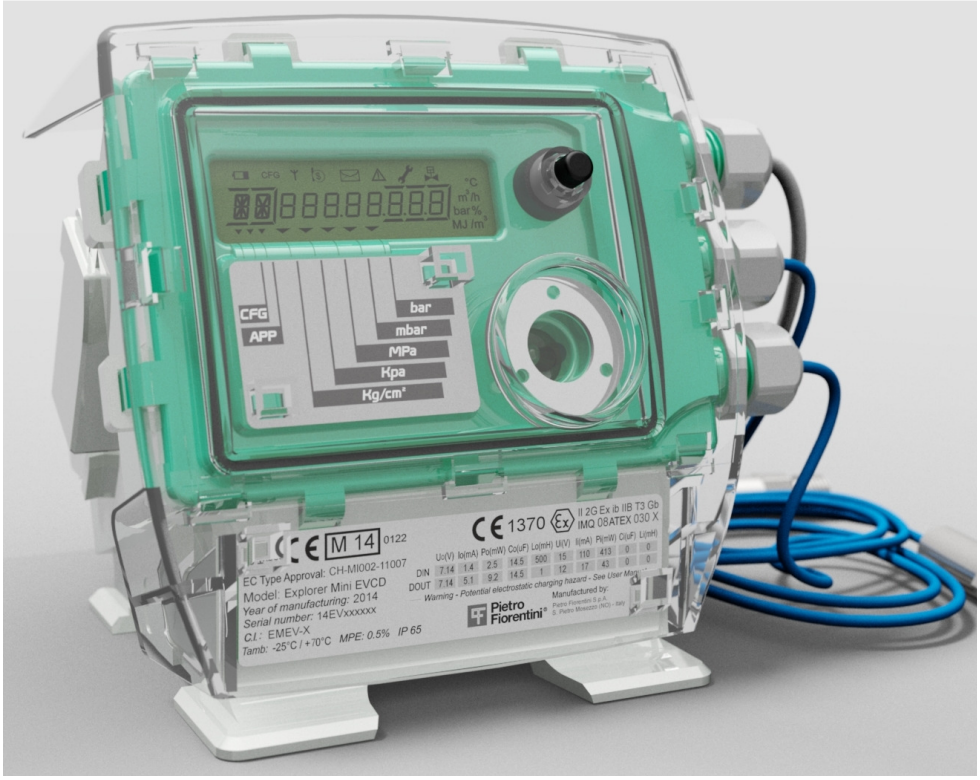
Pietro Fiorentini®

€xplorer *mini EVCD*

Electronic volume converter with built in modem



User manual

Edition	Date
0.1	**01/12/2015**
Firmware Version **3.1** **CRC 0x1AF5**	

ENGLISH

Edition	Revision	Date
0	1	01/12/2015

Index

1 Introduction

€xplorer is a family of products dedicated to the measurement and conversion of gas volume, which is applied at end redelivery points of natural gas networks.

This document describes the €xplorer mini EVCD version, defined as “Electronic Volume Conversion Device” (EVCD) Type 1 in accordance with the definition given by EN 12405. The product has a built-in GSM / GPRS modem to allow the remote reading and remote control without requiring the use of external equipment. This document provides information regarding the installation and use of the device.

Explorer Mini EVCD is available in different models with the following main shared features:

- Compact single block in plastic lightweight material
- IP65 protection and tropicalization treatment
- 1.5B absolute pressure sensor with 1.5 m cable
- Temperature sensor with 1.5 m cable
- LF metering input and digital input with anti-tampering function with 1 m or 2 m pre-wired cable
- Local optical communication port type ZVEI
- LCD display
- Front key (user interface)
- Two programmable digital outputs, Namur compatible
- Integrated GSM/GPRS modem
- Integrated dual band antenna

The various models differ in the following features:

- SIM type
- Modem battery type

1.1 *Product Identification*

The product can be identified by the label of Fig. 2 applied on the front of the device (Fig. 4). The following symbols and fields are shown:

- **Model**
- ***Construction Identification* (C.I.)**
- ***Year of construction***
- ***ATEX approval data and IS parameters***
- **Serial Number**

Model

Explorer Mini EVCD

C.I.

Field consisting of:

EMEV	model identification
C1,C2,C3	configuration identification

C1 (Sensor #1 Type)

T	Temperature Probe

C2 (Sensor #2 Type)

1.5	Pressure FS=1.5 bar A

C3 (Modem Battery pack type)

1	Single battery
2	Double battery

Serial Number

Field consisting of:

AA	Year of manufacture (last two digits)
EV	Product family Explorer Mini EVCD
NNNNNN	Unique identification number (progressive)

Example

14EV004800

Year production	2014
Device	Product family €xplorer Mini EVCD
Identification number	Device No. 4800

1.2 *Packaging content*

The package contains the following parts

Device

- Device €xplorer Mini EVCD including
  - Cable and Pressure Sensor already wired
  - Cable and Temperature Probe already wired
  - Metering cable (3-pole) already wired
  - Control and measurement module battery pack
  - Modem battery pack
  - Internal dual band antenna
  - Two plugs for cable glands

The battery packs are within the operation seat and not electrically connected

The plugs of the cable glands are already installed in the rear glands

Plates

- Meter rating plate and related support

Manuals and communication software

- Quick Installation Guide and Safety Instructions

The complete manuals and standard communication software are available for free download (after registration) from the website www.fiorentini.com

Certificates

- Certificate of CE Conformity
- Calibration certificate

2 Safety instructions

Explorer Mini EVCD is an intrinsically safe device suitable for use in hazardous areas classified as Zone 1, 2 group IIB.

The device consists of a control and measurement card that performs the main operations (acquisition, storage, interface, and local communication) and of a GSM/GPRS modem module.

The minimum installation category is ATEX Category II 2G and the harmonized CENELEC standards relevant to the compliance with the EHSR (Essential Health and Safety Requirements) requirements of the ATEX Directive are EN 60079-0, EN 60079-11, and EN 60079-26.

This device is designed to comply with the requirements of the type of protection Ex ib IIB T3, ambient temperature -25° / + 70° C and ATEX category II 2G.

2.1 *Electrostatic discharges*

This device is approved for installation in a potentially explosive area. In this area, sparks produced from electrostatic discharges could generate explosions. Although during normal operation there is no presence of dangerous potentials on the device, the use of dissipative footwear and of a damp cloth (ρ% > 65%) is recommended during the installation/maintenance. Further information can be found in CEI 50404. Pay utmost care also when accessing the internal parts (terminals, buttons), also in a non-hazardous area, because the device contains sensitive devices and may be damaged.

During the installation or use of this instrument, it is compulsory to take steps to assure protection against electrostatic discharges.

2.2 *Connecting to other devices*

€xplorer Mini EVCD can connect to other data communication and control devices.

All the devices connected to €xplorer Mini EVCD must be **LOCATED IN A SAFE AREA** and be approved as associated devices and, within this framework, they must be compatible with the SAFETY PARAMETERS (IS) given under section 2.3.

While performing this assessment, it is necessary to consider also the connection cable. In particular, the following shall be verified:

Associated device parameter	CONDITION	€xplorer Mini DL parameter
Uo	≤	Ui
Io	≤	Ii
Po	≤	Pi
Co	≥	Ci + Ccable
Lo	≥	Li + Lcable

This condition must be observed even in the opposite direction, where applicable

Uo / Io / Po	Maximum Voltage / Current / Power supply deliverable at output from the Associated Device
Ui / Ii / Pi	Maximum Voltage / Current / Power applicable at input to €xplorer Mini EVCD
Ci / Li	Maximum Capacitance / Inductance present at the input terminals of €xplorer Mini EVCD
Co / Lo	Maximum Capacitance / Inductance applicable at the terminals of the Associated Device
Ccable, Lcable	Maximum Capacitance / Inductance featured by the specific cable (also considering its length)

Pietro Fiorentini S.p.A. denies all liabilities resulting from the risks and consequences caused by the failure to comply with these provisions.

2.3 *Feeding Devices*

The €xplorer Mini EVCD device can be powered ONLY by special approved batteries.

Two different types of batteries are forecast to be used for the measuring and the modem modules, respectively.

As a matter of fact, each battery is a proprietary assembly consisting of a lithium battery, protection devices and a cable ending with an appropriate connector, encased in a protective sheath and called “LITHIUM BATTERY PACK”. On the battery pack a label with the identification code is applied.

- Measurement module **AS0640T03M01R00**
- Modem module **AS0640T02M01R00** single battery pack
- Modem module **AS0640T01M01R00** double battery pack

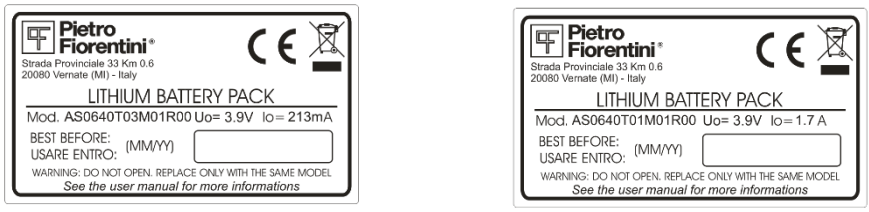
The battery packs are a device certified for exclusive use with €xplorer mini EVCD and it is the only permissible power supply device.

Caution!
Use only batteries of the type and model complying with the original

The connectors of the two EVCD and modem battery packs are incompatible with one another and polarized in such a way that they can be inserted only in their corresponding connector provided on the device.

The label (Fig. 1) bears the following data:

- Model
- Maximum output levels
- Date of maximum use (month/year)
- Symbol for proper disposal



EVCD **MODEM (double battery pack)**

Fig. 1 - Battery pack labels

The date of maximum use is the maximum installation date by which 80% of the initial charge is guaranteed.

The date refers to the pack stored in a dry environment at a temperature not exceeding 20°C. Storage at high temperatures may reduce the remaining charge even significantly.

2.4 *IS Parameters*

The following table shows the electrical parameters related to intrinsic safety.

Parameter	Uo (V)	Io (mA)	Po (mW)	Co (uF)	Lo (mH)	Ui (V)	Ii (mA)	Pi (mW)	Ci (uF)	Li (mH)
DIN(Digital Input)	7.14	1.4	2.5	14.5	500	15	110	413	0	0
DOUT(Digital Output)	7.14	5.1	9.2	14.5	1	12	17	43	0	0

The label of Figure 2 shows the identification data of the individual device, the data relating to IS parameters and their symbols; moreover, it shows the symbols and number of the metrological certificate.

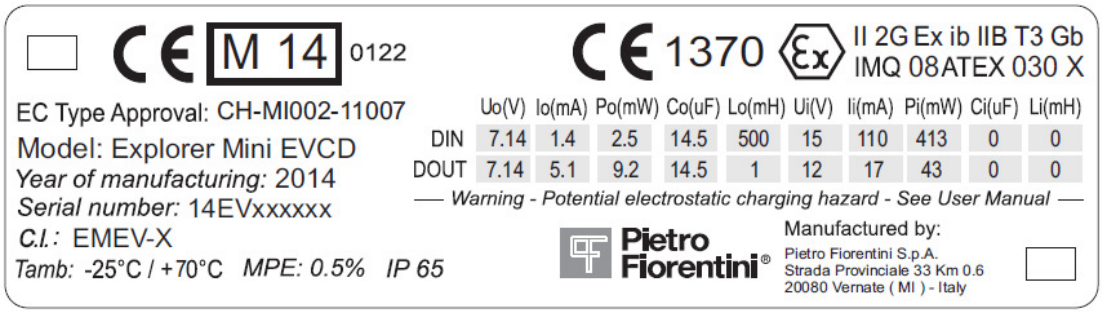


Fig. 2 – Device label

Description of the symbols related to intrinsic safety

IMQ 08 ATEX 030 X	Certificate number according to ATEX standards
CE	CE logo (conforming device)
1370	Code identifying the notification body (IMQ)
Ex	Logo Ex (conforming device)
II	Group II (surface)
2G	Device category 2G
Ex ib	Type of protection
IIB	Gas group
T3	Temperature class
Tamb: -25°C ~ +70°C	Ambient temperature range within which IS conformity is guaranteed

Zones		***Categories pursuant to the Directive 94/9/EC***
Gas, mist or vapor	Zone 0	1G
Gas, mist or vapor	Zone 1	2G
Gas, mist or vapor	Zone 2	3G

Table of Categories / Zone correspondence

3 General Description

Figures 4 and 5 illustrate the structure and the main parts of the device.

The device consists of a plastic enclosure that contains inside it:

- the control and measurement card
- the modem card
- battery support block and batteries

On the front there are:

- a segment and icon display
- one operator key;
- optical communication interface

Three connection cables are connected in a fixed way to the device (1.5 m long). They connect to:

- pressure or temperature sensor (depending on the product configuration)
- pressure probe (depending on the product configuration)
- metering cable and digital input

On the back there are:

- cable grommet for connecting the digital outputs to the terminals
- cable grommet for connecting any external antenna.

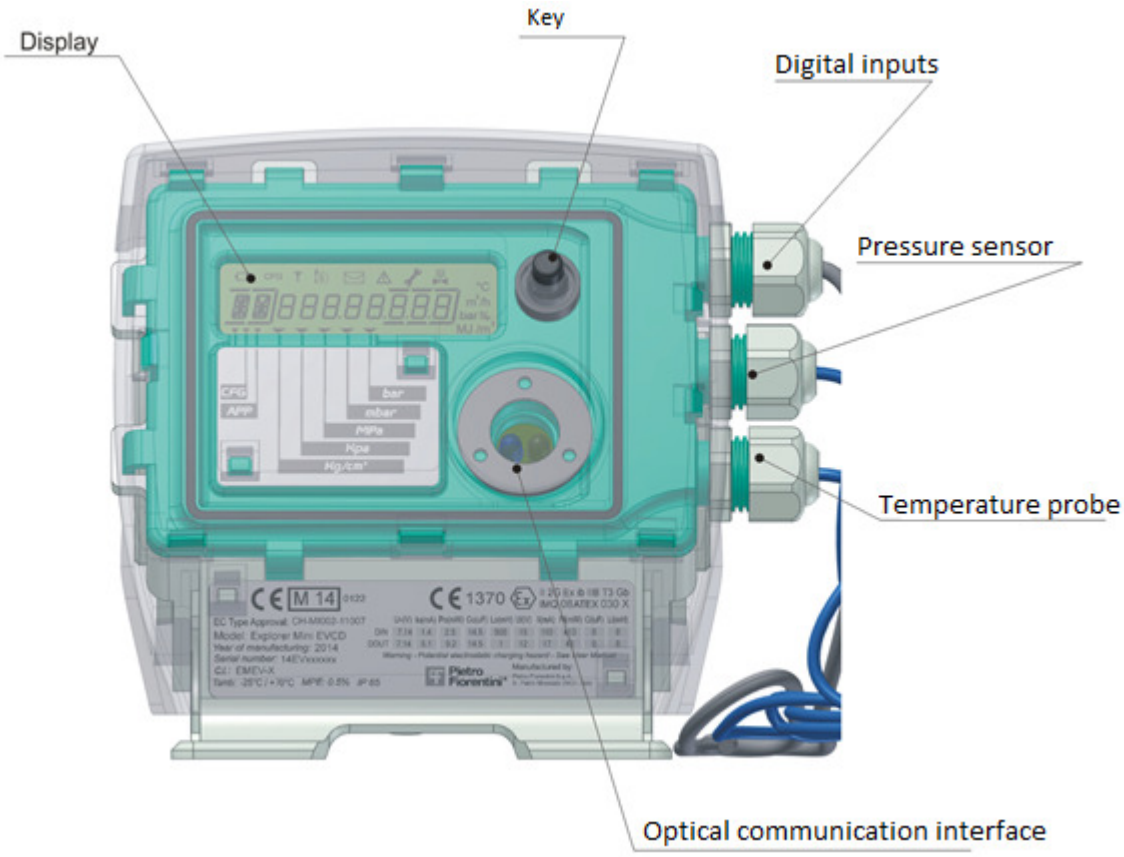


Fig. 4 – Front view of the device and its main parts

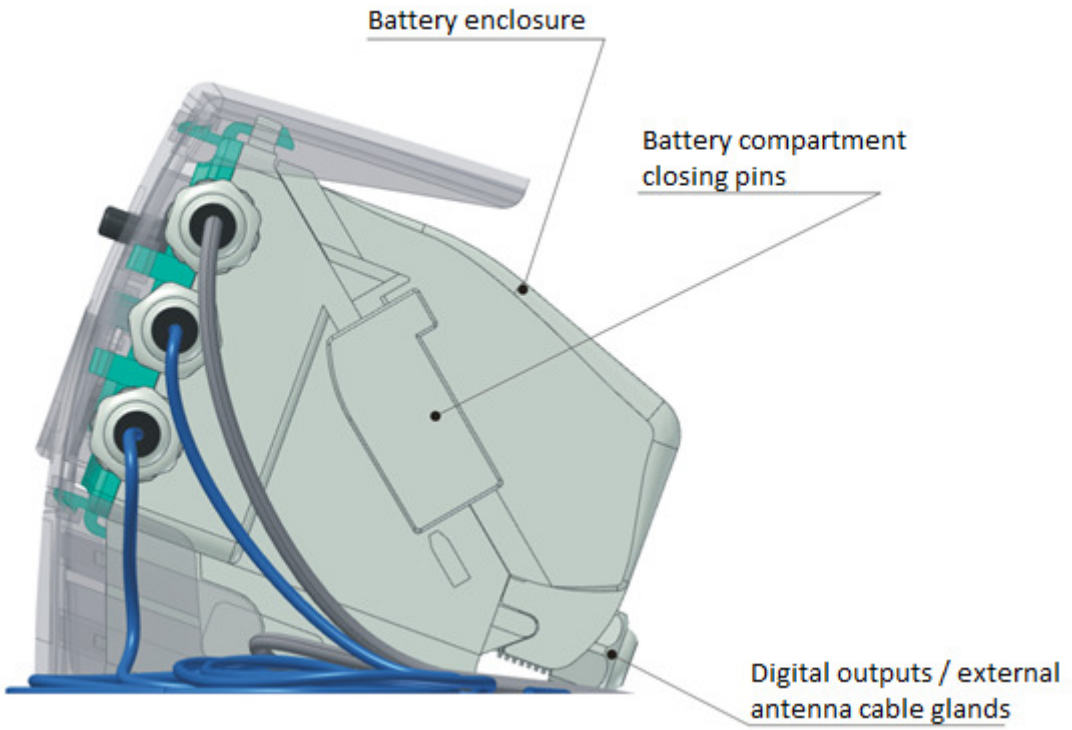


Fig. 5 – Side view of the device

The battery enclosure is separated from the main body and is locked on it by means of plastic closing springs

4 Main Functions

€xplorer Mini EVCD is suitable for installation in hazardous areas (as indicated in the Safety Instructions section) for direct connection to primary elements (gas meter or turbine) and for measuring the operating pressure and temperature through integrated transducers.

4.1 *Acquisition*

The input variables (pressure, temperature (if any), digital input status and meter) are acquired and updated every 30 seconds.

If the user interface is active, the acquisition is continuously updated in order to provide a more immediate feedback on the display.

4.2 *Events and Diagnostics*

€xplorer Mini DL can record events in failure conditions or when specific application operations do occur.

The events log can contain up to 10000 records. The events are stored in an area of the permanent (flash) memory.

4.3 *Volume conversion*

€xplorer Mini EVCD calculates the volumes every 30 seconds. The measured volume **Vm** is calculated by multiplying the number of pulses received in the period for the pulse weight, which is set during the configuration of the system.

The input pulse weight is expressed in m3 per pulse and can be programmed to one of the following values:

- 0.001 m3
- 0.01 m3
- 0.1 m3
- 1 m3
- 10 m3
- 100 m3

When each of the periods expires, the current values are consolidated in the corresponding values of the previous periods and the current ones are zeroed.

The acquisition of new measures and the calculation are normally carried out every 30 seconds, unless there is any ongoing activity from the keyboard or from the communication line. In this case, the acquisition cycle and the calculation is repeated continuously. The calculation of the volumes is in any case performed every 30 seconds.

When the device is in a power-off status (powered by the back-up battery), the pulses are accumulated and will be counted when power is restored. In the event of a system shutdown, they are stored and will be counted upon restart.

4.4 *Digital outputs*

€xplorer Mini EVCD has 2 multifunctional digital outputs. Each output can be independently configured to perform one of the following functions:

- Volume repetition

The outputs can work as volume repeaters (Vm) allowing the remote transmission of the measured volumes. The weight of the pulses can be selected among 1, 10, 100 and 1000 m3/pulse

- Diagnostics status

The digital output repeats the status of one or more diagnostics bits. The information to be repeated is configurable.

The physical interface is open drain, Namur compatible.

4.5 *Data recording*

The acquired and calculated variables (pressure, temperature, Vm, TFS and diagnostic information), can be selected to be recorded in the device. Recording takes place on a permanent (flash) memory.

The configuration of the Log parameters is possible only by using a communication software.

Parameters

- Log name (Default Log1, Log 2, Log3)
- Variable list (1 to 13)
- Period: 30 seconds to 8 hours (with 30-second pitch), daily (value: -1) and monthly (value: -2)
- Strategy: Average (on the period), statistics (min, max, mean and σ standard deviation valid only for analog measurements of P and T)
- Number of records (up to 65535)
- Filling mode (Filling: it stops when the number of selected records is reached; Circular: when the set record number is reached the oldest data are overwritten)

There are 3 separate sets of logs, which can also be active simultaneously. For each set, it is possible to specify different storage parameters. The reconfiguration of a Log requires it to be first of all stopped and then deleted. The use of the statistical recording function is limited only to the P and T quantities and the list of variables must contain only this or these two quantities. Each record also bears the

system status in which it was carried out (normal or maintenance).

4.6 *Communication*

€xplorer Mini EVCD has two communication interfaces, a local one and a remote one:

- ZVEI optical port Infrared port with the IEC1107 physical standards; it requires an external communication device (ZVEI probe)
- GSM/GPRS modem Integrated in the device

The protocol used for both ports is MODBUS. The format and the speed of the optical port are set to the following values:
Velocity: 9600 baud, format: 8, N (no parity), 1

The ZVEI optical port is normally turned off when the display is off; to use it, press the operator key so that it lights up. The interface remains active for one minute after the last exchanged message.

4.7 *User interface*

The user interface consists of a LCD display and one operator key. The interface only allows the consultation of the parameters by pressing the button. Programming is only possible through local or remote communication.
There is also a programming button, accessible after removing the back cover (protected by metrological seal). To allow the modification of the relevant parameters from the metrological point of view it is necessary to press the programming button.

5 Installation

€xplorer Mini EVCD is suitable for installation in hazardous areas and it complies with the protection requirements of type Ex ib IIB T3.

Caution!
Before beginning with the installation, read and verify the safety instructions contained in the first chapter carefully.

5.1 *Mechanics Installation*

The device is pre-arranged for mounting to a pole or a wall using a universal mounting plate - see Fig. 7

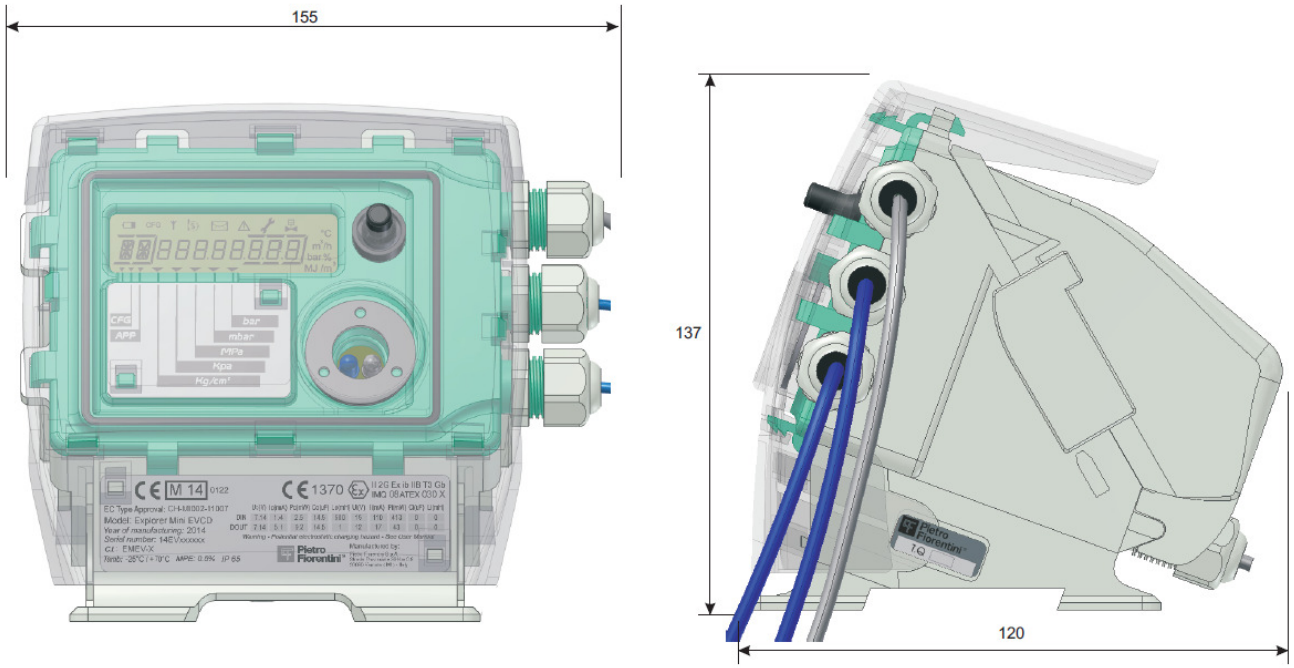


Fig. 6 – Device overall dimensions

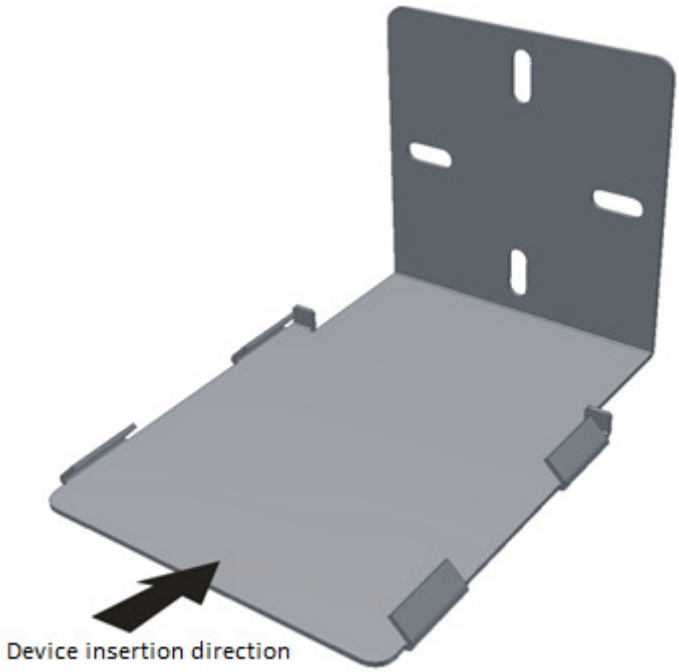


Fig. 7 – Universal mounting bracket

5.1.1 *Pole installation*

- Fix the plate of Fig. 7 to the pole using a strap. The plate is suitable for installation on vertical and horizontal pipes.
- Let the device base slide on the plate in the direction indicated by the arrow in Fig. 7

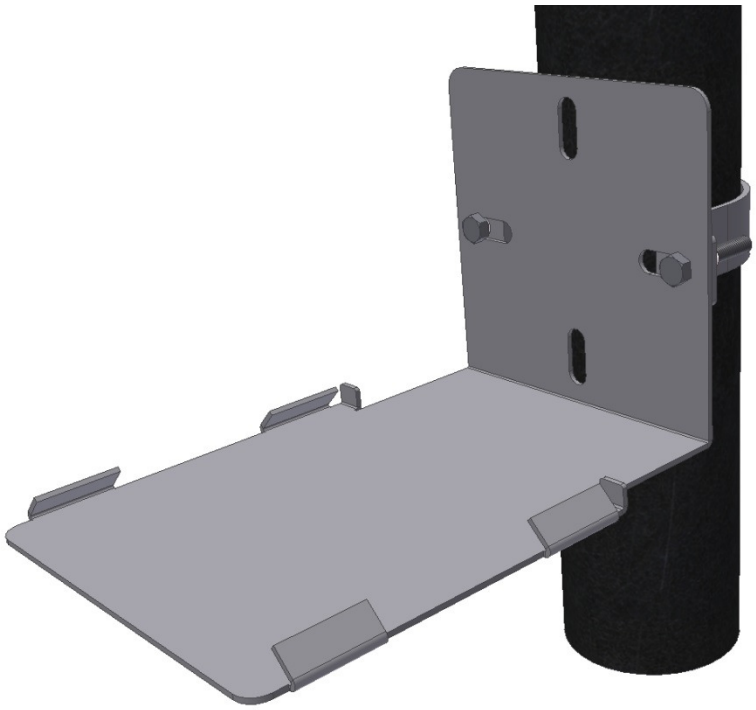


Fig. 8 - Pole installation of the plate

5.1.2 Wall installation

Fasten the plate to the wall using dowels. Let the device base slide on the plate in the direction indicated by the arrow in Fig. 7

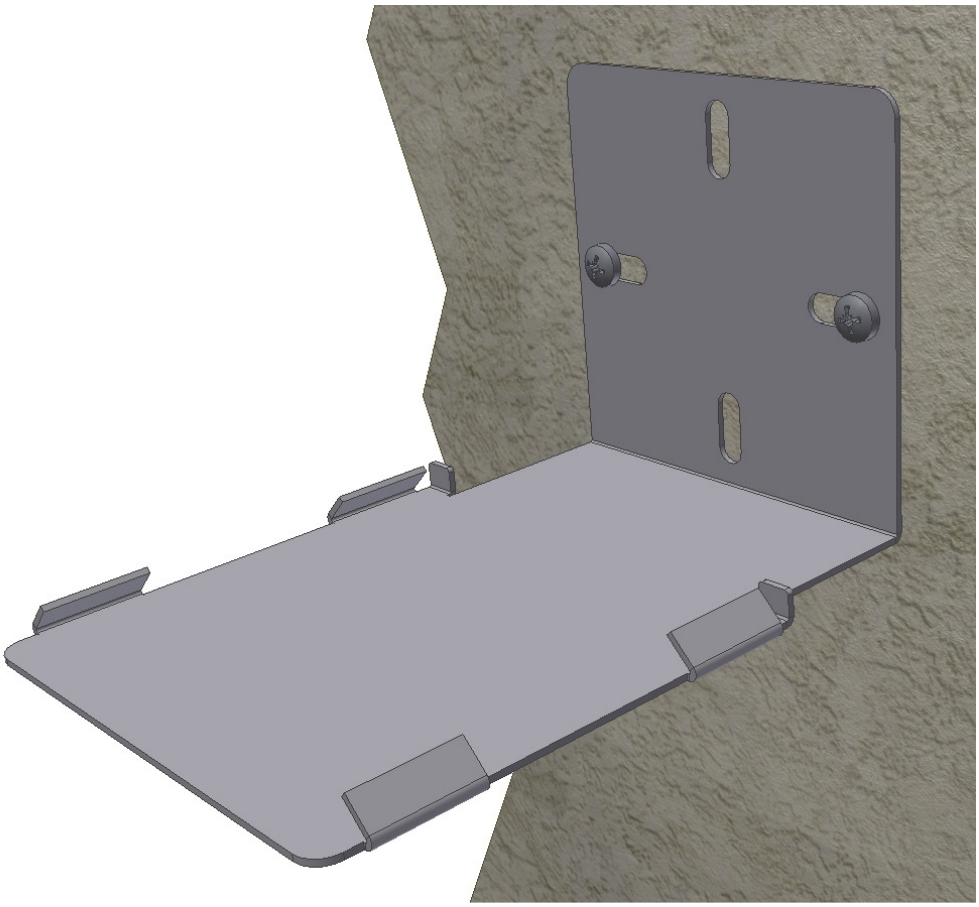


Fig. 9 - Wall installation of the plate

5.2 *Process Connection*

After fastening it, the device must be connected to the system. The pressure and temperature sensors are external and already connected to the device; also the cable providing connection to the turbine is fixed and already internally connected to the device. These connections are not accessible and the corresponding sensors cannot be removed in any way whatsoever as they are an integral part of the metrological equipment of the device.

- Pressure connection sensor(s)

  Before connection, make sure that the piping maximum pressure is lower than the maximum pressure forecast for by the sensor. If necessary, use fittings (not supplied) to connect the sensor to the piping. **Absolutely avoid letting the cable rotate on itself as this may damage the sensor**
- Connection of the temperature probe

  Insert the temperature probe in the temperature well and secure it with a fitting being compatible with the well threading
- Connection to the turbine

  €xplorer Mini EVCD only supports a low frequency output and has a third wire for inspecting the cable integrity

  If you want to use this control, connect the third wire to a ground terminal inside the turbine connector

Once the connections are made and their proper operation is checked, it is possible to insert special *user* seals to protect the door and prevent access to the terminals. Do not confuse the user seals with the metrological seals: the metrological seals (3 seals) consists of a breakable adhesive label and are applied at the factory; their removal shall make the metrological certification void (Fig. 10).

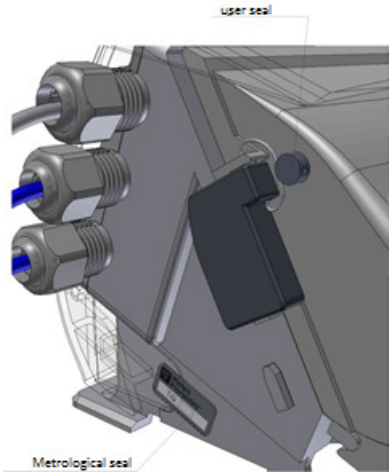


Fig. 10 - Metrological and user seals

5.3 *Electrical installation*

The following figures show the user connections, the installation of the batteries, as well as the metering cable wiring.

5.3.1 Digital outputs

The connector related to the digital outputs is accessible on the back, after removing the battery compartment (Fig. 5). The use of these outputs is optional.

The terminals for these connections are direct insertion spring-type terminals. To insert the single conductor it is advisable to insert first of all its end using a ferrule and then it is sufficient to press it within the hole to block it. To remove the cable, use a flat-blade screwdriver, press on the appropriate terminal pin and, holding it down, remove the conductor.

#Pin	Name	Function	Type of signal
1	OUT1	Digital output 1	Open Drain, Namur compatible
2	OUT2	Digital output 2	Open Drain, Namur compatible
3	GND	Shared ground	

After removing the battery compartment (Fig. 5), disconnect the connectors of the batteries to turn off the device.

IT IS COMPULSORY to use a shielded cable.

- loosen the cable grommet and remove the plug (Fig. 11A)
- remove the rubber cover and cut the tip of the measure required for the cable used
- insert the cable first of all in the cable grommet and then through the rubber plug
- using ferrules, insert the ends of the individual wires; connect together the shield and the rubber cable; it is advisable to use rubber pads or heat shrink tubing to secure and isolate the shield
- connect the conductors to the terminals according to the order shown in Fig. 11B.
- insert the rubber protection back into its seat, align the cable, and tighten the cable grommet

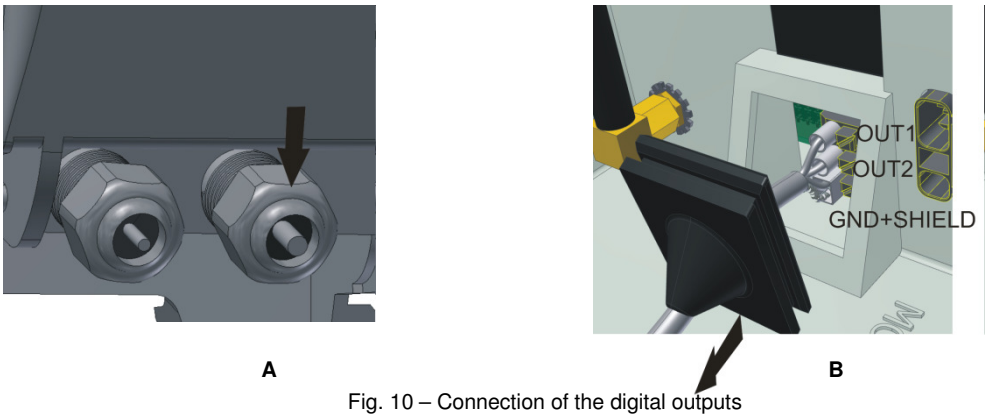


Fig. 10 – Connection of the digital outputs

5.3.2 Digital outputs cable

The cable to be used for connecting the digital outputs has to meet the following functional and security requirements:

- Cable type — Shielded (copper braid or conductive film plus copper braid)
- External diameter — 4 ~ 6 mm
- Conductor section — 0.5 ~ 1.5 mm^2 (ferrules included)
- Regulations — CEI 20-22
- Length — depending on the cable characteristics with respect to the functional and EX parameters
  For a 0.5 mm^2 cable, the maximum allowed length is 100 m

Warning: the shield is to be connected only on the Explorer mini EVCD side, with the ground cable, using a double ferrule - see Figure 11B.

5.3.3 Metering cable

The metering cable is already wired on the device; remove the sheath at the end of the cable and connect it to the LF terminals of the mechanical meter by using the conductors identified by the colors (fig. 11).

YELLOW and BROWN	Ground
GREEN	Metering
WHITE	Digital input or cable integrity check function (anti-tampering)

To use the anti-tampering function, it is necessary to ground the cable of the digital input (white color)

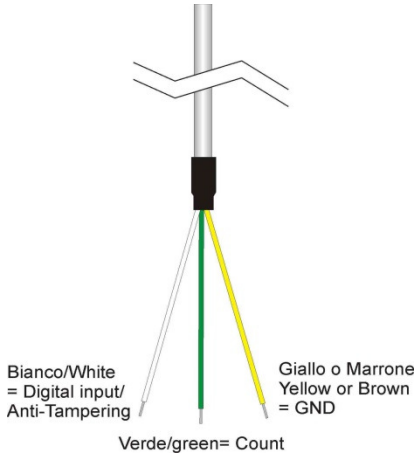


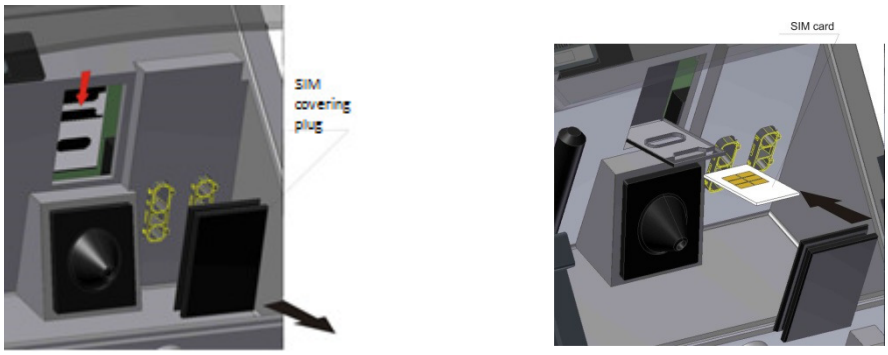
Fig. 11 – Metering cable termination

5.3.4 Installation of the SIM card

The SIM slot is located on the back. Therefore, remove the battery compartment to access it.

Warning: the removal or installation of the SIM card with ON device may result in damages to the SIM card or the device itself.

- Remove the battery connectors in order to turn off the device
- Remove the rubber plug (Fig. 12A)
- Push the metal block of the SIM connector downwards
- Insert the SIM card in the direction shown in the figure (Fig. 12B)
- Close the connector door and secure it by pushing the metal part upwards
- Reinsert the rubber plug in its seat



A **B**

Fig. 12 – Installation of the SIM card

5.3.5 Installation of the external antenna

The device is provided with a pre-installed internal antenna. If the installation site does not allow a sufficient field coverage, it is possible to install an external antenna.

The antenna connector is positioned on the back and is of **SMA** type. Remove the battery compartment to access it (Fig. 5)

- Remove the existing antenna by unscrewing it from the connector
- Unscrew the cable grommet and remove the plug and the sectioned gasket (Fig. 13)
- Insert the antenna cable and screw the connector
- Insert the sectioned gasket on the cable and insert it into the cable grommet, and screw the nut

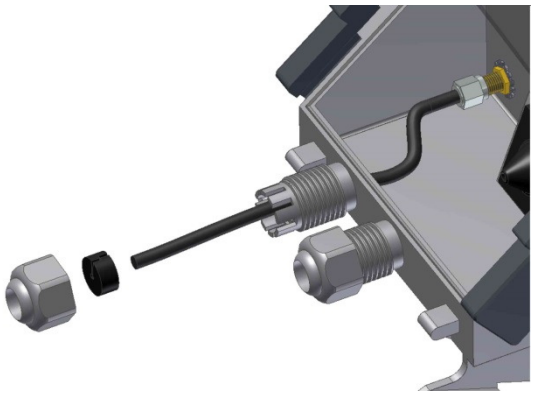


Fig. 13 – Installation of the external antenna

Caution: Use an external antenna with AN0640T01M01R00 code

5.3.6 Using the ZVEI Probe

The ZVEI probe (not supplied) is equipped with magnetic coupling. Place the probe in the provided groove on the front part of €xplorer Mini EVCD with the cable facing downwards (Fig. 14). The magnet and the groove will retain the probe in place. To use the optical communication it is necessary for the display to be turned on, so press the operator button before starting communication

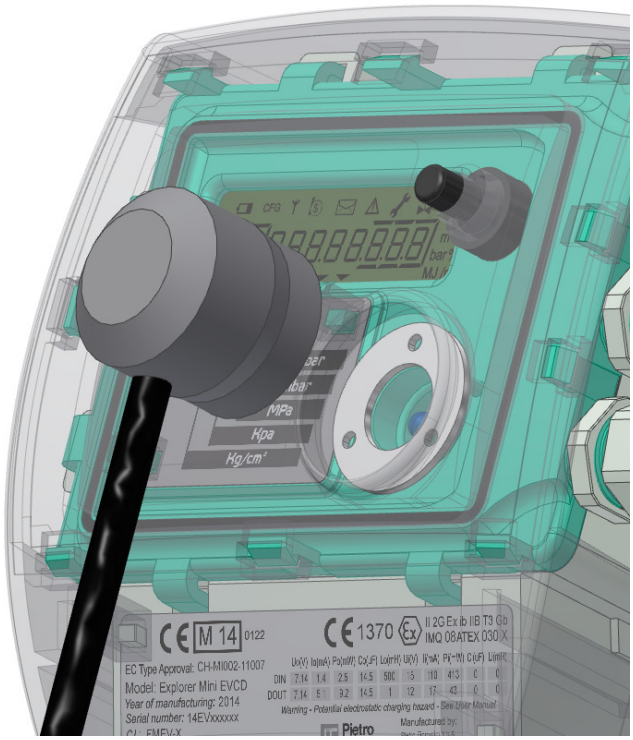


Fig. 14 - Attaching the Probe Zvei to the €xplorer Mini EVCD

5.4 *Power supply*

The €xplorer Mini EVCD meter can be powered exclusively by batteries

The standard configuration includes:

- a battery pack for the measurement section
- a battery pack with single battery for the modem section

As an option, a double battery pack is available for the modem section

A third non-removable internal battery assures that some functions are kept working during battery replacement

5.4.1 Connecting the Batteries

The batteries are already inserted in their specific compartment that is hooked on the back of the device.

It shall be underlined that the batteries are an approved proprietary assembly for exclusive use with Explorer Mini EVCD and they can only be replaced with batteries of the same model.

Connect the two connectors in the corresponding slots provided on the main device. The two connectors differ in terms of shape and polarity. To remove them, press the clip on the left side of the connector and pull them out. Do not try to remove them by pulling the cable.

Close the battery compartment back in its seat, locking it with the sliding pins as shown in Fig. 5.

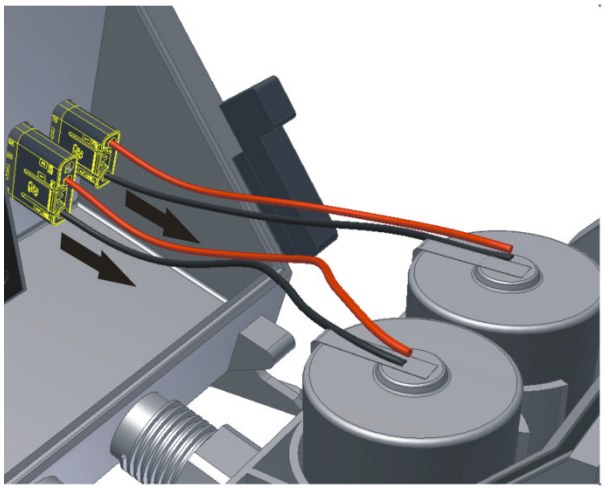


Fig. 16- Connection and disconnection of the batteries

As soon as the batteries are connected the device turns on showing for a few seconds the display with all lighted segments.

5.4.2 Backup function

The device has an internal backup battery that allows keeping a minimum functionality in the event of a power failure (when replacing the battery or the measurement module or when the battery is exhausted); therefore, the following functions remain active:

- Clock update
- Acquisition of metering pulses
- Check of the metering cable integrity

The modem section is not provided with any backup battery; therefore, in the event of power failure, its capabilities are completely inactive.

The device is supplied with disabled battery in order to preserve its charging. The battery is automatically activated when the configuration is done. In case of a power failure (power fail), the device carries out the following functions:

- conclusion of any ongoing activities (acquisition, calculations, data writing)
- storage of the backup data to the permanent memory
    - power fail start time
    - totalizer value (totalizers, totalizer of price ranges, billing period closing data, consumption data, and service quality)
    - current instantaneous values
- switching-off of part of the machine and start of the power fail status

The power fail status is displayed by the battery icon on the display (the rest of the display is off)

The power fail status remains active until power is restored or until a limit of **two hours** expires**.**

- If power supply is restored within two hours, the device automatically resumes operation by restoring the saved data.
- If power supply is not restored within two hours, the device is switched off completely. Upon reset, the device needs to be reconfigured before resuming operation.

5.4.3 Forced shutdown

In case of power-fail, it is possible to run the forced shutdown procedure without having to wait for the two hours of the timeout. To perform the shutdown, it is necessary to act on the programming button and, therefore, **it is necessary to remove the metrological seals to access it.** This feature is useful for example for removing the device for maintenance. The shutdown does not delete the saved data.

To turn off the device that is in a power fail status press the programming button for more than 5 seconds.

5.4.4 Supply status

The power status shows the level of the batteries of the measurement and modem sections.
The time of use data are expressed in hours for the two sections and are available through the communication software.

If the level of one or both batteries (measuring and modem sections) is low, the icon appears on the display.

The icon has two statuses

- Icon lit in fixed mode — Low battery (remaining autonomy < 10% of the initial time)
- Icon lit and flashing — Low battery to be replaced (remaining autonomy < 15% of the initial time)

The low battery status is also indicated on the diagnostics page and recorded as an event

The low battery icon will appear along with the other indications on the display only when the operator key is pressed.
In the power fail status, the battery icon is instead present individually on the display throughout the duration of the power fail status

If the battery of the measurement section is not replaced following the "low batt" warning, when the battery level becomes insufficient, the device goes into power-fail status and, after two hours without battery replacement, it completely shuts off.

5.4.5 Replacing the batteries

The batteries of the measurement and modem modules needs to be placed in the proper compartment in the position described in the following image:

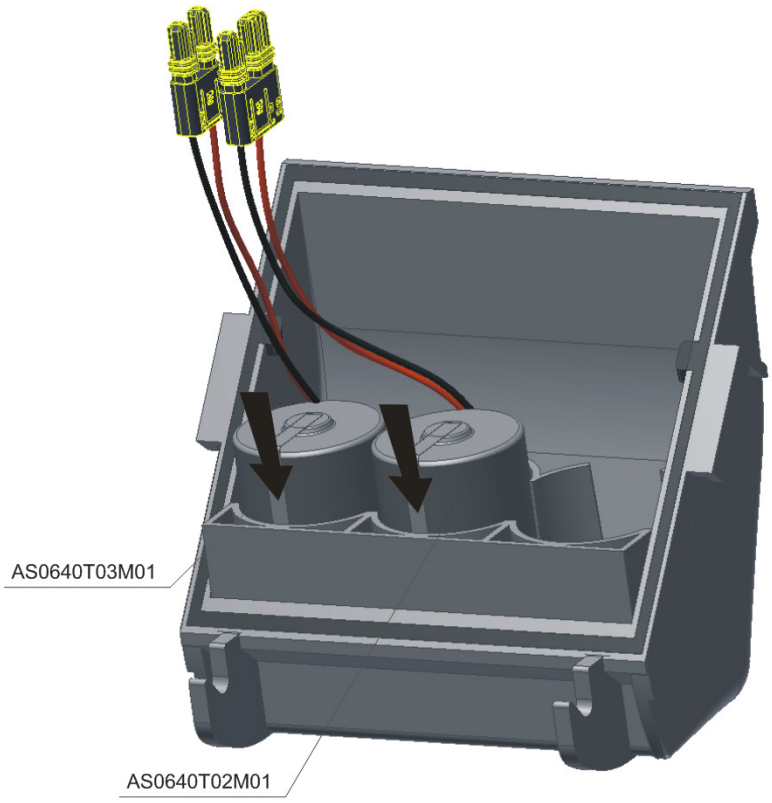


Fig. 17- Positioning of the batteries

If the modem section battery pack is double (code AS0640T01M01R00), insert the second battery into the empty compartment shown in Fig. 17.

CAUTION: Make sure to enter in the terminal that the batteries have been replaced; otherwise, there will be an error in the calculation of the residual autonomy.

6 User interface

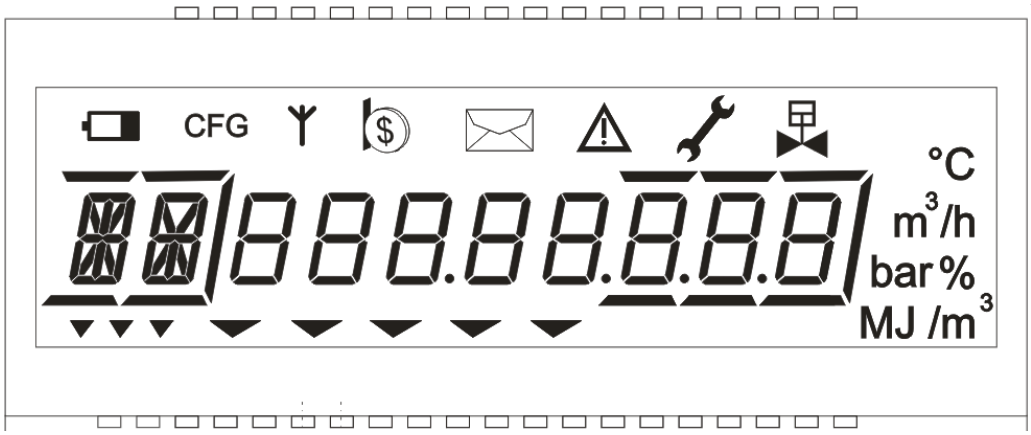
The user interface consists of an operator key, an internal button, two internal DIP switches, and a display. The following paragraphs describe the modes of interaction with the operator and navigation through the user interface pages.

6.1 *Keyboard*

The interaction occurs via a single key on the front of the device, which, as a function of the pressure duration and of the currently displayed page, can take different meanings (see subsequent sections).

6.2 *Display*

The display type is black and white LCD with 1 line consisting of 2 British flag characters, of 13 and 12 segments respectively, and 8 7-segment characters. There are also several icons and symbols, whose meaning is described here below. The contrast of the display is automatically adjusted when temperature changes.



The meaning of the graphical elements is outlined in the following table:

	Explanatory field	2 Characters in British flag (the first in 13 segments, the second in 12 segments) and 5 highlighters
	Numeric Field	8 7-segment digits
	Flag Field	5 arrow indicators (Flg 1..Flg 5) to indicate the pressure measurement unit
	Sub-menu field	3 arrow indicators (F1..F3) to indicate the sub-menu where the currently displayed page is to be found, if any
	Decimal points	3 points in correspondence of the least significant digits (to the right) 1 point in correspondence of the fifth digit
	Highlighters of decimal digits	3 lines in correspondence of least significant digits
	Icons field	See table for Icons
	Units of measurement Field	See the table Unit of measurement and other symbols

To allow a long battery life, the display is usually kept OFF. To use it, just press the operator key.

6.2.1 Display testing functionalities

On the main page, after the key is pressed for a long time, a test sequence is displayed to check the presence of defective segments or icons.
The test sequence sequentially illuminates all the segments of the display, and then turns them off in the same order.
The test can be interrupted by pressing the user key.

6.2.2 Explanatory field

It consists of two alphanumeric characters (a British flag, the first 13-segment, the second 12 segment). Its content varies depending on the displayed page and, in the case of data pages, it indicates the meaning of the numeric field synthetically; in the case of pages relating to the chapters, it contains an indicator specifying it is a chapter with the underlying pages ("_ _"); in the case of pages where the long pressing of the user keys enables a command, the indication is given that it is a command page ("- >").

6.2.3 Data field

It consists 8 7-segment digits. In case of pages related to chapters, it shows the title of the chapter itself; in case of command pages, it gives a string calling up its meaning; while in the data pages it shows the value of the corresponding data.

6.2.4 Icons and symbols

The following tables describe the icons and symbols on the display.

Icon	Description	ON	Flashing
	Low battery Power Fail status	Low battery to be replaced (residual charge ≤10%)	Battery to be replaced as soon as possible (residual charge ≤15%) Power Fail status (the rest of the display is off)
	Communication	sufficient radio coverage	*Installation*: Search for radio coverage *Normal*: Active communication window
	On-off valve	Not used in this application	
	Payment required	Not used in this application	
	Message	Not used in this application	
	Diagnostics		In the presence of diagnostic signals
	Maintenance		System in maintenance status
CFG	Configuration		Configuration in progress (local or remote)

6.2.5 Measurement units and other symbols

Icon		Meaning	Remarks
bar		Not used	The pressure measurement unit is indicated by the Flag field that identifies the preprinted unit on the device front label.
°C		When a temperature value is displayed	
m^3		When a volume value is displayed	
/h		When displaying a flow rate (together with m^3)	
MJ		When an energy rate is displayed	
/m^3		When a PCS is displayed (along with MJ)	
€		Not used by this application	
%		When a percentage is displayed	
▼ ▼ ▼	1, 2, 3 (Sub-menu field)	- Sub-menu indicator	Icons are placed under the explanatory field. The first on the left (corresponding to the mnemonic "M" on the front label) is turned on when a

			page of the main list (Main) is displayed. The other two indicate that the displayed page belongs to one of the two sub-menus ("APP" for device and "CFG" for configuration)
▼ ▼ ▼ ▼ ▼ ▼	1..5 (flag field)	Switched on alternatively, to indicate the pressure measurement unit, when a page is displayed listing a pressure value.	Icons are placed under the numeric field and identify the unit of measurement - on the front label - according to which the pressure is expressed on the current displayed page.
8.8.8.8.8.8	1, 2, 3, 5 (decimal points)	When lit alternatively, they indicate the position of the decimal point relative to the numeric field.	Between one digit and the other of the numeric field each in its decimal place
	1, 2, 3	Highlighters of decimal digits, they are lit concurrently with the decimal point of equal or greater position. They only apply when the shown quantity is a volume.	Segments above and below (for the first one also from the side to the right) of the corresponding digits of the numeric field

6.3 *Programming key and DIP switch*

The key SW1 and the switch SW2 perform the hardware protection levels for the metrological functions.

Both are located on the rear of the device and are accessible by removing the battery compartment visible in Fig. 5 and the adhesive metrological seal placed to protect the access slot (Fig. 18).

SW2-1: If set to ON, it authorizes the download of a new firmware on the device; when set to OFF, it will not be possible to update the device firmware

SW2-2: If set to ON, it authorizes the MODBUS communication without encryption; when set to OFF, only the encrypted communication will be allowed.

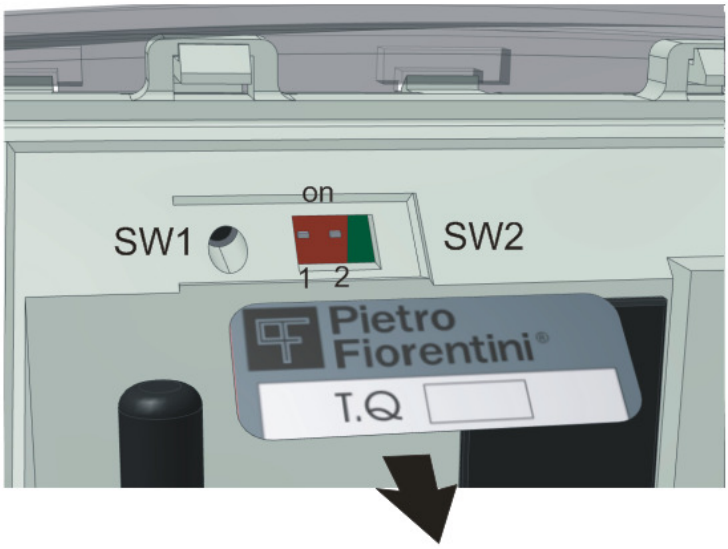


Fig. 18 - Programming key and DIP switch

7 Menu structure

This section shows the hierarchy of the pages making up the user interface.

Under normal operating conditions, the display is completely off. By pressing the only button available, the display turns on and performs a lamp test for a few seconds, during which all segments and icons are lit and switched off alternately. After the test, it displays the contents of the main page.

If not any key is pressed for more than 60 seconds (configurable), the display returns to the off status.

The information is organized according to a main list of pages and into 2 chapters; each chapter consists of a list of pages. During the display of the data pages underlying a chapter, the two arrows to the rightmost of the Sub-menu field indicate to which chapter (1 or 2) the displayed pages do refer. When pages of the main list are displayed, the arrow on the leftmost position from the Sub-menu field turns on instead.

The interaction occurs through the single button on the front of the system. By activating the key, pressing it for a long or short time, it is possible to scroll the page hierarchy or to give commands using the specific pages.

Depending on the pressure and duration of the currently displayed page, the activation of the button can take on different meanings, summarized in the following table:

Key	Main page	Standard pages	Command pages	Chapters pages	Data pages of the chapters
Short press	Next page	Next page	Next page	Next page	Next page
Long press	Display test	Back to the main page	Command activation	First below page	Back to the top chapter

The operator interface consists of two different hierarchies of pages, outlined in the following paragraphs.

7.1.1 Main page

This is the first page that appears each time the display is restarted and it gives the current time in the numeric field. The explanatory field shows the abbreviation "DL", which indicates the product version.

If the key is pressed for long time, display test procedure is run.

A short press leads to the first of the standard pages.

Explanatory field	Numeric field	Flag Field	Sub-menu field	Remarks
Vb	7 whole digits and 1 decimal	NA	F1	Correct volume totalizer (MU = m3)

7.1.2 Standard pages

These are the pages following the main one up to the first chapter. They are meant to provide an immediate display of the main operation data and the current values of the measurements and diagnostics.

A short pressure leads to the next page, until the first chapter is reached.

A long pressure brings back to the main page - control pages excluded. On any page of the main list, the first icon of the Sub-menu field is turned on, corresponding to the symbol "M" on the front label below.

Explanatory field	Numeric field	Flag Field	Sub-menu field	Remarks
DD-	-MM-YYYY	NA	F1	Current date
	Hh-mm-ss	NA	F1	Current time
Vm	7 whole digits and 1 decimal	NA	F1	Gross volume totalizer (MU = m3) (The number of significant digits is defined by the parameter Meter Digit Number; allowed values: 6,7; default = 7)
VE	7 whole digits and 1 decimal	NA	F1	Volume totalizer in error status (MU = m3) (The number of significant digits is defined by the parameter Meter Digit Number; allowed values: 6,7; default = 7)

Qb	8 whole digits	NA	F1	Correct hourly flow rate (MU = m3/h)
Qm	8 whole digits	NA	F1	Gross hourly flow rate (MU = m3/h)
TO	See following table	NA	F1	If there are no alarms, a single page is displayed showing "--------".
P	5 decimal digits	Units of measurement	F1	Current pressure measurement (default MU = bar)
T	2 decimal digits	NA	F1	Current temperature measurement (default MU = °C) This page is displayed if there is a temperature sensor
C	5 decimal digits	NA	F1	Conversion factor
Zb	5 decimal digits	NA	F1	Z at reference conditions
Z	5 decimal digits	NA	F1	Z at operating conditions
->	AL rESEt		F1	Alarm silencing control
->	dG rESEt		F1	Diagnostics history reset command

7.1.2.1 Alarm page (AL)

The display of the alarm page (AL explanatory field) contains the description of the alarm condition in the numeric field according to the following descriptions:

Diagnostics	Numeric Field
Low battery	BAtt
Device failure	FAIL
Clock misalignment > 2 minutes	rTc
Temperature out of range	t
Pressure out of range	P
Calculation error	CALC
Digital input 1 active	dI

7.1.3 Chapters

The 2 chapters provided by the operator interface are indicated in the explanatory field (indication of chapter ) in the numeric field (chapter title) and in the Sub-menu field (F2..F3: chapter number) as follows:

Explanatory field	Numeric field	Remarks
	APP	Device data chapter
	COnFIG	Chapter reserved for the device configuration data

The brief activation of the key causes the transition to the next chapter. Once the last chapter is reached, the sequence resumes from the main page. The long activation of the key causes the display of the first page below the chapter.

The pages of each chapter are shown in the sequences indicated in the following paragraphs that can be listed with a short press of the button. Once the last page of each chapter has been reached, it resumes from the first one of the same chapter.

On any page of a chapter, the flag field indicates to which chapter the page belongs, by illuminating the one of the 2 graphic elements (Sub-menu field) that corresponds to it.

On each page of a chapter, the long press of the key allows returning to the home page of the chapter in which the user is.

7.1.3.1 Device chapter (APP)

Explanatory field	Numeric field	Sub-menu field	Remarks
SN	12 digits that scroll from right to left	F2	Serial number of the device
SP	12 digits that scroll from right to left	F2	Serial number of the pressure sensor
St	12 digits that scroll from right to left	F2	Serial number of the temperature sensor
FW	xx-yy	F2	Firmware version (major-minor)
Cr	C + four hexadecimal digits	F2	Crc of the firmware (0..9, A,b,C,d,E,F)

7.1.3.2 Configuration chapter (COnFIG)

Explanatory field	Numeric field	Flag Field	Sub-menu field	Remarks
IS012213-3 or AGA-8			F3	Formula used
Pb	5 decimal digits	Units of measurement	F3	Reference pressure in bar (MU = bar)
Tb	2 decimal digits		F3	Reference temperature in °C (UM = °C)
TH	2 decimal digits		F3	Reference combustion temperature in °C (MU= °C)
C02	2 decimal digits		F3	CO2 concentration percentage (MU = %)
H2	2 decimal digits		F3	H2 concentration percentage (MU = %)
C0	2 decimal digits		F3	CO concentration percentage (MU = %)
N2	2 decimal digits		F3	N2 concentration percentage (MU = %)
d	5 decimal digits		F3	Relative density
HV	2 decimal digits		F3	Gross calorific value (MU = MJ/M3)
PI	3 decimal digits		F3	Pulse weight (MU = m3)

8 Configuration

The configuration of parameters necessary for the operation of the device takes place through the local and remote communication ports.

The changes to the configuration parameters are tracked in the event log, by generating an event for each parameter subject to change, resulting in the following generation of the plant "audit trail".

The changing of the parameters with metrological relevance is allowed remotely according to the status of DIP switch 1.2 (see section 6.3); even though the remote configuration is enabled, the modification of the meter pulse weight and of the volume totalizer under basic conditions (Vb) requires pressing the programming button (see section 6.3).

The following table lists the relevant metrological parameters that can be changed and the related access criteria.

Parameter	Editing access
Vm	Only local, after pressing the Prog key
Pb	Local or remote (DIP 1.2)
Tb	Local or remote (DIP 1.2)
TH	Local or remote (DIP 1.2)
CO2	Local or remote (DIP 1.2)
H2	Local or remote (DIP 1.2)
d	Local or remote (DIP 1.2)
HV	Local or remote (DIP 1.2)
PI	Only local, after pressing the Prog key

The changes to the configuration parameters are tracked in the event log, by generating an event for each parameter subject to change, resulting in the following generation of the plant "audit trail".

The local and remote communication software made available to Fiorentini is as follows, respectively:

1) Xterm PC – local communication software for PC platform, Windows XP or higher

2) SAC – Central Acquisition System - data collection center with IP communications support, GSM and SMS.

Details of the two products in question are reported within the respective user manuals.

9 Maintenance

9.1 *Routine Maintenance*

9.1.1 Battery Replacement

Replace the batteries when the low battery icon appears on the display or the related event is detected.

The icon and the related event are shared between the two batteries; therefore, to determine which battery is to be replaced, check the time of use. Usually, the modem section battery needs to be replaced more frequently than the measurement one.

To replace the batteries, refer to the Power supply section.

The backup battery is not replaceable. Its duration (if used as intended) is in any way comparable to the life of the device.

9.1.2 Calibration in the field

The calibration in the field corrects errors due to the aging of the sensors and it is normally to be carried out regularly every two years.

To perform the calibration it is necessary to connect to the device using the optical port and have available the reference vales for pressure and temperature accuracy beyond the one of the device (at least ± 0.025% FS for pressure and ± 0.1°C for temperature).

Calibration is protected by a metrological seal; therefore, it is necessary to remove it and to press the programming key.

Through the software, the operator will be prompted to set two values (to be selected at the ends of the scale) for the sensor to be calibrated. With the external reference value, apply the two set measures in the required sequence and confirm when the value is stable.

9.1.3 Firmware update

In case of release of a new firmware version, the notes that describe the changes made since the previous version are distributed.

If a new feature or the correction of an error is deemed relevant to the current application, the firmware update can be easily performed. Contact Fiorentini for further details

10 Technical characteristics

10.1 *General Features*

Parameter	Features	
Enclosure	Main body	Polypropylene
	Transparent cover	Polycarbonate
Protection degree	IP 65 (IP54 for access to the battery compartment)	
Dimensions (overall)	Max 130(H) x 135(L) x 155 (P) mm	
Weight	1.2 kg for the 1 battery version, 1.3 kg for 2 battery version (modem section)	
Display	LCD TN (black, white background) with 112 segments	
Keyboard	A front operator key, an internal key and two internal micro-switches for programming	
Operating/storage temperature	-25°C to +70°C / -30°C to +80°C	
Humidity	≤ 90%	
Certifications	ATEX (Ex ib 2G IIB T3 Gb), MID	
Power supply	Type	3.6V lithium battery
	Format	Replaceable proprietary pack
	Battery number	
	EVCD section	single pack
	Modem section	single or double pack (optional)
	Backup battery	Non-replaceable internal lithium
Autonomy	EVCD section	> 10 years (*)
	Modem section	> 5 years (single battery)
		> 8 years (two batteries)
	Backup (only measurement module)	
	Use	> 20 hours (10 cycles of two hours)
	Storage	≥ 15 years (duration if not used)
Microprocessor	type CISC at 16 bits	
Code memory	512 Kbyte of Flash type	
Data memory	Type	Flash 2Mbyte
	Data retention	≥ 20 years
Real Time Clock	RTC with management of daylight saving time and leap years Accuracy according to EN62054-21	
System accuracy	Reference conditions	±0.5% (according to EN12405)
	Operating range	±1%

(*) Operating conditions (EN 12405)

- Room temperature Ta min (-25°C)
- Gas pressure Max (1.5B)
- Gas temperature min (-20°C)
- Pulse frequency Max
- Use of user interface 1 minute every 2 days
- Communication use 2 minutes per day (optical or remote)
- Rate Log data (200 byte) 30S
- F/W updates: 1/year, duration 20 min

10.2 *Inputs and Outputs*

Parameter	Features	
Pressure Measurements	Sensor body	Stainless steel AISI304
	Process connection	¼" GAS male
	Cable length	1.5m ±10cm
	Accuracy	
	Reference condition	±0.25% rdg
	Operating range	±0.5% rdg
	Aging	≤±0.1% FS /year
	Measuring range	1.5 bar absolute
Temperature Measurements	Sensor body	Stainless steel AISI304
	Dimensions	diameter 6 mm , length 50 mm
	Cable length	1.5 m ±10 cm
	Accuracy	
	Reference cond.	±0.5 °C
	Operating range	±1°C
	Measuring range	-20 to +60°C
	Process connection	threaded nut ½" GAS
Metering digital input	Physical layer	Contact with no voltage
	Max contact R	100 Ohm max
	Maximum frequency	3Hz
	Minimum pulse width	30mS
Digital input 2	Physical layer	Contact with no voltage
	Max contact R	100 Ohm
Digital outputs	Quantity	Number 2 outputs
	Physical layer	DIN 19234 (NAMUR) compatible
	Connection	3-pole terminal with spring hooking
	Conductor section	0.5 x 1.5 mm^2
	Cable diameter	4 – 6 mm

10.3 *Communication ports*

Parameter	Features	
Local communication port	Physical layer	ZVEI (IEC 1107)
	Speed	9600baud
	Application layer	protocol MODBUS
Modem	Type	Integrated
	Standard	GPRS class 8, GSM
	Bands	Dual band 900/1800 MHz
	Supported SIM	SIM card, or SIM on chip (optional)
	Antenna	
	Internal	omnidirectional (standard)
	External	optional, SMA connector