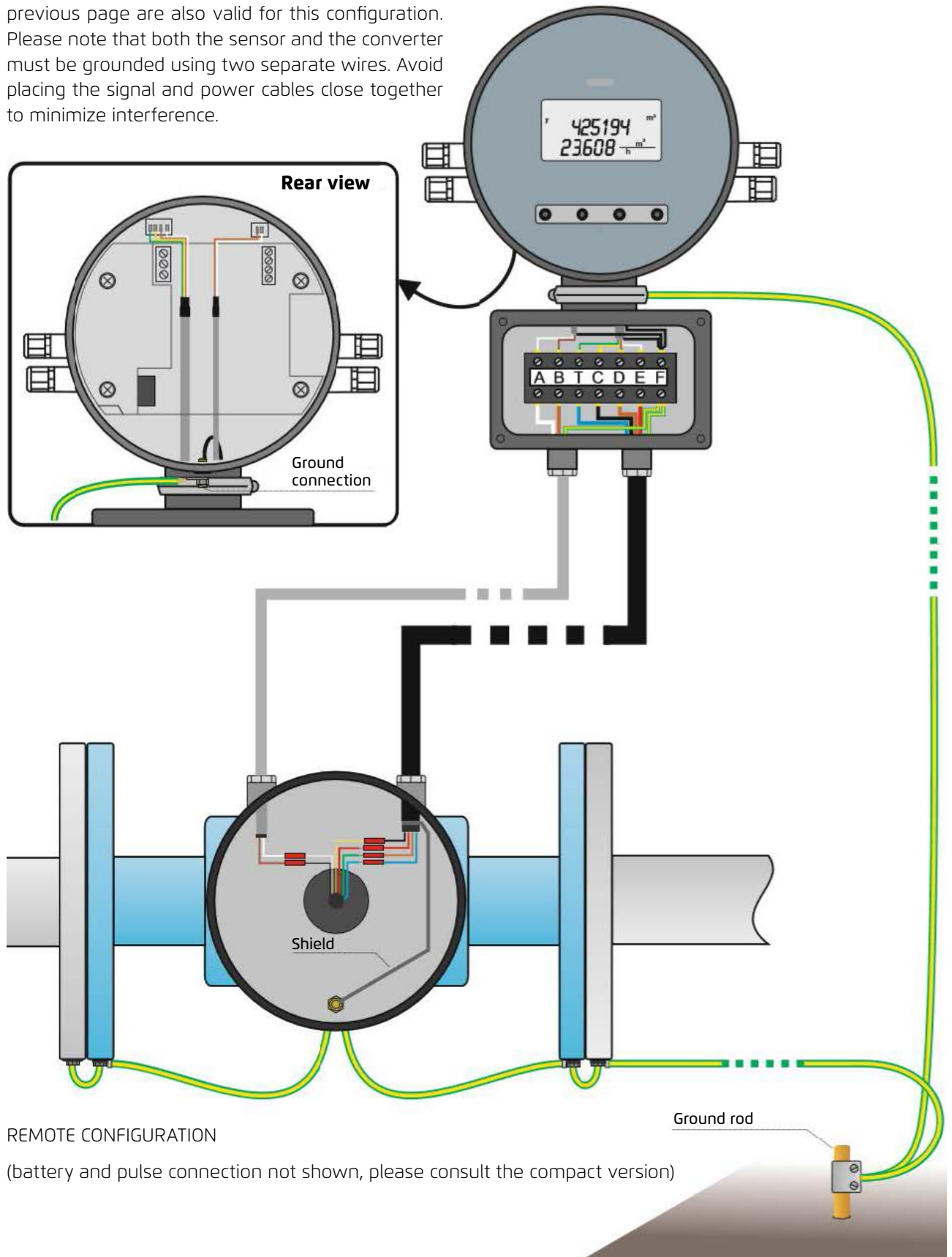
The purpose of the ground connection is to protect the system from external electromagnetic interference and set the reference of meter measurement. To achieve this requirement is A clean ground connection with the lowest possible resistance is required.

We recommend using at least a 4mm<sup>2</sup> / AWG11 cable to make the ground connections. In the event that the liquid is not electrically grounded/connected to the pipes (plastic pipe or internal coating), grounding rings are required. Missing or incorrect grounding will result in unpredictable behavior.



## 10.2 SEPARATE CONFIGURATION

All the grounding recommendations described on the previous page are also valid for this configuration. Please note that both the sensor and the converter must be grounded using two separate wires. Avoid placing the signal and power cables close together to minimize interference.

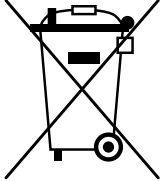
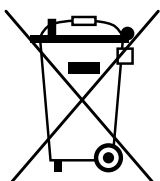


REMOTE CONFIGURATION

(battery and pulse connection not shown, please consult the compact version)

## 11 DISPOSAL OF THE CONVERTER

The manufacturer declares that the design, development and construction of the CONVERTER have been carried out in compliance with the directive on the reduction of the use of hazardous substances with particular attention to the application of electrical and electronic equipment (WEEE), favoring environmental and worker health protection, the intervention of the subjects participating in the application, use and disposal of its products (manufacturer, distributors, consumers, operators involved in the treatment of WEEE).

	<p><b>DISPOSAL OF THE CONVERTER (WEEE / WEEE, waste from electrical and electronic equipment)</b></p> <p>This symbol on the converter, on the accessories and on the documentation indicates that the product and its electronic accessories must not be disposed of with household waste at the end of their life cycle. To prevent damage to the environment or human health from inappropriate disposal, separate it from other types of waste and be recycled responsibly to promote the sustainable reuse of material resources. Business users are encouraged to contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories must not be disposed of along with other commercial waste.</p>
	<p><b>DISPOSAL OF BATTERIES AND ACCUMULATORS</b></p> <p>This symbol shown on the battery pack, and on the documentation indicates that batteries should not be disposed of with waste domestic at the end of their life cycle. Batteries and accumulators contain important resources that can be recycled, and highly polluting chemicals, such as lead (Pb), cadmium (Cd), zinc (Zn), lithium (Li) and mercury (Hg). If batteries and accumulators are disposed of in an undifferentiated way together with other domestic waste, it will not be possible to recycle them and the substances they contain will contribute to the pollution of the environment. They must therefore be sent to the collection points indicated for recycling. For more detailed information about the disposal of the used battery or the product, the Municipality, the local waste disposal service or the company from which it was purchased can be contacted.</p>