**Czech Metrology Institute**
**Notified Body No. 1383**

Okružní 31, 638 00 Brno, Czech Republic

tel. +420 545 555 111, fax +420 545 222 728
www.cmi.cz

V 3112

# EU-TYPE EXAMINATION CERTIFICATE

## Number: TCM 143/18 - 5562

## Addition 5

This addition replaces all previous versions of this certificate in full wording

Page 1 from 22 pages

**In accordance:** with Directive 2014/32/EU of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to the making available on the market of non-automatic weighing instruments (implemented in Czech Republic by Government Order No. 120/2016 Coll.).

**Manufacturer:** ELGAS, s.r.o.
Semtínská 211, Ohrazenice
533 53 Pardubice
Czech Republic

**For:** volume conversion device

type: ELCOR, ELCOR plus

MPE 0.5 %

mechanical environment class: M2

electromagnetic environment class: E2

climatic environments limits: - 25°C...+70°C   or optionally  -40°C...+70°C

**Valid until:** 17 June 2028

**Document No:** 0511-CS-A022-18

**Description:** Essential characteristics, approved conditions and special conditions, if any, are described in this certificate.

**Date of issue:** 16 December 2021

**Certificate approved by:**

RNDr. Pavel Klenovský

This certificate was issued according to module B of the Directive 2014/32/EU of the European Parliament and of the Council
(implemented in CR by Government Order No. 120/2016 Coll.)

V 17-001

## 1 Characteristics of instrument

The volume conversion device ELCOR or ELCOR plus (*Figure no.1*) is the electronic gas volume conversion device which is designed to perform the continuous recalculation of volume at measurement conditions to the volume at base conditions. The volume at measurement conditions is obtained from pulse emitter of gas meter. The volume conversion device ELCOR or ELCOR plus is designed and approved in accordance with *EN 12405-1:2005+A2:2010 / EN 12405-1:2018* like a *gas volume conversion device type 1* (compact system), and can be supplied as T, TZ, PT or PTZ corrector. The volume conversion device ELCOR or ELCOR plus is in accordance with the standard OIML R140 Edition 2007 (E), according to point T.1.5 like an ancillary device.

The measurement of values of temperature and of pressure is performed in optional time periods. The conversion device performs the recalculation of the volume at measurement conditions to the volume at base conditions separately for two channels if they are used.
The base conditions can be:
$p_b$= 100.000 kPa or 101.325 kPa or 101.592 kPa or 101.560 kPa or 101.0085 kPa or 102.3872 kPa or 103.5937 kPa
$t_b$ = 0°C or 15°C  or 15.555555°C or 20°C or 25°C or 27°C
(Other units are possible.)

These values $p_b$ and $t_b$ are fixed from manufacturer and the ones can be changed only after breaking of the seals.

These equations are used for recalculations:

$$V_m = \frac{N}{k_p} \qquad V_b = V_m.C \text{ or } V_b = V_C.C \qquad C = \frac{p}{p_b}.\frac{(t_b+273.15)}{(t+273.15)}.\frac{1}{K}$$

where:

| Symbol | Represented quantity | Units |
|--------|----------------------|-------|
| $C$ | Conversion factor | - |
| $V_b$ | Volume at base conditions | m³ |
| $V_m$ | Volume at measurement conditions | m³ |
| $V_C$ (optionally) | Corrected volume according to the gas meter error | m³ |
| $N$ | Number of pulses from gas meter | - |
| $k_p$ | Gas meter constant | imp/m³ |
| $p$ | Absolute pressure at measurement conditions | kPa |
| $t$ | Temperature at measurement conditions | °C |
| $p_b$ | Absolute pressure at base conditions | kPa |
| $t_b$ | Temperature at base conditions | °C |
| $K$ | The ratio of compressibility factors $K = \frac{z}{z_b}$ <br> where <br> $z$ is the compressibility factor at measurement conditions <br> $z_b$ is the compressibility factor at base conditions | - |

The designations of quantities correspond to *EN 12405-1:2005+A2:2010 / EN 12405-1:2018*. The units of values of pressures and of temperatures are optional and the ones can be changed by user.

ELCOR (*Figure no.2 and 3*) is a single channel volume conversion device powered by a battery with optional extension of an internal communication modem and an interface for connecting a gas meter equipped with encoder. The conversion device ELCOR is not able to use of external mains power supply and the one may exist in the following versions:
a) basic design
        - one channel volume conversion device
        - six-key keyboard
        - graphical display or segment display
        - 1 x digital pressure transducer EDT 96 or variant KP 096 with new sensor KP 096 01a and new electronics board KP 096 06
        - 1 x digital temperature transducer EDT 101 or EDT 87 or
        - 1 x module PT4W (KP 100 161) for connection one or two temperature sensor Pt1000 4-wire (KP 100 35-01)

- 1 x pulse input for connecting the meter to the NF pulse output
- 2 x digital input
- 2 x digital output (binary, or pulse or analogue)
- optical head communication
- 1 x RS232 / RS485 communication interface
- 1 x battery pack to power the volume conversion device

b) optional extension:
- 1 x internal modem module:
  - G2 modem (i.e. GSM, dial-up CMD and GPRS), or
  - LTE modem (including battery pack to power the internal modem)
- 1 x interface module for gas meter with encoder (position SLOT 0):
  - the NAMUR  interface module for NAMUR encoder, or
  - the SCR interface module for the SCR encoder

The ELCOR plus (*Figure no.2 and 3*) volume conversion device can be produced as single channel variant or dual channel variant (i.e. with two temperature transducers and  with two pressure transducers). Its features can be more user friendly with additional optional modules. The device ELCOR plus can be powered either with a battery or with external power supply. In case of an internal modem, the modem is powered by separate batteries, or can also be powered from a separate external power source. Expansion modules are inserted into slots on the input board. These variants of ELCOR plus volume conversion device can exist:
a) Basic (minimum) design of the instrument:
- one-channel volume conversion device
- six-key keyboard
- graphical display or segment display
- 1 x digital pressure transducer EDT 96 or variant KP 096 with new sensor KP 096 01a and new electronics board KP 096 06
- 1 x digital temperature transducer EDT 101 or EDT 87
- 1 x module PT4W (KP 100 161) for connection one or two temperature sensor Pt1000 4-wire (KP 100 35-01)
- 3 x digital input
- 4x digital output (binary, or pulse or analogue)
- optical head communication
- 1 x battery pack for powering of a volume conversion device
b) The basic design can be extended by one of the following modules:
- 1 x digital pressure transducer EDT 96 or variant KP 096 with new sensor KP 096 01a and new electronics board KP 096 06 at the case of dual channel device
- 1 x digital temperature transducer EDT 101 or EDT 87 at the case of dual channel device
- 1 x internal modem module:
  - 2G modem (i.e. GSM, dial - up CSD and GPRS), or
  - 4G modem (LTE) (including battery pack to power the internal modem)
- 1 x interface module for gas meter with encoder (position SLOT 0):
  - the NAMUR interface module for NAMUR encoder, or
  - an SCR interface module for the SCR encoder, or
  - an Indexer interface module for connecting a mechanical gas meter indexer, or
  - module for connecting the HF pulse output of the gas meter (NAMUR, module EXT1)
- 1 x communication interface module or analogue input / output (position SLOT 1)
  - RS232 / RS485 communication module for communication with the control system, or
  - a communication module for connecting subsystems, or
  - analogue input module (4 – 20) mA (2 inputs), or
  - analogue output module (4 – 20) mA (2 output), or
- 1 x communication interface module or analogue input / output (position SLOT 2)
  - RS232 / RS485 communication module for communication with the control system, or
  - a communication module for connecting subsystems, or
  - analogue input module (4 – 20) mA (2 inputs), or
  - analogue output module (4 – 20) mA (2 output), or
- 1 x PWR1 module for connecting an external IS power supply to the device (position SLOT 3)

- 1 x modem external power supply module or communication interface for external modem (SLOT 4 position) PWR2 module to connect an external IS power supply to the modem, or RS232 communication module for connecting an external modem
- 1 x internal modem module (SLOT 5 position) (If the external power supply for modem is not used, then the internal modem module is moved from SLOT 5 to SLOT 4.)
  - 2G modem (i.e. GSM, dial-up CSD and GPRS), or
  - LTE modem (including battery pack to power the internal modem)

Modules for ZONE 2 only:
- 1 x PWR3 module of EVC and modem external power supply (from 230 Vac electric network, position SLOT4)
- 1x PWR4 module of EVC and modem external power supply (from DC power supply, position SLOT4)

The conversion device ELCOR or ELCOR plus counts the pulses from a gas meter and simultaneously the device measures the values of pressures and of temperatures of gas at measurement conditions by independent transducers. The transducers are inseparable from calculator so this device can be called *gas volume conversion device type 1* (complete system - see 3.1.18.1. of *EN 12405-1:2005+A2:2010 / EN 12405-1:2018*).

The device can optionally compensate gas meter error. The corrected volume $V_c$ is counted with respecting gas meter curve. The gas meter curve has to be defined in device with using max 10 points. This option is available only for HF pulses. The correction can only be applied if the gas meter produces at least 10 pulses per second at $Q_{min}$. Below $Q_{min}$ no correction is allowed and above $Q_{max}$, the correction factor shall remain at the value obtained at $Q_{max}$.

There is possible to use one temperature sensor and two pressure sensors for dual channel device at the case of suitable topology of measurement place. There is also possibility to count two gas meter outputs with using one pressure and one temperature sensor for dual channel device. This is allowed at the case if gas meter generate forward and backward flow separately on two pulse outputs.

The value $K$ of the ratio of compressibility factors of natural gas can be computed by methods:
- AGA NX-19 mod.,
- SGERG-88 according to EN ISO 12213-3,
- AGA 8 GROSS CHARACTERIZATION METHOD 1 (designation *AGA 8-G1*),
- AGA 8 GROSS CHARACTERIZATION METHOD 2 (designation *AGA 8-G2*),
- AGA Report No. 8 Part 1 – *Thermodynamic Properties of Natural Gas and Related Gases* (designation *AGA8-DETAIL*),
- GOST 30319.2-2015 (only with $p_b$=101.325 kPa, $t_b$=20 °C),
- GOST 30319.3-2015 (only with $p_b$=101.325 kPa, $t_b$=20 °C),
- the one can be constant ($K=1$ or $K≠1$).

A user can change the method of calculation of the ratio of compressibility factors of natural gas but in case where the maximum pressure of the pressure transducer exceeds the defined limit according to the table mentioned down in *Table* (at the end of chapter 2) then the temperature range can be reduced in accordance with the used method of compressibility calculation. The change of the method of compressibility calculation is memorised in the gas composition archive. The actually used method of compressibility calculation is displayed on the display together with the corresponding temperature range. If methods GOST 30319.2-2015 or GOST 30319.3-2015 are used then the pressure range is limited from 100 kPa. The actual values *Tmax/Tmin* and *Pmax/Pmin* shall be correctly indicated on LCD. If the input parameter of a method is a relative density then in *Telves* (parameter setting software) an absolute value of density can be set and a value of relative density is calculated.

The additional function (out of scope of Directive 2014/32/EU) of volume conversion devices ELCOR or ELCOR plus is also the possibility to calculate the amount of supplied energy $E$ and to be used like an energy conversion device according EN 12405-2. Only if method AGA 8-DETAIL is used then the calorific value $H_s$ is calculated according to EN ISO 6976:2016 by the conversion device. A fixed value of $H_s$ (changeable by user) is used for other methods. There is also possible to define reference conditions ($T_1/T_b$, $p_b$) for calorific value $H_s$ in the conversion device. This equation is used:

$$E = V_b.H_s$$

| Symbol | Represented quantity | Units |
|--------|---------------------|-------|
| E | Energy | MJ, TJ or kWh |
| Hs | Superior calorific value | MJ/m3 or kWh/m3 |

The conversion device ELCOR consists of a calculator, of temperature transducer (1 piece), of pressure transducer (no pressure transducer or 1 piece). The conversion device ELCOR plus consists of a calculator, of temperature transducer (1 piece or 2 pieces), of pressure transducer (no pressure transducer or 1 piece or 2 pieces). The mechanical construction allows connecting internal or external pressure transducers.

The conversion device tasks are distributed to multiple processors. There is the block diagram of the device in (*Figure no.4*). Main processor CPU1 (optional *1 MB* or *2 MB* variant) controls the detection of LF pulse outputs of the gas meter and binary inputs as well as the calculation of volume an of flow rate. It also generates output signals and provides the real time clock (RTC). CPU1 controls the other processors (transducer processors, CPU2, CPU3, …), collects the measured values, performs the calculations. It provides for statistical processing of measured data and it archives them according to parameter settings. Furthermore, it controls data display and communication with the master system including related communication devices. Processor activities are supported by other functional blocks, such as power supply, battery, backup battery with backup circuits, reset with watchdog, display, keyboard circuits, RS-232, RS-485, IEC-1107 communication interfaces etc.

The equipment of the conversion device allows to measure the actual values of pressure $P_1$ at measurement conditions (respectively $P_2$ in the case of dual channel variant of ELCOR plus) and of temperature $T_1$ at measurement conditions (respectively $T_2$ in the case of dual channel variant of ELCOR plus), to recalculate the volume at measurement conditions to the volume at base conditions, to summarize the increments to the counter of the volume at measurement conditions $V_{m1}$ (respectively $V_{m2}$ in the case of dual channel variant of ELCOR plus) and to recalculate the increments to the counter of the volume at base conditions $V_{b1}$ (respectively $V_{b2}$ in the case of dual channel variant of ELCOR plus). In accordance with the parameter settings these and other data are saved to archives. Furthermore, the limits of values, defined alarms and the internal security are watched.

During the faulty conditions (a fault of the transducer, a fault of the device, a crossing of the limits) the volume at measurement conditions $V_m$ and the volume at base conditions $V_b$ are collected to separate counters. The designation of the volumes at faulty conditions is $V_s$ (at measurement conditions) and $V_{bs}$ (at base conditions). During the faulty conditions the device begins to count pulses using both counter of volume at measurement conditions $V_m$ and the counter for substitute (spare) volume at measurement conditions $V_s$. During the faulty conditions the volume at base conditions $V_b$ is not recorded and only the substitute (spare) volume at base conditions $V_{bs}$ is increased using substitute (spare) values for calculation. During faulty conditions no values are saved into the counter of volume at base conditions $V_b$. When faulty conditions disappear then the saving of the values of volume to the counters of substitute volumes is stopped and the device starts to save volume at base condition $V_b$ again.

The indication of values is performed using graphical LCD (128 x 64) or segment display. The local control can be realised using six-button keyboard. Values to be displayed are selected by means of menu but they depend also on parameters saved during configuration via the serial interface and software. To save energy of battery or of mains the LCD is turned off after 30 seconds when the device is powered by batteries. The segment display can be always turned on. The LCD can be turned on by pressing of "Enter" button longer than 2 seconds. In the case of graphical display in the menu "System data"→"Frozen values" there by pressing of "Enter" button more decimal places of the values can be displayed.

All data of actual values or of saved values or of parameters can be read and maintain by special software. The transition of data can be performed via interfaces (RS-232, RS-485, infrared interface IEC-1107 using various protocols (ELGAS ver.2, CTR, MODBUS). The communication with master system can be performed by various means – telephone modem, radio modem, GSM, GPRS. In this way various data from device can be read and it is possible to perform parameters setting.

Data influencing metrological characteristics of device are protected by metrological switch which is sealed. Data that can be changed and that influence the calculation are protected by password and all changes are memorised in setting archive or in gas composition archive.

All changes of the configuration setting are saved. The allowed changes are mentioned down:
- values of volume at measurement conditions $V_m$ and of substitute (spare) volume at measurement conditions during faulty conditions $V_s$;
- the ratio of compressibility factors $K$ as a constant or the method of calculation of the ratio of compressibility $K$
- parameters of natural gas
- pulse constant of gas meter $k_p$
- units of quantities or of constants
- quantities – setting of archives, periods of measurements of quantities
- zeroing of archives with exception of the *setting archive*

- real time setting
- period of recalculation (Maximum period is 30 seconds.)
- the importance of the service switch and the password setting

The device is powered by a battery. The device is able to work more than 5 years in the defined mode. The warning of expire of a battery is started after 90 % of its lifetime. Relevant data are saved when the define procedure of exchange of battery is used. If it is necessary to use the device in the mode with higher consumption of energy then it the mains supply has to be used. The device also includes the standby battery which is able to memorize the counters of volumes even during the interruption of the power supply. During the interruption of the power supply the processor and parts of circuits are powered by standby battery. That is why the volumes are still saved and it is possible to continue to count input pulses from gas meter and to maintain the real time.

The absolute pressure transducer is used for pressure measurement. The main part is the silicon piezoresistive sensor. The output signal from this sensor is changed in A/D transducer. The value in the digital form is processed in processor which performs the correction of the non-linearity a of the temperature dependence. The output data are transferred in the digital form to the calculator.

The temperature is measured by platinum resistance thermometer sensor *Pt1000* (EDT 101 and Pt1000 4-wire) or semiconductor sensor (EDT 87) which is powered from the source of the reference voltage. The voltage drop in Pt-sensor is measured by A/D transducer with high resolution. The digital signal from A/D transducer is processed by processor which performs the correction of the non-linearity and the calculation of the temperature value.

For the EDT 87 is temperature measured by semiconductor sensor. The signal from the sensor is processed by the microcontroller. Microcontroller digitally compensates the non-linearity of the sensor using calibration data.

The output data are transferred in the digital form to the calculator. In the case of graphical display in the menu *"Device parameters"→("Conversion") →"C Convers.factor"→"* there in last item the actual temperature range can be displayed.

The volume at measurement condition $V_m$ is measured by counting the pulses from gas meter with defined pulse constant. The pulse input of the conversion device is able to count pulses from LF emitters (reed contact, contact without potential, Wiegand) or from HF emitters (EXT1 or SCR).

The volume at measurement condition $V_m$ can be optionally obtained from gas meter using Encoder interface or module with digital interface EXT1. In ELCOR or ELCOR plus there is SLOT 0 for a module with digital interface (based on NAMUR standard or SCR) which is capable to receive a totalizer number including checksum. An external power source shall be used in the case of using Encoder interface. There is possible to connect Encoder interface without using of an external power supply but in this case the battery lifetime is quickly decreased.

A user has to set which pulse input is used for the determination of the volume at measurement condition $V_m$. The change can be made at the user level – a change the pulse source. The change of the settings is recorded in the settings archive. It is possible to change from NF pulse input to HF pulse input: Encoder interface – input sign $V_m$ENC or module EXT1 – input sign $V_m$EXT. The indexes 1 or 2 are used to identify the inputs in the dual channel variant. The setting can also be reversed from the HF input to the LF input.

The places of installation of transducers of pressure and of temperature in the pipe(s) are recommended by the procedure of manufacturer. The conversion device is approved to use it in the hazardous area.

## 2 Main characteristics

Maximum permissible error of the conversion
factor under reference conditions                    ±0.5 %

Electromagnetic environments: E2
This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings.

Mechanical environments: M2
This class applies to instruments used in locations with significant or high levels of vibration and shock, e.g. transmitted from machines and passing vehicles in the vicinity or adjacent to heavy machines, conveyor belts, etc.

<u>Climatic environments:</u>  -25°C to 70°C   or     -40°C to 70°C
The device is designed for open or closed location with condensing and also for non-condensing humidity.

| Mechanical parameters: | ELCOR | ELCOR plus |
|---|---|---|
| - dimensions (width x height x depth) | (210 x 190 x 93) mm | (263 x 201 x 111) mm |
| - weight | 1.5 kg | 2.2 kg |
| - material of casing | PC+GF (polycarbonate + glass fibre) | |

| Ingress protection: | IP 66 |
|---|---|

| Explosion proof make: | ELCOR | ELCOR plus |
|---|---|---|
| - basic variant | ⟨Ex⟩ II 1G Ex ia IIB T4 Ga | |
| - variant with internal modem powered by battery | ⟨Ex⟩ II 1G Ex ia IIB T3 Ga | |
| - variant with internal modem powered by external source | not applicable | ⟨Ex⟩ II 2G Ex ib IIA T3 Gb |
| - with module with interface for SCR encoder | ⟨Ex⟩ II 2G Ex ib IIB T4 Gb | |
| $T_{amb}$ for temperature class T4, T3 | $(-40°C \leq T_a \leq +70°C)$ | |

| Certificate | FTZÚ 17 ATEX 0141X |
|---|---|
| -    area classification | ZONE 0<br>ZONE 1, 2 (variant with internal modem with external power supply or with SCR encoder) |

| Power supply: | ELCOR | ELCOR plus |
|---|---|---|
| - supplying battery type | Battery B-03 (17Ah) or B-03D (30Ah) or B-03A (10Ah) | |
| - supplying battery voltage | 3.6 V | |
| - supplying battery life measuring | Yes, warning after 90 % of its lifetime | |
| - feeding from external power supply | Not applicable | Yes, possible. |
| - standby battery type | lithium 3.6V / 1Ah or 3V / 540 mAh | |
| - standby battery life | 15 - 16 years in defined conditions | |

<u>After the issue of Addition 3 of this Certificate:</u>

| Design variant for ZONE 2 only (combined protection of the type "ic" and "nA") | ELCOR | ELCOR plus for ZONE 2 only |
|---|---|---|
| | Not applicable. | Yes, possible. |
| - explosion proof make | | ⟨Ex⟩ II 3G Ex ic nA IIB T4 Gc |
| - certificate | | FTZÚ 19 ATEX 0002X |
| - area classification | | ZONE 2 |
| - $T_{amb}$ for temperature class T4 | | $(-25 °C \leq T_a \leq +60 °C)$ |
| - supplying battery type | | Battery B-03 (17Ah) or B-03D (30Ah) |
| - feeding from external power supply | | Yes, possible |
| - external power supply via module | | PWR3, PWR4 |

Software versions:

| Segment display | version | CRC |
|---|---|---|
| Loader: | ver.1.00 | 3B27 |
| Metrolog: | ver.1.00 | 2D19 |

| Graphical display | version | CRC |
|---|---|---|
| Loader: | ver.1.00 | 3B27 |
| Metrolog: | ver.1.00 | 9145 |

| Segment display | version | CRC |
|---|---|---|
| Loader: | ver.1.01 | A0FE |
| Metrolog: | ver.1.10 | 8C32 |

| Graphical display | version | CRC |
|---|---|---|
| Loader: | ver.1.01 | A0FE |
| Metrolog: | ver.1.10 | DFF3 |

| Segment display | version | CRC |
|---|---|---|
| Loader: | ver.1.01 | A0FE |
| Metrolog: | ver.1.12 | 950F |

| Graphical display | version | CRC |
|---|---|---|
| Loader: | ver.1.01 | A0FE |
| Metrolog: | ver.1.12 | 3873 |

| Segment display | version | CRC |
|---|---|---|
| Loader: | ver.1.02 | 3364 |
| Metrolog: | ver.1.14 | 5984 |

| Graphical display | version | CRC |
|---|---|---|
| Loader: | ver.1.02 | 3364 |
| Metrolog: | ver.1.14 | 54E2 |

**For *1 MB* CPU variant:**

| Segment display | version | CRC -16 |
|---|---|---|
| Loader: | ver.1.03 | 5656 |
| Metrolog: | ver.1.16 | 3B3E |

| Graphical display | version | CRC-16 |
|---|---|---|
| Loader: | ver.1.03 | 5656 |
| Metrolog: | ver1.16 | FA9A |

**For *2 MB* CPU variant:**

| Segment display | version | CRC-32 |
|---|---|---|
| Loader: | ver.2.03 | B78E6242 |
| Metrolog: | ver.2.16 | A6C8734D |

| Graphical display | version | CRC-32 |
|---|---|---|
| Loader: | ver.2.03 | B78E6242 |
| Metrolog: | ver.2.16 | AC7B99CD |

**For *2 MB* CPU variant:**

| Segment display | version | CRC-32 |
|---|---|---|
| Loader: | ver.2.03 | B78E6242 |
| Metrolog: | ver.2.16 | 746C2FDD |

| Graphical display | version | CRC-32 |
|---|---|---|
| Loader: | ver.2.03 | B78E6242 |
| Metrolog: | ver.2.16 | 92974911 |

Only "Loader" and "Metrolog" are legally relevant parts of software.

This software version is approved according to WELMEC 7.2 Guide:
The following requirements have been validated:
- Specific requirements for embedded software for a built-for-purpose measuring instrument (type P)
- Extension I2: Gas Meters and Volume Conversion Devices
- Extension L: Long-term Storage of Measurement Data
- Extension D: Download of Legally Relevant Software
- Extension S: Software Separation

| Period of measurement (recalculation): | (1 to 30) s |
|---|---|

| Pressure measurement: | |
|---|---|
| - number of inputs (transducers) | 0 (ELCOR, ELCOR plus) <br> 1 (ELCOR, ELCOR plus) <br> 2 (ELCOR plus) |
| - absolute pressure transducer | • EDT 96, digital pressure <br> • variant KP 096 with new sensor KP 096 01a and new electronics board KP 096 06 |

| - maximum measuring ranges* | (80 ÷ 520) kPa | If methods *GOST 30319.2-2015* or *GOST 30319.3-2015* are used then the pressure range is limited from 100 kPa. |
|---|---|---|
| | (80 ÷1000) kPa | |
| | (80 ÷ 2000) kPa | |
| | (200 ÷ 1000) kPa | |
| | (400 ÷ 2000) kPa | |
| | (700 ÷ 3500) kPa | |
| | (400 ÷ 7000) kPa | |
| | (1400 ÷ 7000) kPa | |
| | (2500 ÷ 13000) kPa | |
| - accuracy of measurement | < 0.25 % of measured value | |
| - maximal overload capacity | 125 % of upper limit of measuring range | |
| - make | internal or external with bushing | |
| - external transducer cable length | maximum 100 m total length of the internal bus cable | |

*Note:* It is also possible to produce pressure transducers with other ranges but inside the pressure ranges mentioned in brackets in the table above. In this case the minimum range shall be $(p_{max} / p_{min}) > 2$. The actual pressure range shall be indicated both in the LCD and in the name plate of the used pressure transducer.

| Allowed setting of pressure constant (absolute pressure at measurement conditions) if the device is T-corrector | (80 to 1000) kPa |
|---|---|

| Temperature measurement: | |
|---|---|
| - number of inputs (transducers) | 1 (ELCOR, ELCOR plus) <br> 2 (ELCOR plus) |
| - transducer | • EDT 101, digital temperature transducer with Pt1000 sensor <br> • EDT 87, digital temperature transducer with semiconductor sensor <br> • Modul PT4W (KP 100 161) to connect one or two Temperature sensors Pt1000 4-wire (KP 100 35-01) |
| - maximum measuring range <br> (The actual temperature range shall be at least 40 °C and shall be indicated in the LCD. ) | (-25÷ +70) °C or optionally (-40 ÷ +70) °C |
| - measurement error | ±0.2°C |
| - transducer variant | external with bushing |
| - external transducer cable length | maximum 100 m total length of the internal bus cable |

| Digital inputs: | ELCOR | ELCOR plus |
|---|---|---|
| - number | 2 | |
| - terminal designation (DIN terminal) | DI1, DI3 | DI1, DI4 |
| - input options (SW configuration) | 1 x NF pulse input, <br> 1 x binary input / contact intrusion / LF pulse input <br> to evaluate the direction of rotation of the meter | |
| - cable length of each input | 30 m | |
| NF pulse input: | Terminals: DI1, DI3 <br> (DI3 with option to evaluate the direction of rotation of the meter) | Terminals: DI1, DI4 <br> (DI4 with option to evaluate the direction of rotation of the meter) |

| - maximal frequency | 10 Hz | |
|---|---|---|
| - input type | Reed contact or non-potential output, WIEGAND | |
| - minimal pulse/idle period | 40 ms | |
| - open circuit voltage | (2.80 to 3.65) V | |
| | | |
| HF pulse input (module in SLOT0): | - | ELCOR plus |
| - maximal frequency | | 5 kHz |
| - input type | | NAMUR (DIN 19234) |
| - minimal pulse/idle period | | 100 µs |
| - open circuit voltage | | 7,5V |

Communication modules:

| S1-COM Communication module RS232/RS485 | | |
|---|---|---|
| | ELCOR | ELCOR plus |
| maximum number of modules in the device | 1 | 2 |
| place of installation | integrated | SLOT1, SLOT2 |
| galvanic isolation | yes | |
| serial communication interface | RS485 or RS232 (It cannot be used simultaneously.) | |

| M2G Module of Modem 2G | | |
|---|---|---|
| | ELCOR | ELCOR plus |
| Maximum number of modules in the device | 1 | 1 |
| Place of installation | independent position | SLOT4 (battery powered) SLOT5 (if powered from an external power source) |
| Type of communication | GSM/GPRS | |
| Frequency | 900MHz/1800MHz | |

| M4G Module of Modem LTE | | |
|---|---|---|
| | ELCOR | ELCOR plus |
| Maximum number of modules in the device | 1 | 1 |
| Place of installation | independent position | SLOT4 (battery powered) SLOT5 (if powered from an external power source) |
| Type of communication | LTE | |
| Frequency | 900MHz/1800MHz | |

The allowed ranges for methods of calculation of the ratio of compressibility factors:

| Method | Pressure range | Temperature range |
|---|---|---|
| AGA NX-19 mod | (80 ÷ 520) kPa | (-25 ÷ +70) °C |
| SGERG-88 AGA 8–G1 AGA 8–G2 | (80 ÷ 520) kPa | (-25 ÷ + 70) °C or (-40 ÷ +70) °C |
| SGERG-88 AGA 8–G1 AGA 8–G2 | (80 ÷ 1000) kPa (80 ÷ 2000) kPa (200 ÷ 1000) kPa (400 ÷ 2000) kPa | (-25 ÷ +70) °C |
| SGERG-88 AGA 8–G1 AGA 8–G2 | (700 ÷ 3500) kPa (400 ÷ 7000) kPa (1400 ÷ 7000) kPa | (-10 ÷+70) °C |
| AGA8-DETAIL | (80 ÷ 520) kPa (80 ÷ 1000) kPa (80 ÷ 2000) kPa (200 ÷ 1000) kPa (400 ÷ 2000) kPa | (-25 ÷ +70) °C or (-40 ÷ +70) °C |

| | (400 ÷ 7000) kPa<br>(700 ÷ 3500) kPa<br>(1400 ÷ 7000) kPa<br>(2500 ÷ 13000) kPa | |
|---|---|---|
| GOST 30319.2-2015 | (100 ÷ 520) kPa<br>(100 ÷ 1000) kPa<br>(100 ÷ 2000) kPa<br>(200 ÷ 1000) kPa<br>(400 ÷ 2000) kPa | (-23.15 ÷ +70) °C |
| GOST 30319.2-2015 | (400 ÷ 7000) kPa<br>(700 ÷ 3500) kPa<br>(1400 ÷ 7000) kPa | (-10 ÷ +70) °C |
| GOST 30319.3-2015 | (100 ÷ 520) kPa<br>(100 ÷ 1000) kPa<br>(100 ÷ 2000) kPa<br>(200 ÷ 1000) kPa<br>(400 ÷ 2000) kPa<br>(400 ÷ 7000) kPa<br>(700 ÷ 3500) kPa<br>(1400 ÷ 7000) kPa<br>(2500 ÷ 13000) kPa | (-23.15 ÷ +70) °C |

*Note:* If the measured value of temperature is out of limits of the used method of compressibility then the device starts to count the volumes into spare (substitute) volumes. In this case the spare (substitute) value of the ratio of compressibility factors is used but the actual value of temperature and the actual value of pressure are used if they are in the ranges of used transducers.

## 3 Test

The tests and the conformity assessment according to the module B were performed in the laboratory of Czech Metrology Institute (department of gas flow) and in the laboratory of manufacturer under the supervision of Czech Metrology Institute. The serial number of a sample for Addition 3 was 1946100012. The EMC tests were performed in the laboratory VTÚPV Vyškov. The vibration tests were performed in the Electrotechnical Testing Institute in Prague. All used standard meters were traceable to national standards and were regularly recalibrated.

The tests and the assessments were performed according to the harmonised standard *EN 12405-1:2005+A2:2010 / EN 12405-1:2018.*

The conversion device of type ELCOR or ELCOR plus complied with all specified requirements and the one is able to fulfil the determined purpose which was designed for.

The results of tests and of assessment are summarised in the **Test Report no. 5012-PT-A0001-18** (*gas volume conversion device*), **Test Report no. 5012-PT-A0002-18** (*energy conversion device*), **Test Report no. 5012-PT-A0004-19**, **Test Report no. 5012-PT-A0008-19**, Test Report no. 5012-PT-A0009-19 (for conformity with OIML R 140:2007 (E), **Test Report no. 5012-PT-A0015-20, Test Report no. 5012-PT-A0003-21, Test Report no. 5012-PT-A0032-21.**

## 4 Markings

Each conversion device shall be marked with the following information on main name plate which is placed on the front (top) panel (*Figure no.5*):
- type: ELCOR or ELCOR plus
- serial number/ year of manufacture
- MPE at reference conditions
- ingress protection (IP code)
- number of the EU-type examination certificate: **TCM 143/18-5562**
- valid certificate number for hazardous area
- the class of explosion hazardous area
- extreme temperatures of the environmental class $T_{amb}$
- name and address of manufacturer
- 'CE' marking and supplementary metrology marking 'M' and the last two digits of the year of its affixing. The identification number of the notified body shall follow the 'CE' marking and the supplementary metrology marking.

On the display (LCD) there the following information shall be indicated:
- base conditions $T_b$ and $p_b$
- actual method of calculation of the ratio of compressibility factors
- range of the pressure transducer
- actual range of the temperature transducer
- parameters (composition) of natural gas if the ratio of compressibility factors $K$ is not constant (or the value of $K$, if $K$ is constant)
- value(s) of pulse constant(s) of gas meter $k_p$ (imp/m$^3$)

On the name plate of pressure transducers there the following information shall be indicated:
- serial number
- type
- name of manufacturer
- year of manufacture
- measuring range

On the name plate of temperature transducers there the following information shall be indicated:
- serial number
- type
- name manufacturer
- year of manufacture
- maximum measuring range

On the label located on the side of device casing there the ranges of used transducers shall be mentioned. Near the used transducers of temperature or of pressure there the information labels with designations P1, P2, T1, T2 shall be placed in the case of dual channel variant.

The language used on the name plates or on the labels can be the language of the destination where the device is produced for.

The conversion device that corresponds to this *EU-type examination certificate* and to other requirements concerning the assessment according to the module F or D is sealed in the way mentioned in *Figures no.6* and *no.7* for *version 1*, in *Figures no.8* and *no.9* for *version 2* and in *Figure no.10* for *version 3*. The adhesive stickers are used for sealing. Before sealing the metrological switch must be in position OFF (not in the ON position).

**Annex:**
Figure no.1  Design of the conversion devices ELCOR or ELCOR plus
Figure no.2  Dimensional drawings of gas volume conversion devices ELCOR or ELCOR plus
Figure no.3  Construction structure of conversion devices ELCOR or ELCOR plus
Figure no.4  Block diagram of  ELCOR plus or ELCOR
Figure no.5  Variants of the name plates on the front (top) panel of ELCOR or ELCOR plus
Figure no.6  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 1 - part 1)
Figure no.7  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 1 - part 2)
Figure no.8  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 2 - part 1)
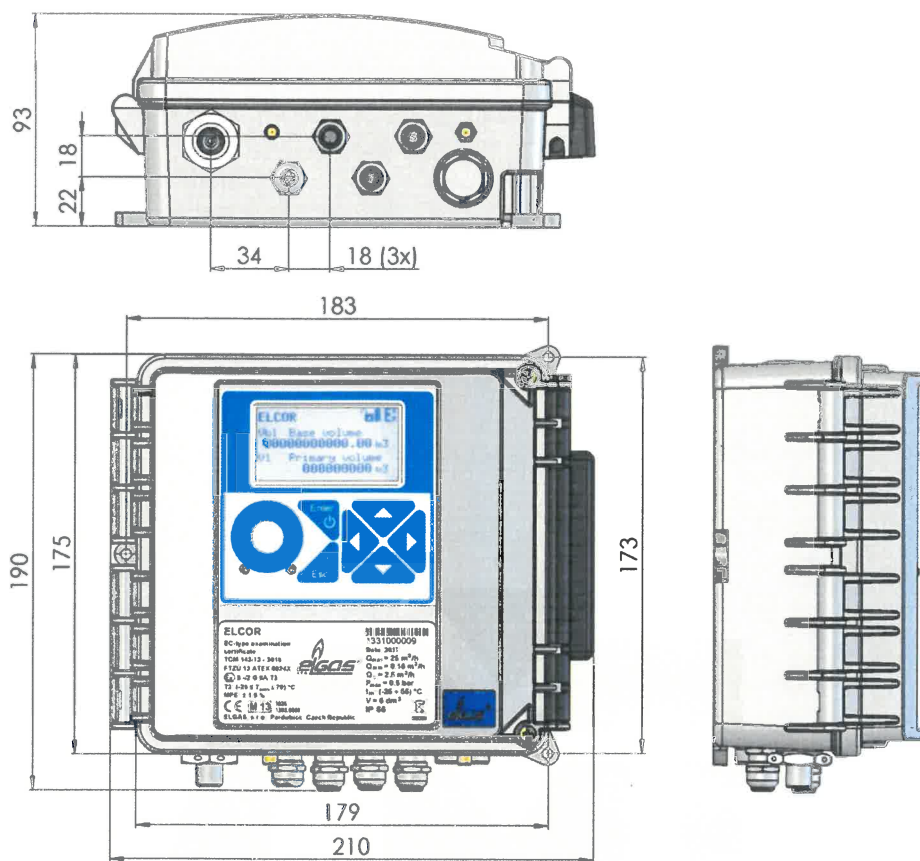Figure no.9  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 2 - part 2)
Figure no.10  Places of seals (stickers) on the conversion device of type ELCOR plus (version 3)

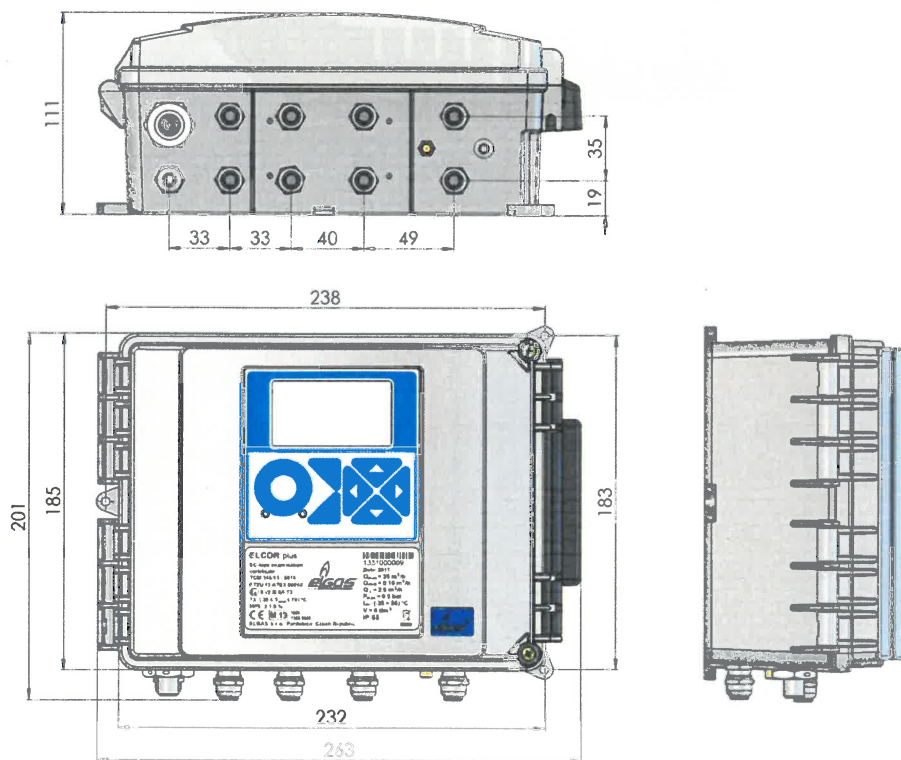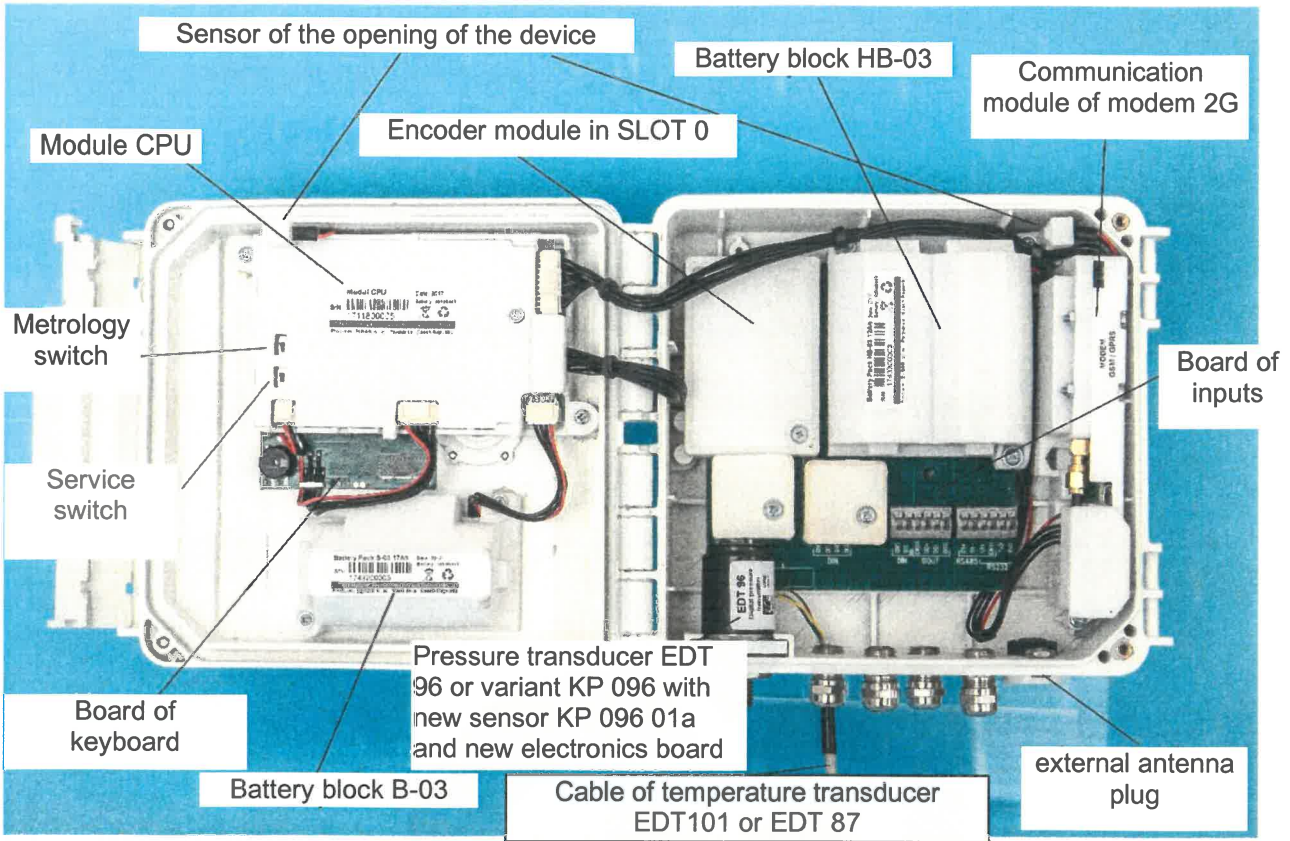Figure no.1 Design of the conversion devices ELCOR and ELCOR plus

**ELCOR:**



**ELCOR plus:**



Figure no.2  Dimensional drawings of gas volume conversion devices ELCOR and ELCOR plus

## ELCOR:



Sensor of the opening of the device

Battery block HB-03

Communication module of modem 2G

Module CPU

Encoder module in SLOT 0

Metrology switch

Board of inputs

Service switch

Pressure transducer EDT 96 or variant KP 096 with new sensor KP 096 01a and new electronics board

Board of keyboard

Battery block B-03

Cable of temperature transducer EDT101 or EDT 87

external antenna plug

## ELCOR plus:



Encoder module in SLOT 0

Module in SLOT 2

Communication module of modem 2G in SLOT 5

Sensor of the opening of the device

Module in SLOT 1

Module in SLOT 3

Module CPU

Battery block HB-03

Metrology switch

Service switch

Board of keyboard

Battery block B-03

SLOT 4 - PWR

Pressure transducer EDT 96 or variant KP 096 with new sensor KP 096 01a and new electronics board KP 096 06

Board of inputs

Cable of temperature transducer EDT101 or EDT87

Figure no.3  Construction structure of conversion devices ELCOR and ELCOR plus

EDT 96
EDT 101      IB0
EDT 87

Pt1000         PT4W Module

HF inputs    SLOT0
Encoders     Terminals
Indexer                Indexer Module      Interface
                                           only

                       SCR Module          CPU2
                       NAMUR Module

             SLOT0                          IB0

                                 Metrological
                                 channel

Main
Battery        3,6V/17Ah

Backup         3,6V/1Ah
Battery        or
               3,0V/0,6Ah

Infrared Interface

LF inputs    DI1-4       DIN

                                                        SLOT1, SLOT2                SLOT1,
                                                                                    SLOT2
                                                        RS232/RS485   Interface     Terminals
                                                        Interface     only

Outputs      DO1-4       DOUT                            Analog
                                 CPU1                    Inputs/outputs  CPU3
                                                        (ELCORplus only)

                                                        SLOT4(5)

                                                        Wireless    PWR2         Battery for
                                                        modem       Module       Communication
                                                                    (ELCORplus only)

EDT 96       IB1         IB1     User channel                                      PWR
EDT 101                          or                                               Terminals
EDT 87                           2. Metrological
                                 channel             SLOT3
             (ELCORplus only)
                                           External   PWR1
                                           power      Module        (ELCORplus only)
                                                     (ELCORplus only)

                       DISPLAY   KEYBOARD   MEMORY

Figure no.4  Block diagram of  ELCOR plus and ELCOR

**ELCOR**
**Gas Volume Converter**

1846000001　Date: 2018
　　　　　　　IP 66

Pressure: (400 ÷ 7000) kPa
Temperature: (-40 ÷ 70) °C
$(-40 \leq T_{amb} \leq 70)$ °C
MPE: ± 0.5 %

EU-type examination certificate:
TCM 143/18 - 5562
FTZÚ 17 ATEX 0141X
⟨Ex⟩ II 1G Ex ia IIB T4 Ga
$(-40 \leq T_{amb} \leq 70)$ °C

CE ⟨M 18⟩ 1026
　　　　　　1383,0678
ELGAS, s.r.o.　Semtínská 211, 533 53 Pardubice, Czech Republic

**ATTENTION! Electrostatic hazard. Do not rub.**

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**ELCOR plus**
**Gas Volume Converter**

1846100001　Date: 2018
　　　　　　　IP 66

Pressure: (400 ÷ 7000) kPa
Temperature: (-40 ÷ 70) °C
$(-40 \leq T_{amb} \leq 70)$ °C
MPE: ± 0.5 %

EU-type examination certificate:
TCM 143/18 - 5562
FTZÚ 17 ATEX 0141X
⟨Ex⟩ II 1G Ex ia IIB T4 Ga
$(-40 \leq T_{amb} \leq 70)$ °C

CE ⟨M 18⟩ 1026
　　　　　　1383,0678
ELGAS, s.r.o.　Semtínská 211, 533 53 Pardubice, Czech Republic

**ATTENTION! Electrostatic hazard. Do not rub.**

After an issue of Addition 3 of this Certificate, variant of the name plates to ZONE 2 only

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**ELCOR** *plus*
**Gas Volume Converter**
**for ZONE2 only**

1946190012
IP 66
Date: 2019

Pressure: (0.8 ... 5.2) bar
Temperature: (-25 ... +70) °C

MPE: ± 0.5 %
$(-25 \leq T_{amb} \leq 60)$ °C

EU-type examination certificate:
TCM 143/18 - 5562

FTZÚ 19 ATEX 0002X
⟨Ex⟩ II 3G Ex ic nA IIB T4 Gc

CE ⟨M 19⟩ 1026
　　　　　　1383, 0678
ELGAS, s.r.o.　Semtínská 211, 533 53 Pardubice, Czech Republic

**ATTENTION! Electrostatic hazard. Do not rub.**

Figure no.5 Variants of the name plates on the front (top) panel of ELCOR and ELCOR plus
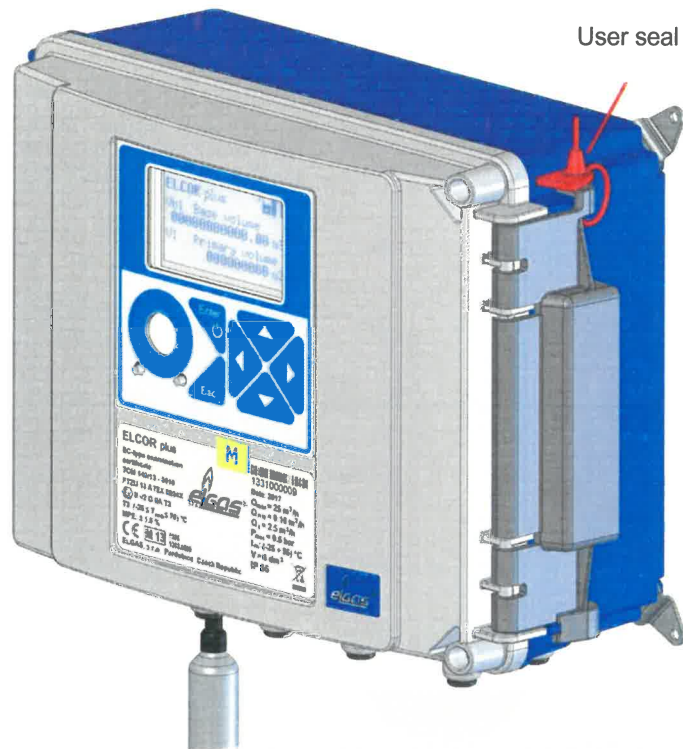(Other language variations are allowed).

## ELCOR:
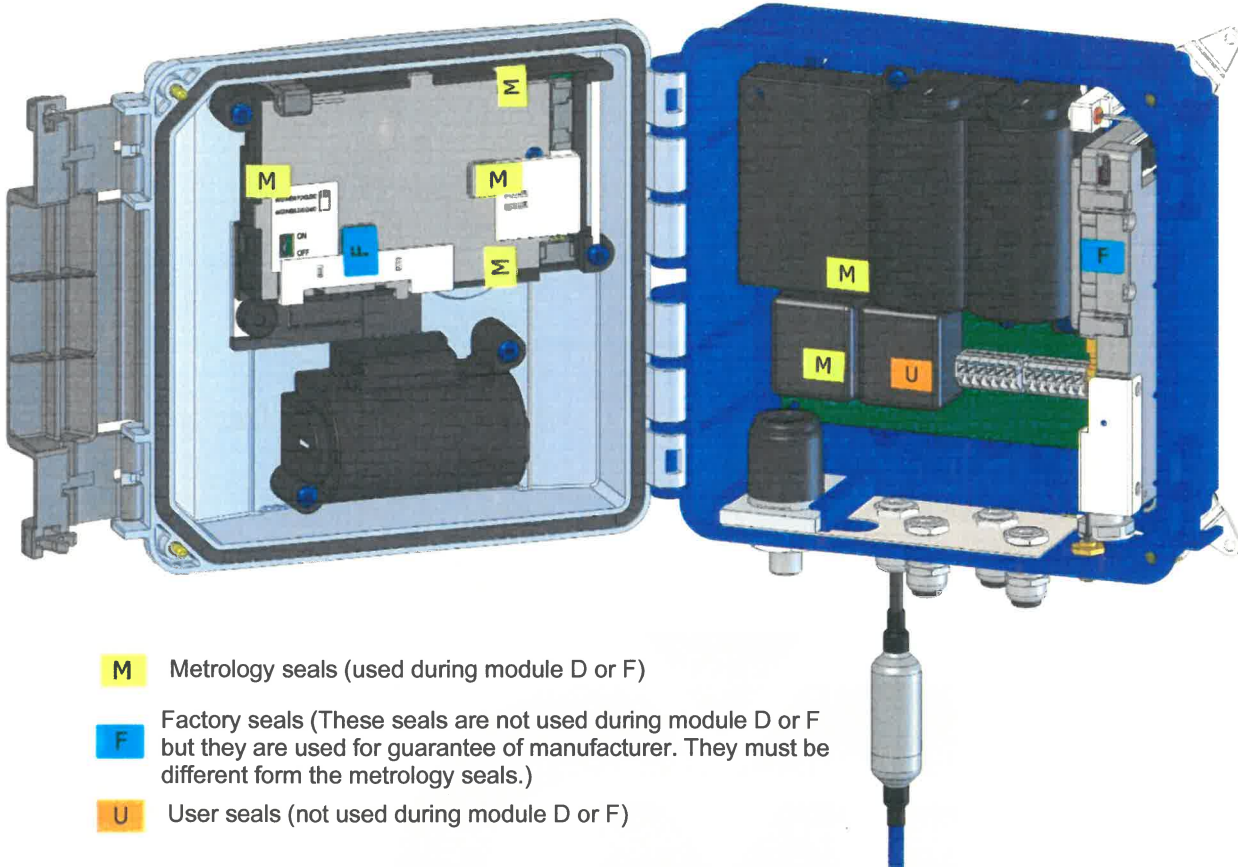


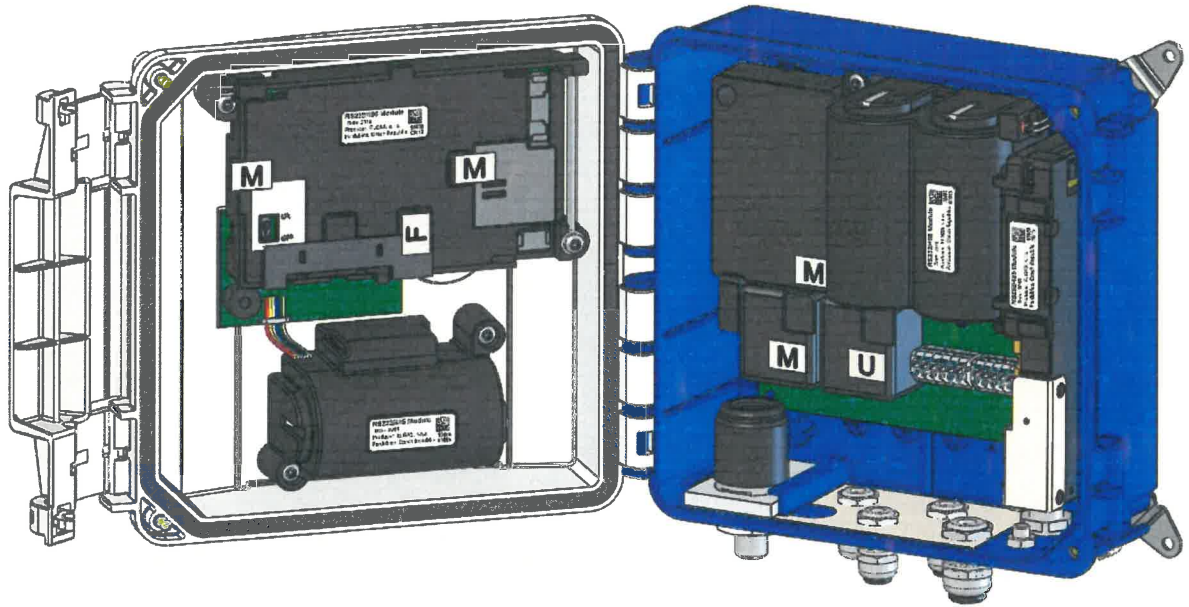| M | Metrology seals (used during module D or F) |
|---|---|
| F | Factory seals (These seals are not used during module D or F but they are used for guarantee of manufacturer. They must be different form the metrology seals.) |
| U | User seals (not used during module D or F) |

## ELCOR plus:



Figure no.6  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 1 - part 1)

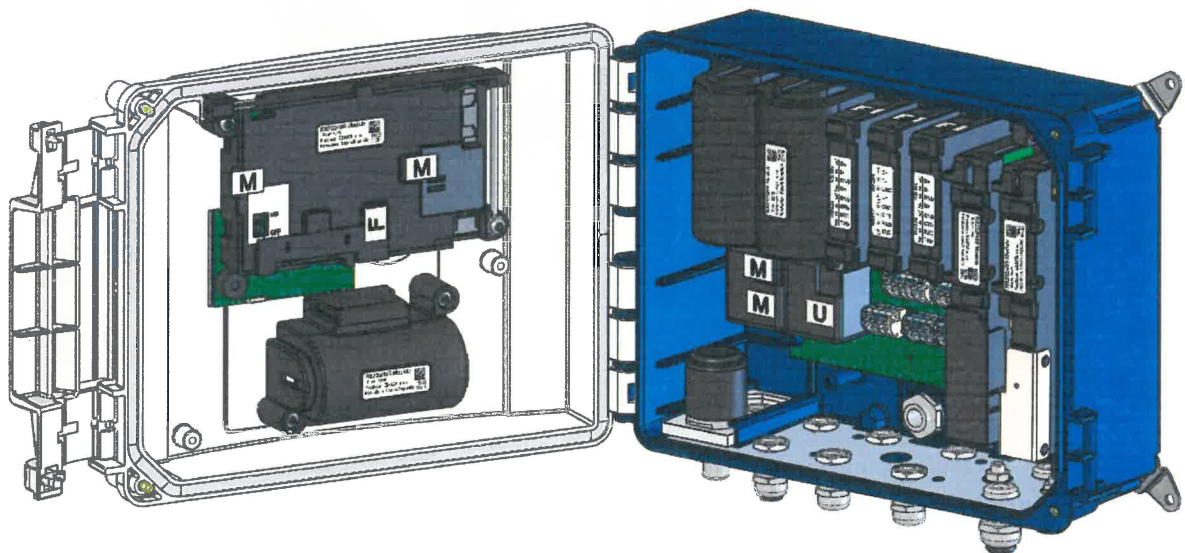M  Metrology seals (used during module D or F)

Figure no.7  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 1 - part 2)

M - Metrology seals (used during module D or F)

F - Factory seals (These seals are not used during module D or F but they are used for guarantee of manufacturer. They must be different from the metrology seals.)

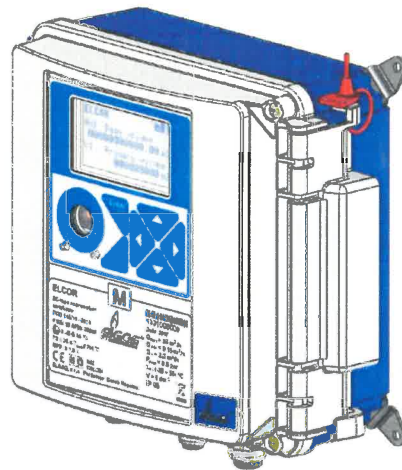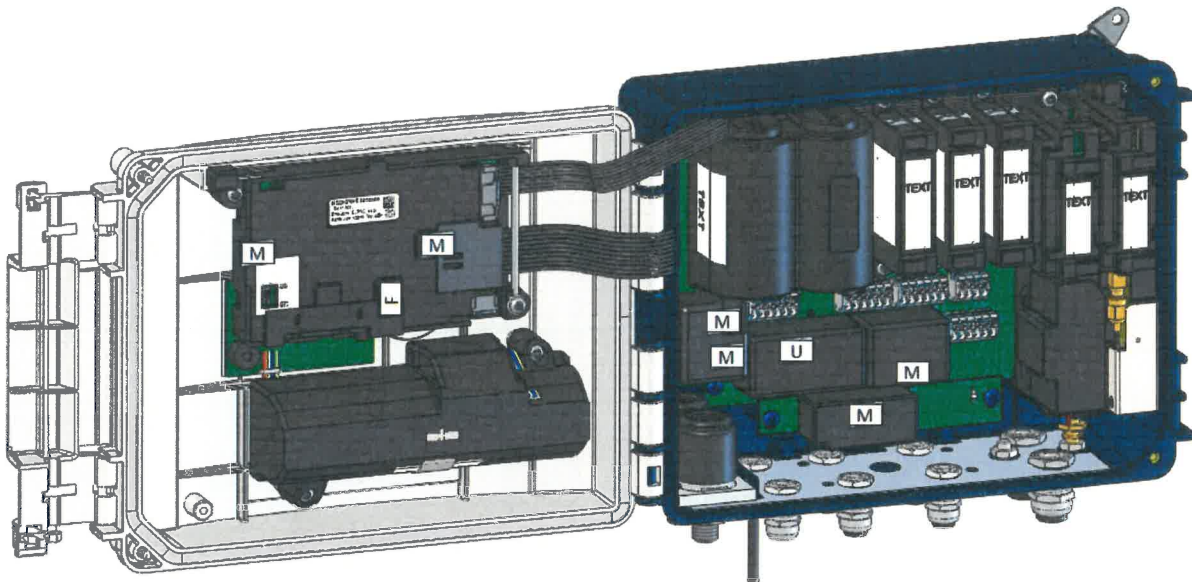U - User seals (not used during module D or F)



Figure no.8 Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 2 - part 1)

M   - Metrology seals (used during module D or F)


Figure no.9  Places of seals (stickers) on the conversion device of type ELCOR or ELCOR plus (version 2 - part 2)

| M | - Metrology seals (used during module D or F) |

| F | - Factory seals (These seals are not used during module D or F but they are used for guarantee of manufacturer. They must be different from the metrology seals.) |

| U | - User seals (not used during module D or F) |

Figure no.10  Places of seals (stickers) on the conversion device of type ELCOR plus (version 3) in dual channel variant with module PT4W.