



Corus Evo Compact

Gas Volume Converter

810-2010-00

AA

EN User manual

*Gas flow volume corrector under base conditions.
Approved for installation in potentially explosive atmospheres.*



Safety Measures

Only a person trained in accordance with specifications, safety regulations and European standards may operate the metering device. In addition, take other legal and safety regulations in account for the special cases when the device is used in potentially explosive atmospheres. Similar measures apply to the use of its accessories. Operators are required to be trained in accordance with Decree 50/1978 Coll., as amended.

The information in these instructions establishes no legal commitment by the manufacturer and it reserves the right to change them. Both the instructions and the product may be changed at any time without prior notice to make improvements or to correct typographical or technical errors.

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Symbols and terms

Symbol	Meaning	Unit
AGA8-G1	method to calculate gas compressibility factor	
AGA8-G2	method to calculate gas compressibility factor	
AGA8-DETAIL	method to calculate gas compressibility factor (Note: The earlier designation of this method was AGA8-92DC)	
AGA NX-19 mod	method to calculate gas compressibility factor	
ASC	Authorized Service Centre	
BTS	Base Transceiver Station of mobile network	
BP	battery pack	
CLO	4-20 mA current output module	
CRC	checksum - for data protection purposes	
CSD	Circuit Switched Data - is a basic type of data connection within mobile GSM networks. It is a point-to-point connection based on a dial-up connection.	
CTR	communication protocol	
DC, dc	DC voltage	
dE	energy addition (difference)	MJ
dE _s	energy difference (difference) in error conditions	MJ
dV	addition primary volume V _m or V (difference)	m ³
dV _b	addition converted volume V _b (difference)	m ³
dV _{bs}	increment (difference) of the recalculated volume V _b under the error conditions	m ³
dV _c	addition corrected primary volume V _c (difference)	m ³
dV _m	addition primary volume (difference)	m ³
E	energy	MJ
Es	spare energy value	MJ
EDTxx	digital transducer of pressure EDT 96 or of temperature EDT 101	
IFLAG	Communication protocol developed by Dresser Utility Solutions	
EMC	electromagnetic compatibility and resistivity	
EMI	electromagnetic radiation	
EMS	electromagnetic susceptibility, immunity to electromagnetic interference (EMI)	
EVC	Electronic gas volume corrector	
Ex equipment	explosion-proof equipment	
Ex i	electrical equipment / circuits protected against explosion by intrinsically safe protection, see [4]	
firmware, FW	software in the device	
GOST 30319.2	method to calculate gas compressibility factor	
GOST 30319.3	method to calculate gas compressibility factor	

Symbol	Meaning	Unit
GPRS	General Packet Radio Service is a designation for a mobile data network that works on packet switching technology and dynamically uses unoccupied channels, which are then shared by multiple users. For this reason, throughput and baud rate cannot be guaranteed.	
GSM	Global System for Mobile Communications refers to the mobile data network.	
H _s	combustion heat	MJ/m ³
IS	intrinsic safety "i" a type of explosion protection which is based on limiting the electrical energy in equipment and interconnectors exposed to an explosive atmosphere to a level below that which could cause ignition by sparking or thermal effects (see [4])	
LF	low frequency	
LTE	telecommunication technologies for high-speed data transmission in mobile networks	
MID	(Measuring Instrument Directive), 2014/32/EU Directive on the making available on the market of measuring instruments (NV č. 120/2016 Sb.)	
Modbus	communication protocol designed by Modicon company [19]	
MPE	maximum permissible error	
M900	communication protocol designed by RMG company	
NB, Narrow Band	communication wireless narrowband technology specially developed for the Internet of Things. Its advantage is the possibility of deployment in the GSM and LTE bands	
notified body	A notified body is an organization designated by an EU country to assess the conformity of certain products before they are placed on the market. These bodies perform tasks related to conformity assessment procedures	
PLC	Programmable Logic Controller - programmable logic controller for process control or machine control	
reed contact	pulse sensor in a gas meter on the principle of a mechanical switch controlled by a magnetic field	
RTD sensor	Resistance Temperature Detector, resistance temperature sensor	
SGERG-88	method to calculate gas compressibility factor	
SW	software – PC program	
C	conversion factor	-
K	gas compressibility factor (Z/Z_b)	-
k _p	gas meter constant (number of pulses per 1 m ³)	imp/m ³
N	number of input pulses from the gas meter	imp
p	absolute pressure at metering conditions	kPa
p _b	absolute pressure at base conditions	kPa
Q	flow rate at measurement conditions (primary flow rate)	m ³ /h
Q _b	flow rate at base conditions (converted flow rate)	m ³ /h

Symbol	Meaning	Unit
SELV	Safety Extra-Low Voltage, a low voltage system (i.e. usually not exceeding AC 50 V or DC 120 V) which is electrically isolated from earth and other systems so that a single fault cannot cause electric shock	
T	absolute temperature at measurement conditions ($T = t + 273,15$)	K
t	gas temperature	°C
T_b	absolute temperature at base conditions	K
V	volume V_m or V_c	
V_m	volume at measurement conditions (primary volume)	m ³
V_c	corrected volume at measurement conditions (volume corrected based on correction profile of the gas meter)	m ³
V_b	volume at base conditions (converted volume)	m ³
V_{bs}	spare volume at base conditions (spare converted volume)	m ³
V_s	spare volume at measurement conditions (spare primary volume)	m ³
V_f	operating volume for the set tariff (tariff counter of the operating volume)	m ³
V_{bf}	volume under base conditions for the set tariff (tariff counter of the recalculated volume)	m ³
Wiegand sensor	pulse sensor in the gas meter working on the principle of switching the Wiegand sensor by a magnetic field	
Z	gas compressibility factor at measurement conditions	-
Z_b	gas compressibility factor at base conditions	-
Zone 0	a space in which an explosive gas atmosphere is present permanently or for long periods of time or frequently (see [36])	
Zone 1	a space in which the occasional formation of an explosive gas atmosphere is likely during normal operation (see [36])	
Zone 2	a space in which the formation of an explosive gas atmosphere is not likely during normal operation, but if such an atmosphere is created, it will persist only for a short period of time (see [36])	

1 Introduction

1.1 Basic Description of the Device

The Corus Evo Compact gas volume corrector ("device") is a measuring device designed to convert the volume of gas measured under operating conditions to the volume under base conditions.

Information about gas volume is scanned through the gas meter's pulse outputs. Integrated transducers measure both gas temperature and pressure. The device calculates gas compressibility using either common methods or a constant value.

The corrector has been engineered and approved in compliance with EN 12405-1:2005+A2:2010 / EN 12405 1:2018 as a Type 1 corrector (compact system) and can be supplied as a T, TZ, PT or PTZ corrector. It has likewise been manufactured in accordance with OIML R140 Edition 2007 (E).

From a safety point of view, the device has been engineered in compliance with applicable standards and approved for use in potentially explosive atmospheres.

It is manufactured and delivered in accordance with the following directives issued by the European Parliament and by the Council:

2014/34/EU	ATEX) Equipment and protective systems intended for use in potentially explosive atmospheres (NV 116/2016 Coll.)
2014/30/EU	Electromagnetic Compatibility (NV 117/2016 Coll.)
2014/32/EU	(MID) Measuring Instruments (NV 120/2016 Coll.)
2014/53/EU	RED) Radio Equipment and Telecommunication Broadcasting Equipment (NV 426/2016 Coll.)
2011/65/EU	(RoHS) NV 481/2012)

The device has been placed on the market and put into service in compliance with these directives, with the CE mark affixed.

The device is built into an enclosure made of durable plastic and rated IP66. It is equipped with a graphic or segment display and either with a 6-key or 2-key keypad, or with 1 button.

1

Device Trade Name

These instructions specify the features and parameters for the **Corus Evo Compact** corrector.

The device is powered by a battery and also by an external power supply. When powered by a battery in a defined operating mode, the battery life is 15 years (see Section 6.1). A digital pressure sensor, normally found on the right side wall of the device, measures gas pressure, while a digital temperature transducer on the cable measures gas temperature. Metered information on gas consumption can be transferred to the corrector from the gas meter's low-frequency pulse output.

Besides pulse inputs, the device also has binary inputs that can work, for example, as a control to check the connection to the gas meter or perform other functions such as monitoring the state of the safety quick closing valves, the condition of the door, etc. It also has digital outputs that can be configured as pulse, binary, or data outputs for the CLO module. Using this module, an analog current output can be realized.

The device stores values in several types of internal archives. The data archive stores values that have been measured and calculated and have an adjustable structure with an adjustable storing frequency. Daily and monthly archives

allow programming the storage of important quantities and for some statistical values to be calculated and stored. The binary archive captures changes in binary inputs and the occurrence of monitored events (limits, ...). Error states and diagnostics are stored in the status archive. The settings archive, for service and metrology purposes, records actions that affect the device parameters when changing settings. There are also other archives available. For more details, see Section 10.3.

The device is normally equipped with an integrated modem, optional for 2G and 4G (Cat1, CatM1 and NB) network communication. In the event of an alarm condition, the device can initiate the connection itself. The device is equipped with a serial interface RS485 for communication with a superior system. The various communication protocols installed inside allow easier connection to SCADA systems. It is also equipped with an IR interface for an optical head, designed especially for service settings.

The device allows wide-range user parametrization. Either the keypad or supplied PC software (see [38]) can be used for configuration. The software also allows both actual measured values and the contents of internal archives to be read, displayed and saved.

Main features

- Latest technology to ensure high performance and durability when the device is used and handled
- High resistance to electromagnetic interference (EMC), withstanding up to twice the interference values the industry standard requires
- Architecture that permits easy customization
- Digital inputs and outputs that end users can broadly configure
- Durable capacitive keypad for easy operation
- Displays actual and archive values with a graphic display option
- Option suitable for temperatures up to -40 °C with always ON segment display
- New-generation digital pressure and temperature transducers with high precision and long-term stability
- High-capacity FLASH memory to enable internal archives to store measured and calculated data for several years
- Communication through 3 independent communication channels. It can run locally or remotely via an internal modem on the latest generation networks, using different communication protocols and high communication speed (up to 115 kBd)
- Each communication channel can communicate with a different protocol
- Communication is completely independent and has no impact on the measuring, computational and data archiving systems
- Option of remote downloading of the control FW according to Welmec 7-2 Extension D
- Several levels of protection against device abuse
- Device settings changeable locally or remotely
- Corus Evo Compact device can be an electronic volume corrector for billing purposes
- Open architecture to satisfy new requirements and projects
- Battery can operate up to 15 years before it has to be replaced
- NF (reed, Wiegand) gas meters connection
- Battery powered with optional external power supply

1.2 Device security

The device is equipped with the following mechanisms against abuse:

Sealing the device

- Sealing the closed device with the user's seal (Section 5.2)
- Sealed where the pressure transducer connects to the pipeline
- Sealed where the temperature transducer connects to the pipeline (Section 5.4.5)

Sealing internal parts (Section 5.2)

- Official MID security mark protects metrological parts
- Either the manufacturer's or user's security mark protects selected non-metrological parts

Detecting Tampering with the Device

- Option of an alarm sent when the device is opened

Protection of device settings and data in the device (Section 10.6)

- Metrological switch - secured by an official MID security mark, it blocks any attempted operations that directly modify the device's metrological properties (measuring accuracy, transducer calibration and replacement, setting of converted volume counters, etc.)
- Servicing switch - blocks parameter settings not directly affecting the device's metrological properties.
- Password security - optionally, a system of 50 passwords in 5 groups with different hierarchies of authorization to modify device settings can be used
- Encryption - protects transmitted data (symmetric AES encryption with 128-bit encryption key length). The option can be used for data transmission with the Dresser communication protocol, or CTR protocol. (Section 7.5)

All changes to device parameter settings are stored along with personnel identification in a settings archive that cannot be deleted.

1.3 Device versions

The Corus Evo Compact corrector is a certified measuring instrument for commercial measurement in compliance with 2014/32/EU.

In terms of design and most technical specifications.

This battery-powered single-channel device has several optional extensions. There are several versions depending on the setup:

1. Standard features:

- Single-channel gas volume corrector
- One EDT 125 digital pressure transducer
- One EDT 124 digital temperature transducer
- Pulse input for connecting a gas meter with an LF pulse output
- Possibility of connecting a gas meter with reverse operation
- Three digital inputs (pulse, binary, tamper contact)
- Two digital outputs (binary, pulse, or analog 4-20mA (using a CLO module)
- Capacitive keypad
- Display screen
- Optical head communication
- Batteries for powering the corrector
- Option of an external power supply for the corrector

2. Optional extension:

- Display option:
 - Graphic display with backlight, or
 - Segment display with backlight (down to -40 °C), or
 - Segment display without backlight
- Keypad option:
 - Six-button, or
 - Two-button, or
 - One-button
- One communication interface
 - RS485, or
 - RS232
- One internal modem module (plus batteries to power it):
 - 2G modem (i.e. GPRS), or
 - 4G modem (3G compatible), or
 - NB modem
- Option of an external power supply for the modem
- External antenna
- Digital outputs with or without galvanic isolation

**ATTENTION!**

If the device is delivered without inserted modem battery cells, the modem battery cells must be installed immediately after delivery, otherwise there is a risk of discharge and destruction of the supercapacitor!

Before inserting the cells, it is necessary to check the voltage of the supercapacitor and follow the procedure for replacing the battery cell - see paragraph 6.2.1.

1.4 Device architecture

The corrector features a compact design with a temperature and pressure transducer permanently attached. The standard version has the pressure transducer built into the right side wall of the enclosure. In the case of an external pressure transducer, the transducer is connected with a shielded cable. The device consists of the following two main electronic components:

1) EVC module

- Compact module consisting of corrector circuits (processor, memory, display, keypad, pressure and temperature transducers, electronic security elements, backup power battery and input/output circuits including connection terminals) and battery for powering the EVC module.

2) Internal modem module

- Optional, user-replaceable module. There are several possible modem designs to choose based on remote communication requirements. The module includes an antenna (built-in or external) and a battery to power the modem (separate from the EVC module's power supply). The modem module is located under the EVC module.

1.5 Main parts

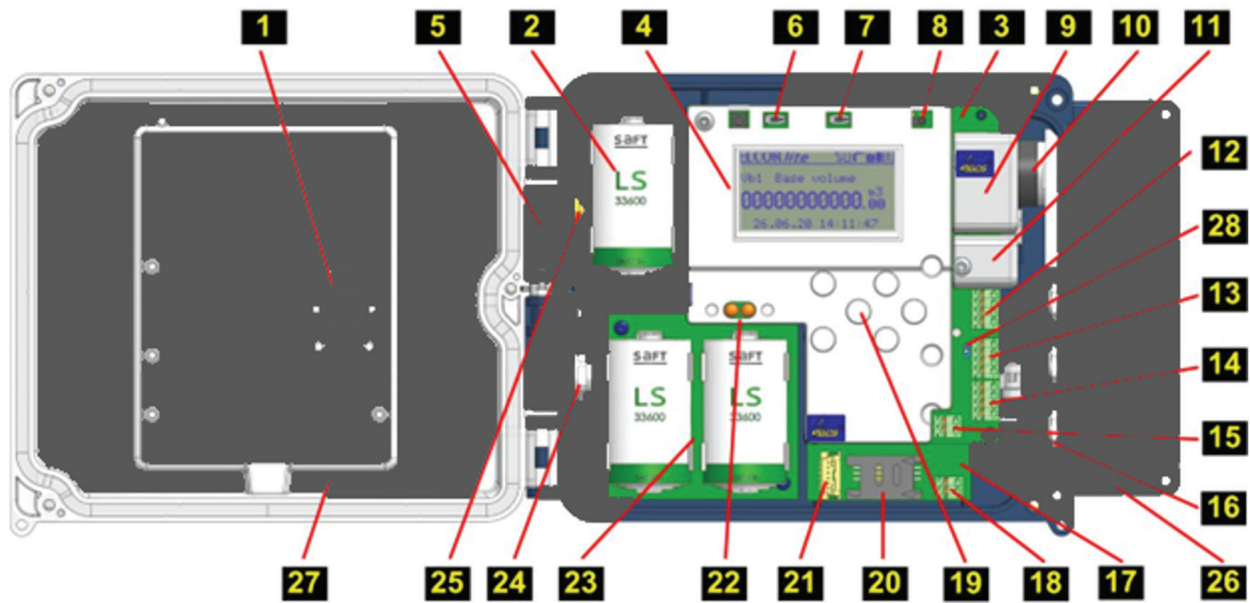


Fig. 1 Main Corus Evo Compact device parts

1	window for optical head	16	metal cable glands (4 - 5 pcs.) electrically connected by a conductive sheet
2	device battery		
3	basic board (module EVC)	17	internal modem board
4	display	18	PWR2 terminals of the external power supply of the internal modem
5	modem antenna under cover	19	keyboard buttons
6	service switch (user switch)	20	SIM card holder
7	metrology switch	21	connector for connecting the modem power supply battery
8	lid opening sensor	22	Infra-diodes for optical head communication
9	pressure and temperature transducer connection terminal cover	23	battery (battery pack) for modem supplying
10	internal pressure transducer	24	ventilation gland
11	cover of DIN terminals for gas meter connection	25	modem antenna connection pin
12	DIN terminals	26	cable gland cover
13	DOUT terminals	27	upper lid of the device
14	terminals for communication COM1	28	jumper for special use of digital outputs
15	terminals PWR1 for external power supply of EVC internal modem board		

2 Safety

2.1 General

The device is approved in compliance with Directive 2014/34/EU (NV 116/2016 Coll.) and the following certificates have been issued for it:

FTZÚ 25 ATEX 0004X	EU type-examination certificate (ATEX) for use in potentially explosive atmospheres. A device Corus Evo Compact - Intrinsically safe (IS) design of the device.
IECEX FTZU 25.0003X	IECEX Certificate of Conformity A device Corus Evo Compact - Intrinsically safe (IS) design of the device.

Important Notices:



CAUTION!

The Corus Evo Compact device has been designed in compliance with safety rules for use in potentially explosive atmospheres. It is approved as an intrinsically safe device compliant with EN 60079-11.



DANGER!

Install the device and use it in accordance with this documentation and the conditions stated in the ATEX certificate.



WARNING!

Use only batteries listed in the technical specifications table (see Sections 3.9 and 3.10) to power the device.
Replace batteries as mentioned in this documentation (see Sections 6.1.2 and 6.2.1).



WARNING!

The specified IP66 rating applies only if cables of the appropriate diameter and correctly tightened are used in the device's cable glands. Blind any unused cable glands.

2.2 Use in potentially explosive atmospheres

How the device is marked for explosion safety depends on whether an internal modem is installed.

EU type-examination certificate FTZÚ 25 ATEX 0004X allows the battery-operated version of the device to be operated without an internal modem in potentially explosive atmospheres designated as ZONE 0.

If an internal modem is installed, the device is then designed for ZONE 1 environments.

Designation of explosion safety	Device and its internal equipment	Environment
 II 1G Ex ia IIB T4 Ga	- IS design without internal modem	Zone 0
 II 2G Ex ib IIB T3 Gb	- IS design with internal modem	Zone 1

**CAUTION!**

When the device has an FTZÚ 25 ATEX 0004X certificate, it is engineered and approved as intrinsically safe. Only approved devices (intrinsically safe devices, associated apparatuses) or the “simple apparatuses” listed in EN 60079 11 [4] and compliant with intrinsically safe parameters listed in the EU type-examination certificate [16] may be connected to all terminals on the device.

Observe relevant safety standards when connecting the device.

Consider the electrical characteristics of the connecting cables when connecting the device and comply with requirements in the relevant safety standards. Additionally, follow the Special Conditions for Use if they are stated on the Certificates. The device's explosion safety parameters are specified in Section 4.

2.3 Special conditions for use

**CAUTION!**

Under certain extreme circumstances, an electrostatic charge capable of explosion initiation may form on the plastic enclosure. Do not install the device where external conditions could result in electrostatic charge. Wipe the device only with a damp cloth.

2.4 Risks of use

The device's enclosure is made of polycarbonate with a polyester foil keypad located on the top cover. In some extreme cases, an electrostatic charge may accumulate on the surface of the enclosure, whose energy can ignite the surrounding explosive atmosphere.

To prevent the risk of ignition due to electrostatic charge, follow the procedure below:

- If the device is going to be used in potentially explosive atmospheres, do not install it where external conditions can generate an electrostatic charge.
- Only clear the device with a damp cloth.

2.5 Connecting external devices

Intrinsically safe signals run to all of the device's connection terminals. Follow the intrinsic safety principles below when connecting external devices to the terminals. Follow the applicable standards when connecting the device, in particular:

EN 60079-25:2010 Explosive atmospheres – Part 25: Intrinsically safe electrical systems,
 EN 60079-14:2014 Explosive atmospheres – Part 14: Electrical installations design, selection and erection,
 EN IEC 60079-0:2018 Explosive atmospheres – Part 0: Equipment – General requirements,
 EN 60079-11:2012 Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”.

Intrinsic safety parameters for the connection terminals are specified in Section 4. Electrical installation and connection are described in Sections 5.5 and 5.6. The recommended cable types are listed in the sections describing how the particular devices are connected.

3 Technical specifications

3.1 Product identification

Device name	Corus Evo Compact
Drawing number	KP 126

3.2 Operating conditions and environment

IP Rating	IP66, according to CSN EN 60529
Operating temperature T _a	-25 ÷ +70 °C (standard) -40 ÷ +70 °C (optionally)
Storage temperature	-40 ÷ +70 °C
Working environment	class 4K3 (according to the standard EN 60721-3-4) The device is designed for use in inside and outside environment (based on IP66 certification).
Mechanical Environment Class	M2 (according to the standard EN 12405-1+A2)
Electromagnetic Environment Class	E2 (according to the standard EN 12405-1+A2)

3.3 Mechanical specifications

Mechanical dimensions (W x H x D) without/with cover for cable glands and antenna (more in paragraphs 5.1)	240/266 x 182 x 61 mm
Weight	0,9 kg (without batteries and transducers)
Cabinet material	PC (polycarbonate)
Recommended working position	vertical
Connection terminals - conductor cross section	0,2 ÷ 1,5 mm ² (without cable lug) 0,25 ÷ 0,75 mm ² (with cable lug)

3.4 Safety and explosion protection

Protection against dangerous contact with living and non-living parts

type of protection	safety extra-low voltage (SELV)
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Explosion protection

- version without internal modem

designation	 II 1G Ex ia IIB T4 Ga
environment classification	Zone 0, Zone 1, Zone 2
EU Type Examination Certificate	FTZÚ 25 ATEX 0004X
IECEx Certificate of Conformity	IECEx FTZU 25.0003X

- version with internal modem

designation	 II 2G Ex ib IIB T3 Gb
environment classification	Zone 1, Zone 2
EU Type Examination Certificate	FTZÚ 25 ATEX 0004X
IECEx Certificate of Conformity	IECEx FTZU 25.0003X

3.5 Display and control

Display Features - display	
alternatively:	
- segment	- without backlight / -25 ÷ +70 °C (standard) - with backlight / -40 ÷ +70 °C (optional)
- graphical	LCD display 128 x 64 points with backlight / -25 ÷ +70 °C
Control - keyboard	
alternatively:	
- outside keyboard	6 buttons (capacity keyboard)
- internal buttons	2 buttons (accessible after opening the cabinet lid)
- external button	1 button (lighting/changing display)

3.6 Metrological specifications

3.6.1 Metrological approval

Type-approval marking	TCM 143/25 –6003 (MID certification)
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3.6.2 Instrument measurement accuracy

- Max. total error of the corrector	< 0.5 % of the measured value (MID certification)
- Typical total error of the corrector	< 0.15 % of the measured value (MID certification)
- Compressibility calculation	SGERG-88, AGA NX-19 mod, AGA 8-G1, AGA 8-G2, AGA 8-DE- TAIL, GOST 30319.2-2015, GOST 30319.3-2015
- Compressibility factor calculation error	< 0.05 %

3.6.3 Measurement specifications

3.6.3.1 General

Measurement principle	PTZ corrector ¹⁾
Measurement Period	30 s (adjustable, range 1 s ÷ 30 s)
Reference conditions	
- Reference temperature Tb	15° C, or 0 °C, 15.555555 °C, 20 °C, 25 °C, 27 °C (other units available)

- Reference pressure pb	101.325 kPa, or 100.000 kPa, 101.592 kPa, 101.560 kPa, 101.0085 kPa, 102.3872 kPa, 103.5937 kPa (other units available)
Setting protection	- Metrological switch - Service switch
Period of official metrology check	- 5 years - valid for the Czech Republic (based on Decree No. 345/2002 Coll. of the Ministry of Industry and Trade) - varies from country to country. In general, the validation period of a specified meter is determined by a country's decree.

1) Simpler conversion variants can also be configured. Supported variants are PTZ, PT, TZ, and T

3.6.3.2 Supported units of quantities

Measurand	Units
Temperature	°C, °F, K, °R
Pressure	Pa, kPa, MPa, PSI, torr, bar, at, kgf/cm ² , atm, mbar, PSIA, PSIG
Volume	m ³ , ft ³ , CF, CCF, MCF, MMCF
Flow	m ³ /h, ft ³ /h, CFH, CCFH, MCFH
Energy	MJ, kWh, Btu, kcal, Mcal, Gcal, CBtu, MBtu, MMBtu
Density	kg/m ³ , lbs/ft ³
Heat of combustion	MJ/m ³ , kWh/m ³ , Btu/ft ³ , kcal/m ³ , Mcal/m ³ , Gcal/m ³ , BtuCF
Height above sea level	m, ft



ATTENTION!

Some units are not allowed for some device variants. This applies, for example, to an instrument with metrology certificate TCM 143/25 –6003 (ČMI MID).

3.6.3.3 Measuring pressure

Number of pressure transducers	1
Designation of the pressure transducer	EDT 125, Digital pressure transducer
Transducer version	internal - built-in in the device, or external – connected by cable
External transducer cable length	2.5 m (standard) 0.7 m (optional)
Cable type for external transducer	LiYCY (standard interior design) PUR (exterior design)
External transducer cable protection	optional (metal cladding)
Pressure connection	Ø 6 mm tube, ERMETO M12 x 1.5 threaded joint
Measurement of gas pressure within temperature range of	-25 ÷ +70 °C (standard) -40 ÷ +70 °C (optional)

Measurement ranges - MID certified		
- Absolute pressure values	80 ÷ 520 kPa	If the GOST 30319.2-2015 or GOST 30319.3-2015 method is used to calculate compressibility, the lower pressure limit is increased to 100 kPa
	80 ÷ 1000 kPa	
	80 ÷ 2000 kPa	
	200 ÷ 1000 kPa	
	400 ÷ 2000 kPa	
	400 ÷ 7000 kPa	
	700 ÷ 3500 kPa	
	1400 ÷ 7000 kPa	
- Measurement error	< 0.25 % of the measured value	
- Long-term stability	< 0.1 % of the measured value per year	
- Overload capacity (without changing metrological parameters)	1.25 x upper limit (UL) of the measuring range	
- Mechanical resistance (without leakage)	2 times upper limit of the measuring range	
- Constant pressure setting (absolute pressure value at measurement conditions) if the device is set as a T-corrector	In the range of 80 to 1000 kPa	
Measurement ranges - without MID certification		
- Relative pressure values	0 ÷ 20 kPa	
	0 ÷ 100 kPa	
	0 ÷ 160 kPa	
	0 ÷ 400 kPa	
	0 ÷ 600 kPa	
	0 ÷ 1000 kPa	
	0 ÷ 2500 kPa	
	0 ÷ 4000 kPa	
- Measurement error	< 0.20 % of the range (ranges 100 kPa and higher) ²⁾ < 0.40 % of the range (ranges lower than 100 kPa) ²⁾	
- Long-term stability	< 0.20 % of the range (ranges 100 kPa and higher) ²⁾ < 0.40 % of the range (ranges lower than 100 kPa) ²⁾	
- Overload capacity without changing metrological parameters	2 x upper limit (UL) of the measuring range	
- Mechanical resistance (without leakage)	2 x upper limit of the measuring range	

2) For device versions without MID certification, measurement errors in % of range are specified according to US practices

3.6.3.4 Temperature measurement

Number of temperature transducers, single channel	1
Designation of the pressure transducer	EDT 124, Digital temperature transducer
Temperature sensor	semiconductor
Transducer measuring range	-25 ÷ +70 °C (standard) -40 ÷ +70 °C (optional)
Measurement error	±0.2 °C (standard) ±0.15 °C (optional) – meets Class A requirements
Long-term stability	< 0.02 % of the measured value in Kelvin per year
Sensor design	Ø 5.7 mm tube measuring shank 50 mm long (standard) measuring shank 120 mm long (optional) integrated cable
Type of cable	LiYCY (standard interior design) PUR (outdoor design)
Length of the sensor cable	2.5 m (standard) 0.7 m (optional)
Transducer cable protection	metal cladding (optional)

3.6.3.5 Other measured parameters

Device internal temperature measurement

- location	integrated sensor in the EVC module of the device
- accuracy	± 3 °C

Barometric pressure measurement (optional)

- measuring range	30 ÷ 110 kPa
- accuracy	± 0.25 kPa

Device System Time (RTC)

- long-term stability	max. ± 13 s / month max. ± 156 s / year (in the temperature range -40 °C ÷ +70 °C)
- RTC backup in case of failure power supply (RTC works, when battery and external power supply is disconnected)	Yes (CR2450 lithium backup battery)
- backup time (RTC in operation) when using a CR2450 lithium backup battery	15 months

Device opening detection

- lid opening detection	yes (mechanical switch)
-------------------------	-------------------------

3.7 Digital inputs

DIN terminals	
- Number	4
- Terminals marking	DI1, DI2, DI3, DI4
- Input options (SW configuration) (see below)	standard: - LF pulse input, binary input/intrusion contact (tamper) optional: - pulse input (LF), binary input/intrusion contact (tamper)
- Direction of rotation of the gas meter	yes (SW configuration)
- Backup of pulse counting from the gas meter in case of power failure (battery and/or external power supply)	yes
- Backup time (pulse counting)	15 months (when using a CR2450 lithium battery)
- Cable length for each input	max. 30 m
- Input type (SW configuration)	standard: - reed contact/potential-free contact - Wiegand
- no-load voltage	2.5 V ÷ 3.6 V
- short-circuit current	approx. 3 µA
- level „ON“	$R < 100\text{ k}\Omega$ or $U < 0.2\text{ V}$
- level „OFF“	$R > 2\text{ M}\Omega$ or $U > 2.5\text{ V}$
LF pulse inputs – without flow direction detection (standard)	
- Number of inputs	3 (DI1, DI2, DI3)
- Maximum frequency	10 Hz
- Min. pulse/delay time	40 ms
LF pulse inputs - with flow direction detection (standard)	
- Number of inputs	1 (DI1, DI4)
- Maximum frequency	10 Hz
- Min. pulse/delay time	40 ms
- Phase shift between DI1 and DI4	min 10 ms ($40^\circ \div 140^\circ$)
Binary input or intrusion contact (Tamper)	
- Number of inputs	4 (DI1, DI2, DI3, DI4)
- min. duration of the condition	100 ms

3.8 Digital outputs

DOUT Terminals	
- Number of outputs	2
- Terminals designation	DO1, DO2

- Outputs options (SW configuration)	standard: LF pulse output, binary output, analogue output (via CLO)
- Backup of pulse generation in case of power failure (battery and external power supply)	no
- Output type	Open collector
- Galvanic separation	standard: YES (output circuits require external power supply connected to terminal U0+) option: NO
- application / connection	only for intrinsically safe (IS) circuits or via IS barrier (B-DO module)
- Cable length for each output	max. 30 m
- max. voltage at the output and at terminal U0+	15 V ³⁾ (application in potentially explosive atmospheres) 24 V ³⁾ (applications outside potentially explosive atmospheres)
- max. output current	100 mA
- max. resistance in closed state	5 Ω
LF pulse outputs - standard	
- On time	programmable 5 ms ÷ 25 s
- Off time (delay)	programmable 0.1 s ÷ 25 s, or adaptive
Analog outputs	
- type of output	Data output for external module CLO
- output from the external CLO module	Current output 4-20 mA, passive transmitter

3) Jumper U0+ must be disconnected!

3.9 Power supply for the measuring part

Battery version of the device	
- Battery	Lithium battery – size D
- Type of battery	Saft LS 33600 (3.6 V/17 Ah)), or EVE ER34615C (3,6 V/19 Ah)
- Operating temperature range	-25 ÷ +70 °C (standard) -40 ÷ +70 °C (optionally)
- Battery life	LS 33600: 12 ÷ 15 years ⁴⁾ ER 34615C: 8 ÷ 11 years ⁴⁾
- Battery voltage	3.0 ÷ 3.6 V
- Battery life measurement	Yes, alert when the capacity drops to 10 %
- Battery replacement by the user	Yes (D cell is situated in battery holders)

- Possibility of powering the corrector from an external power supply	standard: yes, terminals PWR1 (the battery of the measuring part then serves as a backup in the event of a failure of the external power supply) optional: no
- External power supply	PS-E, intrinsically safe source
- The magnitude of external supply voltage at the PWR1 terminals (applications outside potentially explosive atmospheres)	typically 5 V max. 6 V
Back-up Battery of the Corrector	
- Function	backup of pulse counting from gas meter and RTC run
- Type of power supply battery	Lithium Renata CR2450N
- Backup time	15 months (see paragraph 6.1.1)
- Battery life	16 years (see paragraph 6.1.1)
- Battery voltage	2.5 ÷ 3.0 V

4) Depending on the configuration of the device, see Section 6.1

3.10 Communication inputs/outputs

Communication channels	
Number of independent communication interfaces	standard: 1: IR interface for optical head (HIE-04) optionally: 2: IR + COM0 (internal modem), or 2: IR + COM1 (RS485/RS232), or 3: IR + COM0 + COM1
Communication protocol	Optionally (SW configuration) for every communication channel separately

1. IR communication interface for optical head (standard)

- Interface type	according to IEC-1107 / IEC 62056-21
- Communication speed	9600 Bd to 115200 Bd, adjustable
- Communication protocol	optional, according to firmware version (see paragraph. 7)

2. Metallic interface - serial port COM1 (optionally)

- Number of integrated interfaces	1
- Type of interfaces	RS485 (standard)
- Marks of terminals RS485	GND1, U1+, D1+, D1-
- Marks of terminals RS232	GND1, RxD, TxD, CTS
- Communication speed	2 400 Bd to 115 200 Bd, adjustable

- Galvanic separation	yes (the communication circuit requires an external power supply at the U1+/CTS terminal)
- Communication protocol	optional, according to version of firmware (see paragraph 7)
- Byte format (cannot be changed)	8 data bits, 1 stop bit, 1 start bit, no parity
- Connection	Only to IS circuits, or via IS barrier (e.g. B-RS module)
- Voltage at terminal U1+ (RS485)/CTS (RS232)	+5 ÷ +24 V (only outside potentially explosive atmospheres)
- Cable length of RS485	max. 100 m
- Cable length of RS232	max. 30 m

3. Internal modem – serial port COM0 (optional)

- Design	User-replaceable modem board
- Supported modem types	GSM ⁵⁾ / GPRS (2G network) LTE-Cat NB (NB-IoT) LTE-Cat M1 LTE-Cat 1
- Communication speed	9600 Bd to 115200 Bd
- Required SIM card size	mini SIM
- Antenna (SMA connector)	internal (standard) external (optional)

3a. GSM 5) /GPRS internal modem 2G

- Type of connection	2G modem, GSM/GPRS <i>Note: Modem doesn't support data calling in dial-up mode (CSD in GSM mode)</i>
- Frequency	Quad band 850 / 900 / 1800 / 1900 MHz
- Output power	Class 4 (2 W) GSM 850 MHz, 900 MHz Class 1 (1 W) GSM 1800 MHz, 1900 MHz
- Communication protocol	Selectable, depending on the firmware version (see Section 7)
- SIM card size required	MiniSIM
- Modem module power supply:	
a) battery:	
- Battery designation (BP)	HBL-03, or HBL-03E ⁶⁾ , or HBL-03U - battery with replaceable cell (by the user)
- Battery type	lithium
- The battery contains capacitor	yes (except HBL-3E)

5) Data transmission via dial-up CSD connection in GSM mode is not supported.

6) The HBL-03E battery block has an extended temperature range of use -40 °C ÷ 70 °C.

- Temperature range BP	-25 ÷ 70 °C (HBL-03, HBL-03U) 10 let -40 ÷ 70 °C (HBL-03E) 9 or 10 years (based on used cell)
- Battery life (more detailed data see par. 6.2)	HBL-03: 10 years HBL-03U: 9 or 10 years (according to the cell used) HBL-03E: 6 years
- Battery voltage	3,6 V – HBL-03, HBL-03U 3,0 V – HBL-03E
- Prescribed type and number of cells for batteries with replaceable cells	HBL-03U: 1x SAFT LS33600, or 1x EVE ER34615C
b) external power supply:	
- Possibility of external power supply (PWR2 terminals)	optional (battery pack for the modem serves as a backup in the event of an external power failure)
- External power supply for modem (application in potentially explosive atmospheres)	PS-M1, intrinsically safe (IS) power supply
- Supply voltage at terminal PWR2 (applications outside potentially explosive atmospheres)	3.4 ÷ 3.8 V (use only outside potentially explosive atmospheres)
3b. LTE-CatM1W, internal modem	
- Type of connection	LTE –M1
- Localization	worldwide
- Frequency	LTE Cat M1: 700 (Bd12, Bd13, Bd28, Bd85), 800 (Bd18, Bd19, Bd20, Bd26, Bd27), 850 (Bd5), 900 (Bd8), AWS-3 (Bd66), AWS-1 (Bd4), 1800 (Bd3), 1900 (Bd2, Bd25), 2100 (Bd1) LTE Cat NB1/2: 600 (Bd71), 700 (Bd12, Bd13, Bd28, Bd85), 800 (Bd18, Bd19, Bd20, Bd26), 850 (Bd5), 900 (Bd8), AWS-3 (Bd66), AWS-1 (Bd4), 1800 (Bd3), 1900 (Bd2, Bd25), 2100 (Bd1)
- Output power	LTE Cat M1: Class 5 (+20dBm ±2dB) for all supported LTE Cat M1 bands LTE Cat NB1/2: Class 5 (+20dBm ±2dB) for all supported LTE Cat NB1/2 bands
- Communication protocol	Selectable, depending on the firmware version (see Section 7)
- SIM card size required	MiniSIM
- Modem module power supply:	
a) battery:	
- Battery designation (BP)	HBL-03, or HBL-03E ⁷⁾ , or HBL-03U - battery with replaceable cell (by the user)
- Battery type	lithium
- The battery contains capacitor	yes (except HBL-3E)

7) The HBL-03E battery block has an extended temperature range of use -40 °C ÷ 70 °C.

- Temperature range BP	-25 ÷ 70 °C (HBL-03, HBL-03U) 10 let -40 ÷ 70 °C (HBL-03E) 9 or 10 years (based on used cell)
- Battery life (more detailed data see par. 6.2)	HBL-03: 10 years HBL-03U: 9 or 10 years (according to the cell used) HBL-03E: 6 years 6 years
- Battery voltage	3,6 V – HBL-03, HBL-03U 3,0 V – HBL-03E
- Prescribed type and number of cells for batteries with replaceable cells	HBL-03U: 1x SAFT LS33600, or 1x EVE ER34615C
b) external power supply:	
- Possibility of external power supply (PWR2 terminals)	optional (battery pack for the modem serves as a backup in the event of an external power failure)
- External power supply for modem (application in potentially explosive atmospheres)	PS-M1, intrinsically safe (IS) power supply
- Supply voltage at terminal PWR2 (applications outside potentially explosive atmospheres)	3.4 ÷ 3.8 V (use only outside potentially explosive atmospheres)
3c. LTE-Cat1W, internal modem	
- Type of connection	LTE cat.1
- Localization	worldwide
- Frequency	GPRS bands: 850 (BdV) / 900 (BdVIII) / 1800 (BdIII) / 1900 (BdII) LTE bands: 2100 (Bd1) / 1900 (Bd2) / 1800 (Bd3) / 2100 (Bd4) / 850 (Bd5) / 2600 (Bd7) / 900 (Bd8) / 800 (Bd20) / 700 (Bd28) / TDD2600 (Bd38) / TDD2300 (Bd40) / TDD2500 (Bd41) / 2100 (Bd66)
- Output power	Class 4 for 850 (BdV) / 900 (BdVIII) GMSK Class 1 for 1800 (BdIII) / 1900 (BdII) GMSK Class E2 for 850 (BdV) / 900 (BdVIII) 8-PSK Class E2 for 1800 (BdIII) / 1900 (BdII) 8-PSK LTE Cat 1: Class 3 for all supported LTE Cat 1 bands
- Communication protocol	Selectable, depending on the firmware version (see Section 7)
- SIM card size required	MiniSIM
- Modem module power supply:	
a) battery:	
- Battery designation (BP)	HBL-04U - battery with replaceable cell (by the user)
- Battery type	lithium
- The battery contains capacitor	yes

- Temperature range BP	-25 ÷ 70 °C 9 or 10 let (based on battery cell)
- Battery life (more detailed data see par. 6.2)	7 years (according to the cell used)
- Battery voltage	7,2 V
- Prescribed type and number of cells for batteries with replaceable cells	2x SAFT LS26500, or 2x EVE ER26500C
b) external battery supply:	
- Possibility of external power supply (PWR2 terminals)	optional Attention! - The modem battery cannot be used in this case, it is the exclusive power supply from the external source !
- External power supply for modem (application in potentially explosive atmospheres)	PS-M, intrinsically safe (IS) power supply
- Supply voltage at terminal PWR2 (applications outside potentially explosive atmospheres)	4.5 ÷ 5.6 V (use only outside potentially explosive atmospheres)
3d. LTE-CatNB (NB-IoT) internal modem	
Supported standard	LTE Cat NB1, 3GPP Release 13
Localization 1	LTE-CatNB localization Europe
- Localization	Europe
- Frequency	2100 (Bd1), 1800 (Bd3), 850 (Bd5), 900 (Bd8), 800 (Bd20), 700 (Bd28)
- Output power	+23 dBm
Localization 2	LTE-CatNB localization China
- Localization	China
- Frequency	2100 (Bd1), 1800 (Bd3), 850 (Bd5), 900 (Bd8)
- Output power	+23 dBm
Localization 1 and 2	
- Communication protocol	Selectable, depending on the firmware version (see Section 7)
- SIM card size required	MiniSIM
- Modem module power supply:	
a) battery:	
- Method	power supply from 1 or 2 cells of size A - cells are part of the modem board (it is not an external battery pack)
- Battery designation	2x SAFT LS17500 (standardly), or 2x EVE ER17505, or 1x SAFT LS17500, or 1x EVE ER17505
- Battery type	lithium

- The battery contains capacitor	yes
- Temperature range BP	-25 ÷ 70 °C 9 or 10 let (based on battery cell)
- Battery life (more detailed data see par. 6.2)	11 years - 2x SAFT LS17500 9 years - 2x EVE ER17505 7 years - 1x SAFT LS17500 6 years - 1x EVE ER17505
- Battery voltage	3.6 V
a) external power supply:	
- Possibility of external power supply (PWR2 terminals)	optional (battery pack for the modem serves as a backup in the event of an external power failure)
- External power supply for modem (application in potentially explosive atmospheres)	PS-M1, intrinsically safe (IS) power supply
- Supply voltage at terminal PWR2 (applications outside potentially explosive atmospheres)	3.4 ÷ 3.8 V (use only outside potentially explosive atmospheres)

3.11 Quantities archiving

Data archive	
- Archiving frequency t_{arch}	1 hour as standard (adjustable from 1 s to 1 h)
- Capacity	approx. 112 000 records (i.e. approx. 12 years at $t_{arch}=1$ h) (changes dynamically depending on the configuration)
- Stored quantities	Vm, Vb, Vs, Vbs, E, Es, Status, t, p, Q, Qb, C, K, Hs + optionally depending on the configuration
Daily archive	
- Capacity	Approx. 4 200 records (approx. 11.5 years)
- Stored quantities	Vm, Vb, Vs, Vbs, E, Es, Status, t, p, Q, C + optionally depending on the configuration
Monthly archive	
- Capacity	Approx. 960 records (approx. 80 years)
- Stored quantities	Vm, Vb, Vs, Vbs, E, Es, Status + optionally depending on the configuration
Other archives (capacities)	
- Binary archive	Approx. 4 600 records
- Status archive	Approx. 5 000 records
- Gas composition archive	Approx. 1 870 records (approx. 5 years at 1 change per day)
- Settings archive	More than 1 000 records (depending on the type of setting)
- Limit archive	1 record for each monitored quantity
- Billing archive	Approx. 1 260 records

4 Explosion safety parameters

Pressure sensor P1: (terminals: GND, U+, TXD, RXD)

Only for connection of pressure sensor EDT 125.

Temperature sensor T1: (terminals: GND, U+, SDA, SCL)

Only for connection of temperature sensor EDT 124.

Digital inputs DIN: (terminals: GND, DI1, DI2, DI3, DI4, UT+)

$U_o = 6.5\text{ V}$, $I_o = 2\text{ mA}$, $P_o = 3\text{ mW}$, $C_o = 20\text{ }\mu\text{F}$, $L_o = 10\text{ mH}$

$U_i = 5.5\text{ V}$, $I_i = 1\text{ mA}$, $P_i = 1\text{ mW}$, $C_i = 0$, $L_i = 0$ (not applicable to UT+ terminal)

Digital outputs DOUT: (terminals: GND0, U0+, DO1, DO2)

$U_i = 15\text{ V}$, $I_i = 0.3\text{ A}$, $\Sigma P_i = 0.5\text{ W}$, $C_i = 3.3\text{ }\mu\text{F}$, $L_i = 0$

RS485 interface: (COM1 terminals: GND1, U1+, D1-, D1+)

$U_i = 10\text{ V}$, $I_i = 0.15\text{ A}$, $\Sigma P_i = 0.33\text{ W}$, $C_i = 4\text{ }\mu\text{F}$, $L_i = 0$

RS232 interface: (COM1 terminals: GND1, CTS, RXD, TXD)

$U_i = 20\text{ V}$, $I_i = 0.15\text{ A}$, $\Sigma P_i = 0.46\text{ W}$, $C_i = 1\text{ }\mu\text{F}$, $L_i = 0$

(MTL5051 terminals 1, 2, 5, 6)

External power supply PWR1: (terminals: PWR1+, PWR1 -)

$U_i = 6.5\text{ V}$, $I_i = 0.2\text{ A}$, $P_i = 0.41\text{ W}$, $C_i = 2\text{ }\mu\text{F}$, $L_i = 30\text{ }\mu\text{H}$

External power supply PWR2: (terminals: PWR2+, PWR2-)

$U_i = 4.5\text{ V}$, $I_i = 1\text{ A}$, $P_i = 4.5\text{ W}$, $C_i = 9700\text{ }\mu\text{F}$, $L_i = 30\text{ }\mu\text{H}$

5 Installation and commissioning

The corrector (logger) is a compact device built into a tough plastic enclosure rated IP66. The device is intended for installation in potentially explosive atmospheres. Permitted installation in potentially explosive atmospheres (either ZONE 0 or ZONE 1) depends on the specific modules installed in the device, as specified in Section 2.

In addition to completely covered electronics, the enclosure contains power pack batteries and a digital pressure transducer with a M12x1.5 threaded joint compliant with DIN W 3861 for connecting pressure pipes.

A side of the enclosure contains metal cable glands for connecting input and output signal cables with the option of connecting the cable shielding conductively.

5.1 Device dimensions

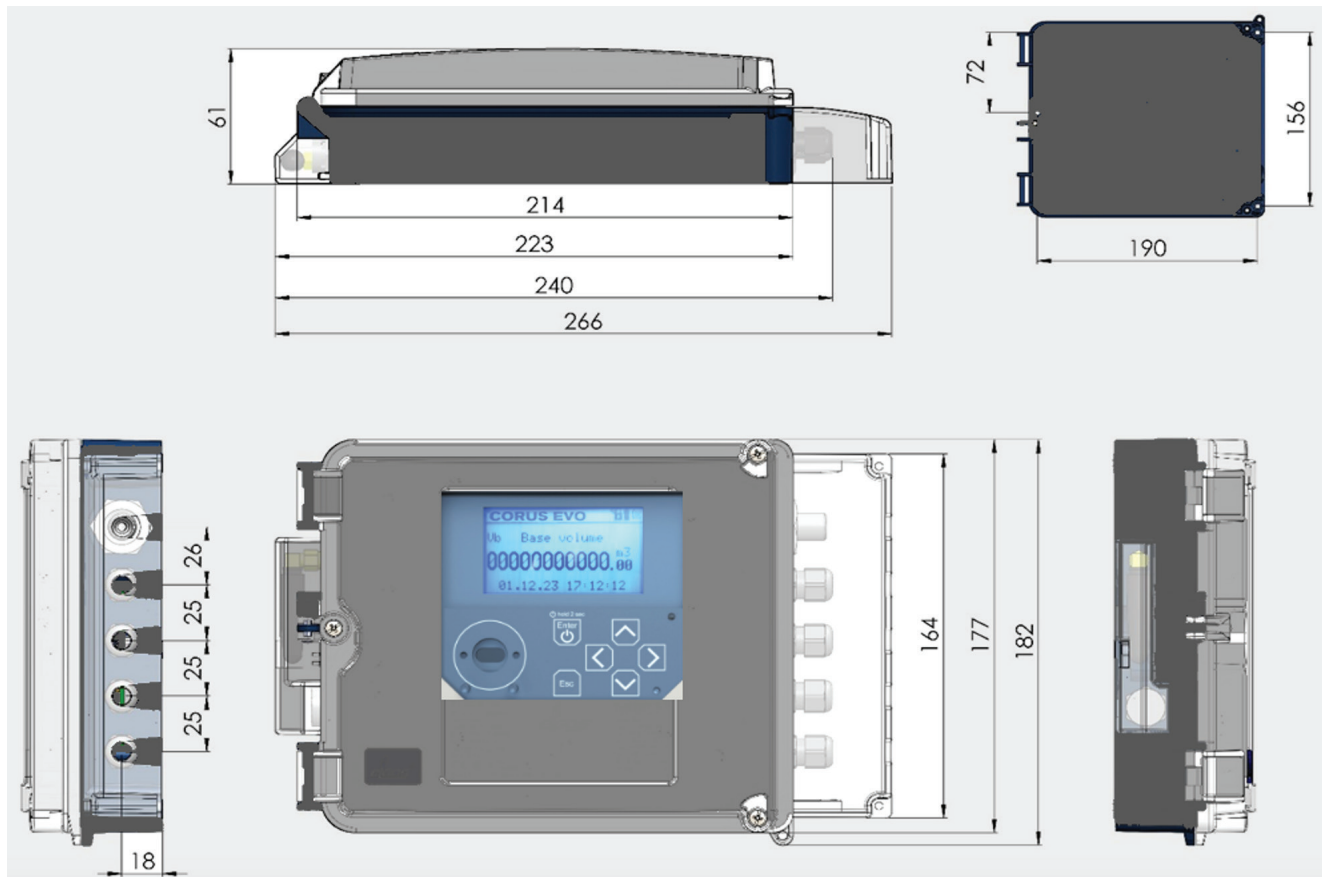


Fig. 2 Corus Evo Compact device dimensions

5.2 Security markings on the device

Security markings on the device indicate if there was any unauthorized tampering with its technical condition.

MID Security Mark

- its form is prescribed by the Certificate of Quality Management System for Production, Output Inspection and Testing in accordance with Annex 2, Procedure D of Government Regulation 120/2016 Coll., issued by Notified Body No. 1383.

This security mark together with the CE conformity marking and supplementary metrology marking, e.g. M20, have the same significance for users in the Czech Republic as the Official Mark of Initial Verification under the Metrology Act (§9 par. 3).

According to Decree 345/2002 Coll., in the Czech Republic, the verification validity period is 5 years (applies provided that gas volume converters are subjected to a regular abbreviated test with a validity period of 1 year).

If the marking is infringed, then the manufacturer can no longer guarantee that the device's properties comply with the EU type-examination certificate.

Manufacturer's Seal

- Manufacturer's inspection markings according to his needs.

User Mark

- User's inspection markings (seal) according to his needs.

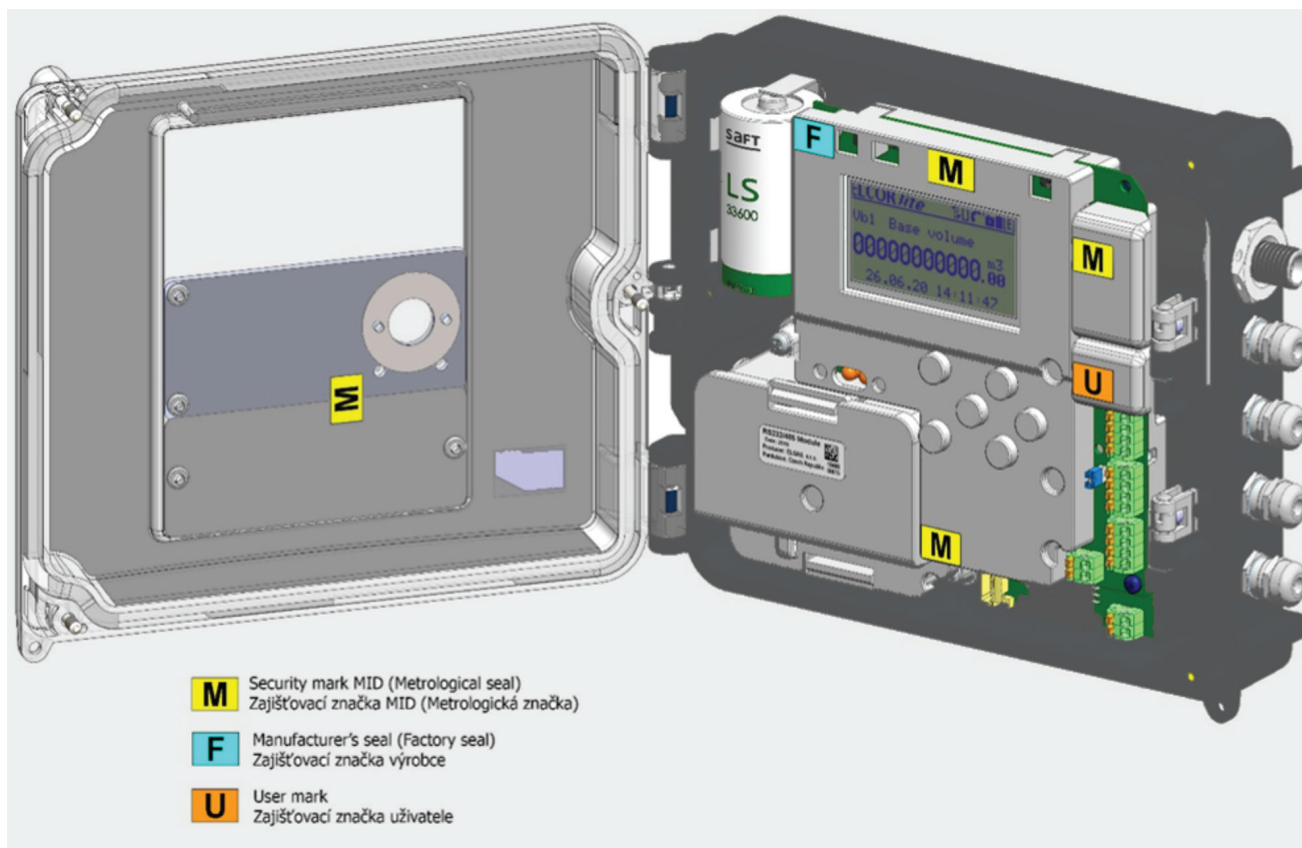
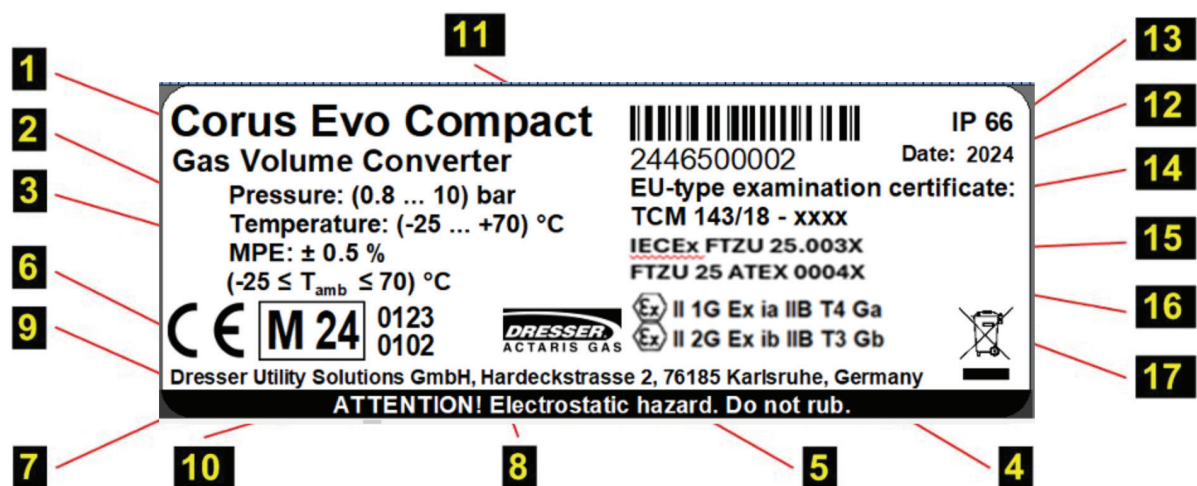


Fig. 3 Internal security markings



Fig. 4 External security markings

5.3 Type plate



1	device identification	10	notice for the operator
2	pressure measuring range	11	serial number of the device
3	temperature measuring range	12	year of manufacture
4	ambient temperature range	13	degree of coverage
5	max. permissible device error	14	EU-Type examination certificate (metrology)
6	CE conformity marking	15	EU type examination certificate (ATEX)
7	year of conformity assessment	16	Ex marking (device without internal modem)
8	designation called "notified bod- ies" authorized for conformity as- sessment in the EU	17	Ex marking (device with built-in internal modem)
9	manufacturer's address		

Fig. 5 Example of a type plate

5.4 Mechanical installation

The device is intended for mounting on a wall or on a pipe via a mounting plate. If it is going to be mounted on a pipe, special holders can be used in lieu of the normally supplied mounting plate.

The device is first placed on the mounting plate. If the connection of the device pressure sensor via a three-way ball cock⁸⁾ is required, the three-way ball cock can also be placed on this mounting plate. The plate has been designed for three-way ball cocks supplied by Dresser to be fitted thereon. The mounted mounting plate can be fastened to the wall by means of screws and dowels, or by means of two brackets with locking attachments on horizontal or vertical pipes.

8) The three-way cock allows regular, abbreviated testing to check the instrument's accuracy. It can be supplied as a separate accessory.



CAUTION!

The gas volume corrector is **dedicated technical equipment** subject to government technical supervision.

It may only be installed only by a qualified person with proof of professional competence issued by a government occupational safety overseer.

Any person meeting these conditions must also hold a vocational training certificate that covers the installation and operation of this particular type of equipment. Such a certificate is usually issued by the device manufacturer or an authorized partner from the training provided.

Failure to comply with the above requirements risks an infringement of warranty conditions.



CAUTION!

From the point of view of the Metrology Act, the Corus Evo Compact gas volume converter is included in the category of legal metrology instruments. Entities that intend to carry out the installation of legal metrology instruments in the Czech Republic are obliged to submit an application for registration to the Czech Metrology Institute; see §19 of the Metrology Act.



CAUTION!

The device is available in various models. The model designed for ZONE 1 must not be used in a ZONE 0 environment.

The device may be operated in ZONE 0 only if it is not equipped with an internal modem and the "II 1 G" category is indicated in the ATEX marking on the data plate.

•
1

A transparent protective foil protects the device display and optical head window against scratching. Remove the foil after you have installed the device (otherwise, it may make the display harder to read and impair the optical head's functionality).

5.4.1 Recommendations for installation of the device

- Install the device so that the display is not exposed to direct sunlight.
- The device uses a capacity keyboard. For this reason, follow min. distance of 1 cm foreign obstacles (door, cover, etc.) from the front of the device.

5.4.2 Mounting the device on a plate

For easier mounting on a pipe or wall, put the device on a sheet metal mounting plate **4** (optional accessory). It is fitted to the plate with 3 pieces M4 x 12 mm screws (see position **3** on Fig. 7), which are included in the accessory package.

Open the device and flip the cover up. There are two holes for inserting the M4 x 12 screws at the corners on the right side of the enclosure and one hole in the middle of the left side wall. There are M4 rivet nuts at the corresponding position on the mounting plate for fitting the screws.

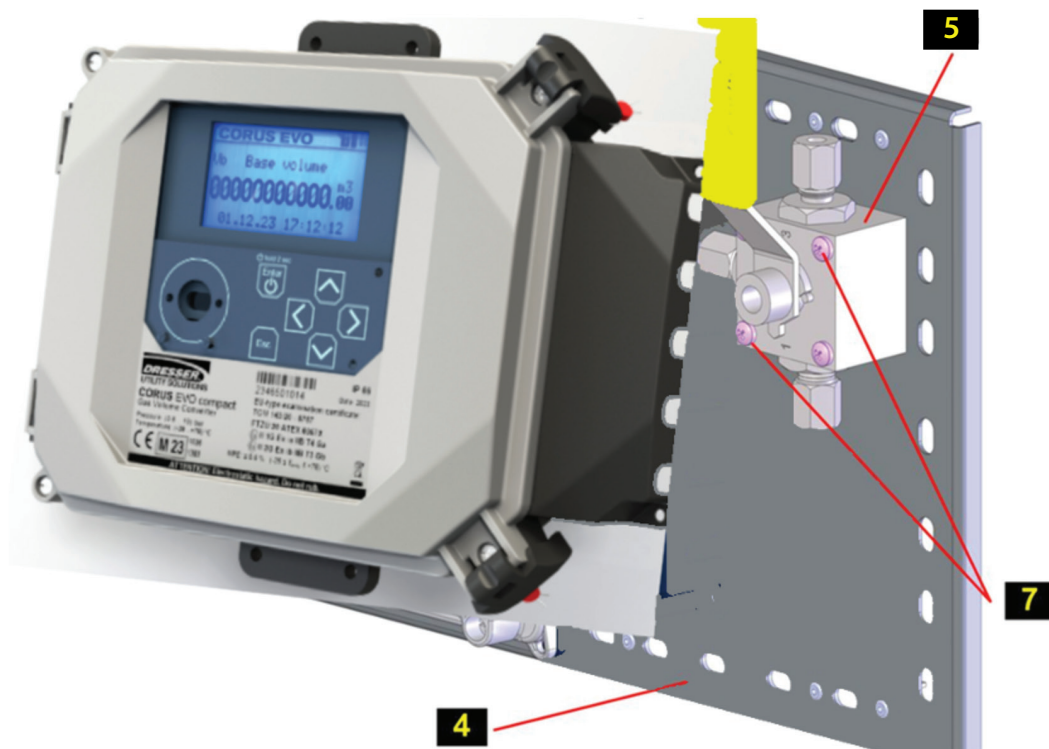


Fig. 6 Mounting the Corus Evo Compact corrector on the mounting plate

1. Connect a 6 mm connecting pressure pipe **6** to connect the three-way cock to the pressure sensor in the side wall of the housing. Attach the tube to the pressure sensor using a cutting ring with a M12x1.5 ERMETO nut.
2. Screw the three-way cock to the mounting plate **4** in the prepared position **5** using 2 M4x40 ISO 7045 screws **7**, but do not tighten them. For now, leave them completely loose. Prior to mounting, check whether the outlets are correctly oriented and the position of the three-way cock's control lever. Connect the free end of the connection tube to the three-way cock outlet (see Section 5.4.4 for more details). Only tighten the fastening screws **7** of the three-way cock after tightening the union nut of the pressure connection.
3. Check that the connections are tight.

Mounting plate designation	Designed for device	Size [mm]	Note
KP 126 86	Corus Evo Compact	390 x 220	allows installation of three-way cock
KP 107 89	Corus Evo Compact		allows mounting on the pipe flange, allows mounting a three-way cock on the rear wall of the board

Tab. 1 Mounting plates supplied

5.4.3 Mounting the device on a pipe

Clamps **10** (see Fig. 7) whose spacing corresponds to the diameter of the pipe are reeved through the openings in the mounting plate **4** and inserted over the pipe. Fix the attachment **11** onto the free ends of the clamps with M6 nuts **14** and washers **12** and **13** secure the mounting plate in the desired position on the pipe. The mounting plate can be fixed to a pipe with the following diameter:

- DN80 - DN150 for horizontal piping, and
- DN80 - DN200 for vertical piping.

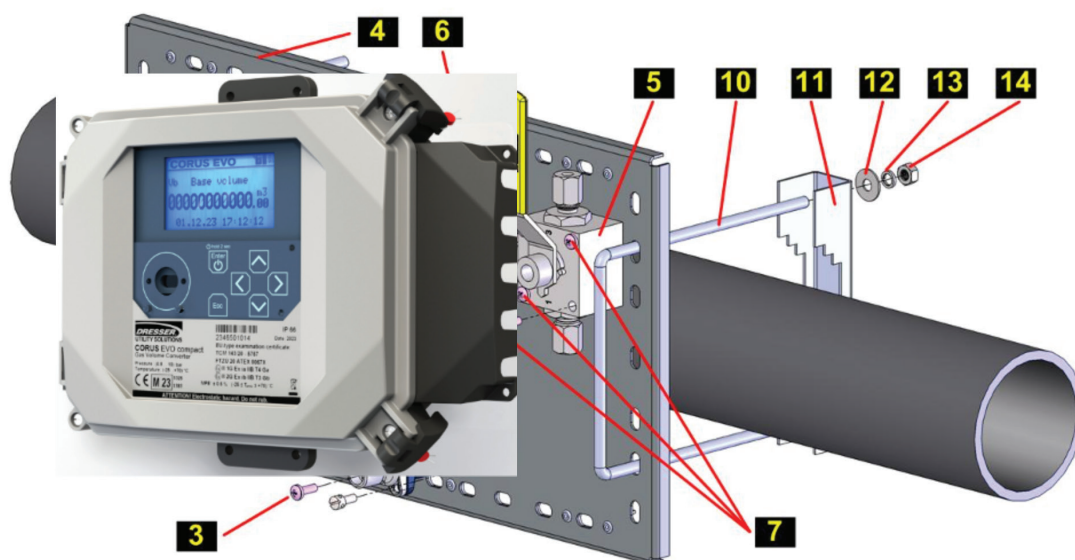


Fig. 7 Mounting the device on a pipe (KP 126 86 plate)

It is also possible to use the special holder KP 107 89, shown in Fig. 8, in the case of mounting on a pipe flange.

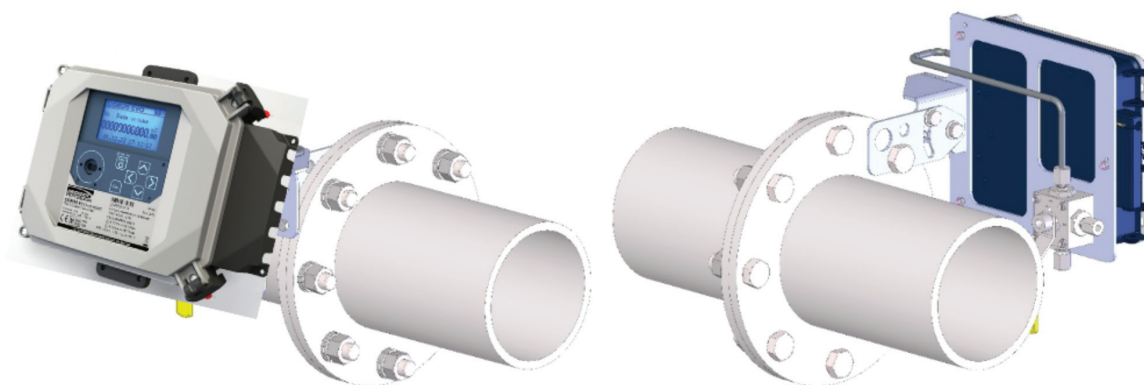


Fig. 8 Mounting the device on a pipe flange (KP 107 89 holder)

5.4.4 Mounting a pressure transducer

To apply pressure either to the pressure transducer or to the three-way stopcock, it is recommended to use precise seamless 6 x 1 mm stainless steel pipes or approved plastic hoses fitted with suitable end caps. Measured pressure is taken from the gas pipe either the Pm outlet (former Pr) on the gas meter body or directly from the pipe (e.g. by means of a welded-on pressure fitting to connect the required size pressure pipe). The pipeline pressure outlet is positioned as instructed by the manufacturer of the gas meter to be used, usually in front of it, while the recommended distance depends on the type of gas meter (rotary, turbine, etc.).

Fig. 7 shows the corrector connected by the three-way cock. First, thoroughly insert a 6 x 1 pressure tube **6** with a cutting ring pre-pressed on both sides into the pressure inlet of the device and secure it with a M12x1.5 ERMETO nut. Attach the other end of the tube to the three-way cock's working outlet, fitted on the mounting plate, and gently tighten the nut. Finally, tighten the nuts on both sides of the connecting pressure pipe. Do not apply excessive force when tightening with a key or else the thread will be damaged.

5.4.4.1 Mounting an external pressure transducer

When handling and assembling the external transducer, it is necessary to proceed in such a way that the transmitter body (its cylindrical electronics cover with cable gland and cable) is not mechanically stressed.



CAUTION!

It is forbidden to mechanically stress the cover of the pressure transmitter, grip it in pliers, etc., otherwise mechanical damage to the transducer may occur.

When mounting the transmitter, use a size 22 assembly key to screw it to the pressure weld-on or connecting fitting (see Fig. 9).

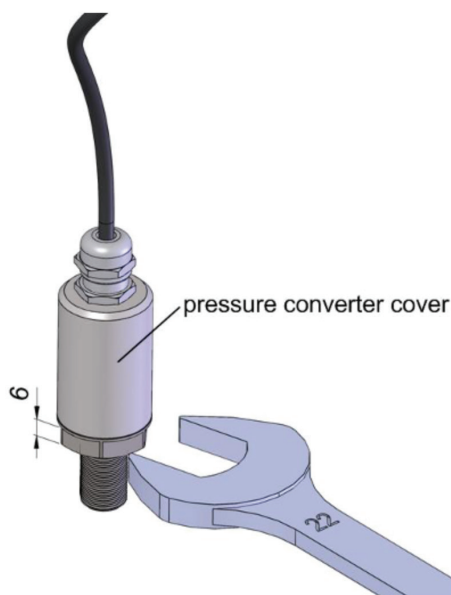


Fig. 9 Mounting an external pressure transducer

5.4.5 Installation variant with three-way valve PN 16

5.4.5.1 Mounting on the plate

- Connect the three-way valve to the pressure transducer of the converter. Insert the 6x1 pressure tube with notching ring into the pressure inlet of the device and tighten with the M12x1.5 ERMETO nut. Excessive force must not be used when tightening the wrench, otherwise the thread will be damaged (stretched).

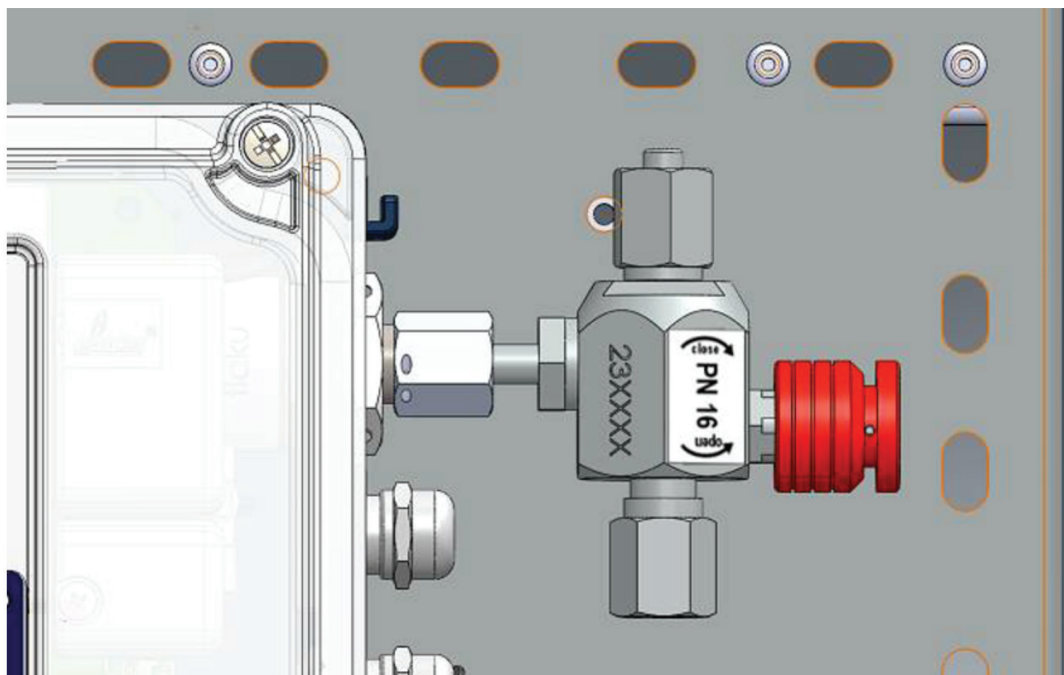


Fig. 10 Connecting the three-way valve to the transducer

- Slide the retaining bracket onto the valve in the direction of the arrow

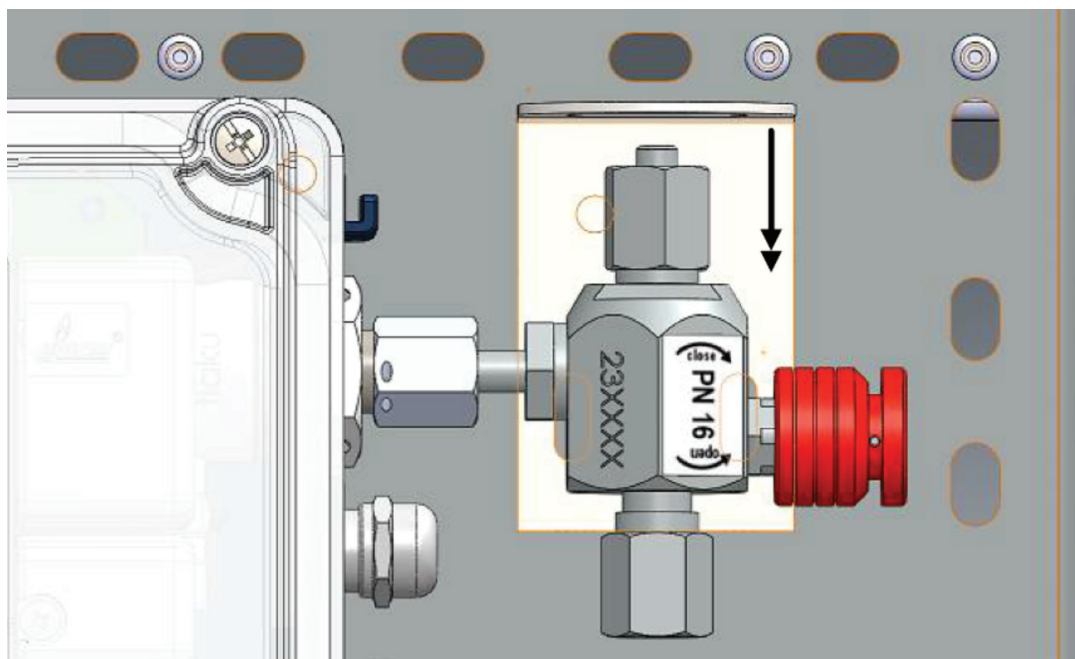


Fig. 11 Sliding the retaining bracket onto the valve

- Fix the retaining bracket with two M4 screws

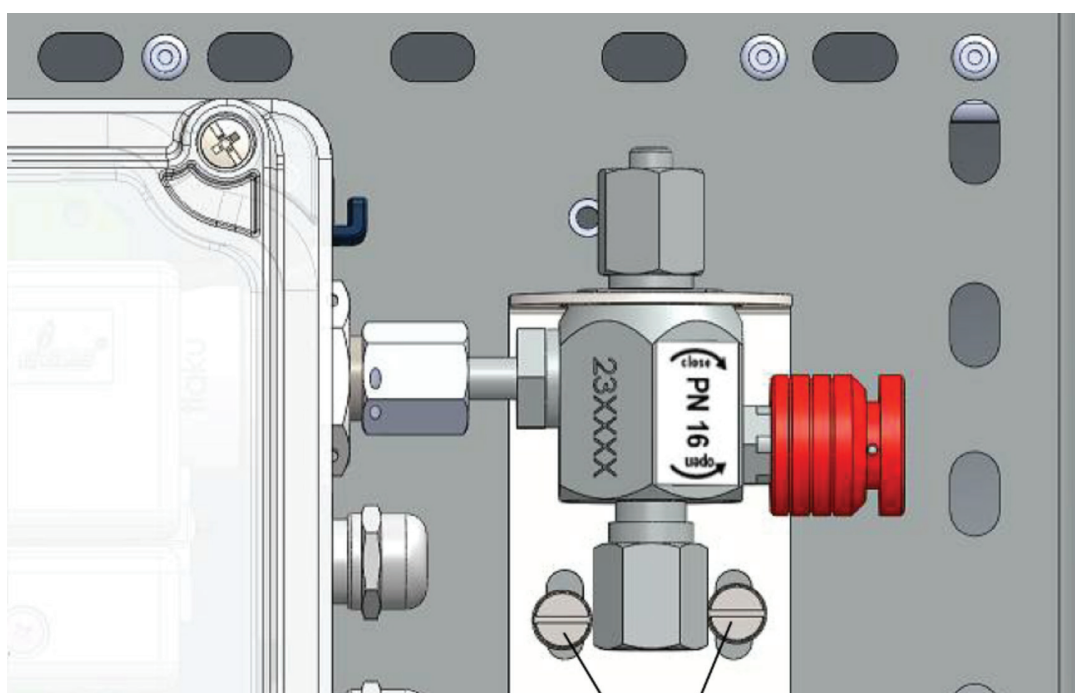


Fig. 12 Fixing of retaining bracket with two M4 screws

- Connect the working pressure pipe and open the valve
- Seal
 1. Three-way valve input - three-way valve control wheel
 2. Three-way valve output - pressure transducer nut
 3. Three-way valve input - three-way valve bracket

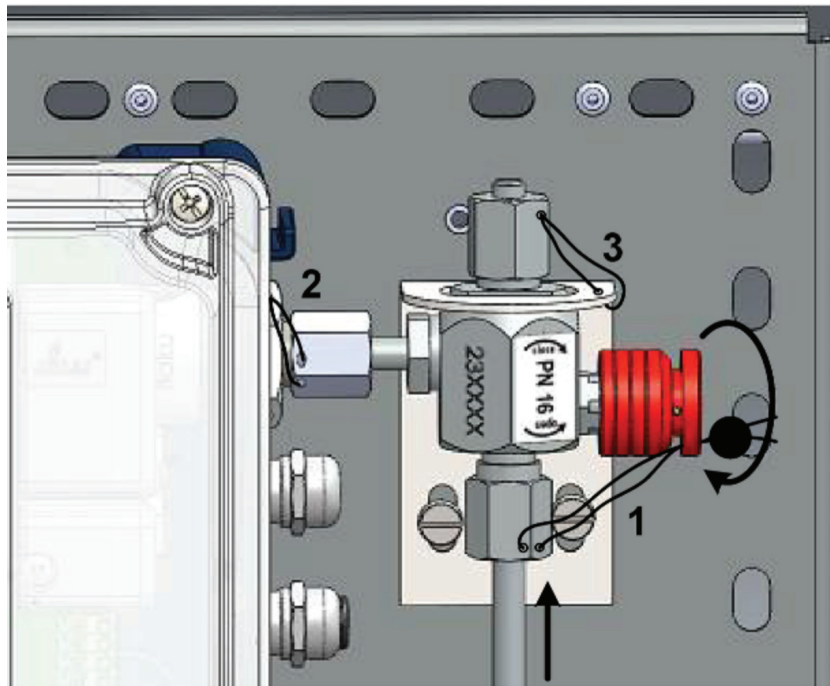


Fig. 13 Connecting the working pressure pipe, opening the valve and sealing

5.4.5.2 Use of a three-way valve in an abbreviated test of a converter

Calibration on working pressure

1. Close valve by control wheel 1
2. Unscrew the nut of the inlet of the pressure calibration etalon 4 and pull out the plug 5
3. Connect the pressure calibrator to the loose fitting 4
4. Open valve by control wheel 1
5. Perform an abbreviated converter test
6. Close valve by control wheel 1
7. Blind inlet 4 with plug 5
8. Open valve by control wheel 1
9. Check gas connections for leaks
10. Seal input 4

Calibration at non-working pressure

1. Close valve by control wheel 1
2. Unscrew the nut of the inlet of the pressure calibration etalon 4 and pull out the plug 5
3. Connect the pressure calibrator to the loose fitting 4
4. Perform an abbreviated converter test
5. Blind inlet 4 with plug 5
6. Open valve by control wheel 1
7. Check gas connections for leaks
8. Seal input 4

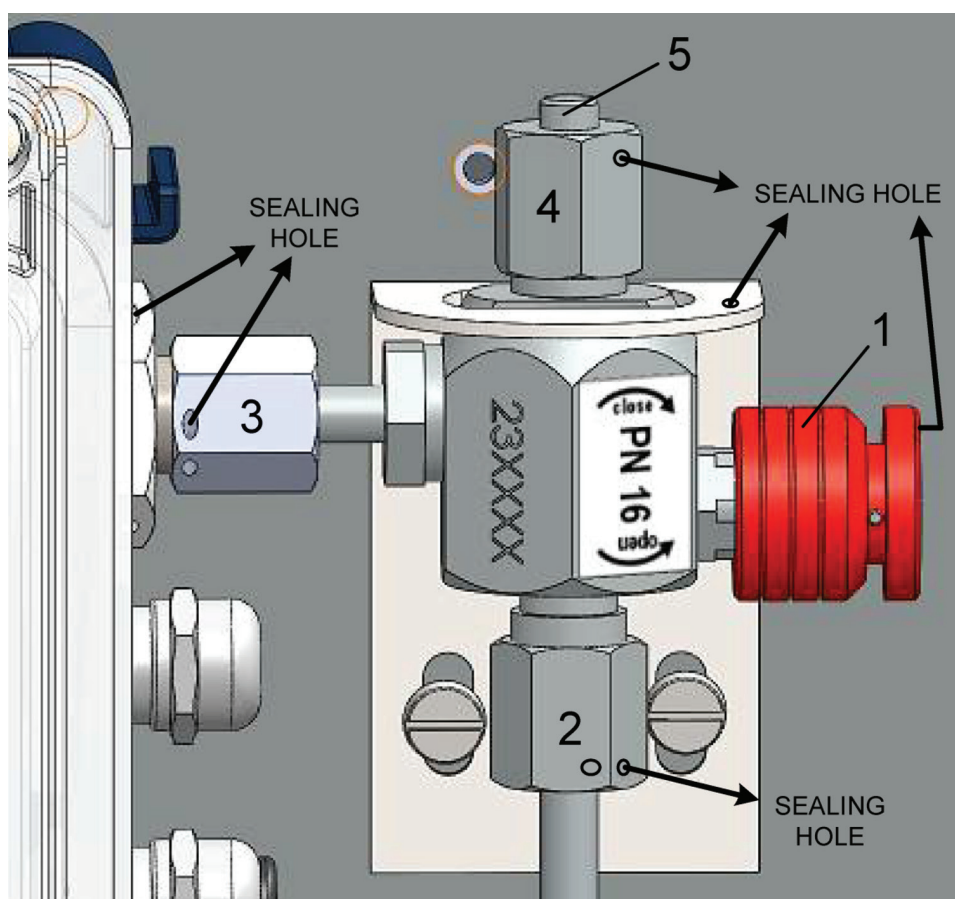


Fig. 14 Use of a three-way valve in an abbreviated converter test

5.4.6 Mounting a temperature transducer

To connect the temperature transducer, the thermowell located on the gas meter is used as a priority. If no thermowell is fitted on the gas meter, weld on a fitting to mount the thermowell as instructed by the manufacturer of gas meter, typically at a distance of 1 DN to 2 DN downstream of the gas meter in the direction the media will be flowing.

It should be welded so that the thermowell is either vertical or deviated by 45° from the vertical axis with the cavity up (Fig. 15). Screw over a copper gasket the appropriate length thermowell, which depends on the pipe diameter, into the weld-on fitting (see Tab. 2). Thoroughly insert the metal shank of the temperature transducer into the thermowell and secured by a locknut. The maximum axial load of the temperature transducer cable is 50 N.

Before inserting the sensor shank into the thermowell, it is recommended for the space around the shank inside the thermowell to be filled with silicone oil or for the shank to be lubricated with silicone grease for better heat transfer to the temperature sensor.

DN (mm)	L – Thermowell (mm)	Weld-on fitting
40	55	inclined
50	55	straight
80	100	inclined
100	100	straight
150	160	inclined
>200	160	straight

Tab. 2 Weld-on fittings and thermowells appropriate for listed pipe diameters

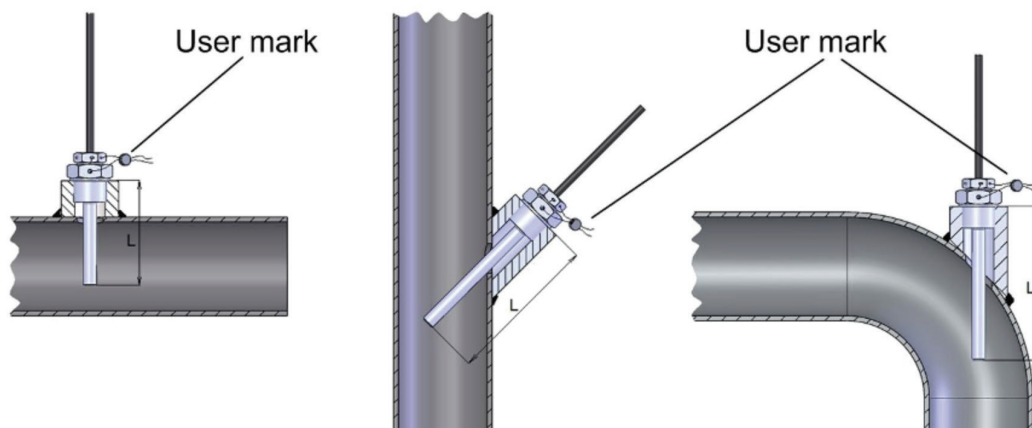


Fig. 15 Mounting the temperature sensor on the pipe

1 temperature transducer

2 locknut

3 thermowell

4 straight weld-on fitting

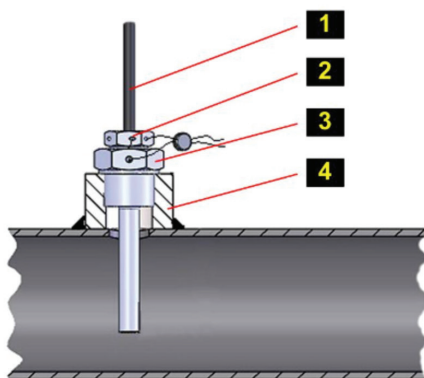


Fig. 16 Mounting the temperature sensor using a straight weld-on fitting

5.5 Electric installation

5.5.1 Basic installation requirements in terms of interference and EMC

Electrical and electronic equipment must work flawlessly at the place of use, even if electromagnetic interference (up to a certain force) is going to affect it. The most important effects of electromagnetic interference that can jeopardize the function of the device are:

- Overvoltage - mainly pulse overvoltage and HF interference induced by atmospheric disturbances (storms, discharges) and interference from industrial equipment (frequency converters, compressors, pumps, etc.)
- Transient effects when switching inductive loads in the network (motors, valves, pumps, elevators, etc.)
- Differences in voltage potential between individual parts of the device installation and the flow of unwanted balancing currents
- Electrostatic discharge

These effects can be limited with appropriate installation, shielding of electrical and magnetic induction, using filters in supply wires to the device, and both interconnecting and grounding metal parts in the installation.

Devices manufactured by Dresser Utility Solutions are designed to have very high resistance to interference. They are tested in compliance with current standards (EN 61000 4, set of standards) for radiation (EMI) and resistance (EMS) to electromagnetic interference in an industrial environment (see [28], [29]). If the device is installed improperly,

however, resistance may be reduced, especially if the device is connected to other devices (such as for communication, external power supply, etc.). Therefore, comply with certain principles when installing the device in order not to reduce resistance to interference.

5.5.2 EMC connection principles

The principles below are a prerequisite for the corrector and logger to operate properly.

Fig. 18 shows a correct example of how to install them in a gas control station, following these principles. The corrector is connected here with a telemetry and power supply box and an external power supply from a 230Vac electrical distribution network.



CAUTION!

Follow [10] EN 60079-14, when installing the device and connected devices.

5.5.2.1 Overvoltage protection

If the devices are going to be powered by an electrical network, use the TN-S network (i.e. with a separate middle conductor N and a separate protective conductor PE). When designing the electrical installation, seek to reduce the effects of lightning strikes to a safe level (see [30] IEC 62305-3, Annex D). Comply with the EN 60099 set of standards to protect the power supply against overvoltage. Three-stage overvoltage protection [31] HD 60364-5-534 (ČSN 332000-5-534) is recommended and used as standard for the electrical distribution network:

First level is protection against the effects of lightning. It is provided by SPD type 1 overvoltage protection, which is placed either in the low-voltage part of the substation or in the building's main switchboard. It mainly limits atmospheric overvoltage.

Second level protection is usually provided by SPD type 2 overvoltage protection, usually located in the secondary switchboard. It further reduces the magnitude of overvoltage for the next, third level. It mainly eliminates industrial interference (switching overvoltage, etc.).

Third level protection involves SPD type 3 overvoltage protection with a built-in HF filter, which must be placed in close proximity to the protected devices (see [31]) to protect them, here a TENAS-01 cabinet (e.g. PI-k8, HSAF10, DA-275 protection, etc.).

A certain minimum line distance between the individual stages of the overvoltage protection must be observed ("coordination" of the overvoltage protections) so that the switching of the pulse overvoltage protections takes place in the correct order.



CAUTION!

If the corrector/logger has an external power supply, surge protection must always be applied to the power supply using a type 3 SPD surge arrester with an integrated HF filter.

Therefore, TENAS-01 power supply and telemetry cabinets are always supplied by the manufacturer with an SPD type 3 surge arrester along with the power supply, more precisely a type 3 SPD with a built-in HF filter, which also suppresses HF interference. The SPD type 3 version with the HF filter is used to protect devices with a built-in processor (i.e. corrector or logger).

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If the supply from the power supply network is not protected against surges with a 2nd level arrester or even a 1st level arrester, they must be added, e.g. in a separate box to be connected in front of the TENAS-01 cabinet.

Comply with the correct principles for connecting the arresters when using any type, observing the following:

- Recommended minimum conductor cross-sections for individual SPDs;
- Minimum distances between type 1 and type 2 SPDs; and
- Minimum distances between type 2 and type 3 SPDs.

If the prescribed minimum distance between type 1 and type 2 SPDs and between type 2 and type 3 SPDs cannot be observed, connect decoupling inductors between them.

It is recommended for the distance between a type 3 SPD and the protected device to be the shortest possible. It is generally recommended for third level protection not to be followed by a connecting cable longer than 1.5 m. In an extreme case, 5 m is acceptable if the building is not located in an area prone to storms.



CAUTION!

If surge protectors in the mains supply are missing or connected incorrectly, the manufacturer of the corrector/logger cannot guarantee its correct function.

If the corrector is going to be remotely communicating via a cable line (RS485 interface, Ethernet, etc.), use overvoltage protection for this data line, too.

An integral part of overvoltage protection is making the protective connection at the control station (generally at the installation point) that is linked to the main protective terminal block connecting the PE protective conductor of the supply cable and the grounding of the building (and any other conductive technical wiring inside such as gas, water, heating and air conditioning).

5.5.2.2 Grounding and interconnection

The gas pipe inlet to the control station and outlet from it has to be galvanically isolated from the pipe located inside the station in order to prevent the flow of balancing currents through the pipes, which can be a source of interference.

The isolated pipe inside the control station has to be properly grounded and its individual components, including the gas meter, must be perfectly interconnected so that no voltage potential is created between the individual parts, which would cause the flow of disturbing balancing currents (Fig. 17).



Fig. 17 Pipe interconnection

5.5.2.3 Device grounding

Neither the corrector (Corus Evo Compact, Corus Evo) have to be functionally grounded.

In the case of a device with an internal pressure sensor, the device is grounded (connected to the pipeline) via a pressure sensor housing and a 6 mm diameter gas supply pipe from the pipeline (so-called "impulse tube") screwed to it – see Fig. 18.

For devices with an external pressure sensor, the cable shield on the sensor side is conductively connected to the sensor housing (provided by the manufacturer) - see Section 5.6.1. In this case, the device is galvanically connected (grounded) to the piping via the external pressure sensor's cable shield.

Note:

If the device is not to be earthed, the pressure supply to its pressure sensor (internal or external) of the device must be electrically insulated with a suitable insulating coupling. However, it is always necessary to ensure that no electrostatic charge can be generated on the surface of the device.

5.5.2.4 Grounding of overvoltage protection

There should also be proper grounding of surge protection at all three levels. There are minimum cross-sections of live conductors and PE conductors (see [31]) prescribed for each level. For type 3 SPDs, a PE conductor with a minimum 1 mm² cross-section is recommended (for type 2 SPDs, a minimum PE conductor cross-section of 6 mm² is prescribed).

5.5.2.5 Using shielded cables

Connect the corrector with other devices with shielded cables. Recommended shielded cable types and their cross-sections and maximum lengths are provided in Section 3, in the sections describing the particular connections (5.6, 6.3, 7.2) and in the accessory manual [35]. In general, comply with the requirements for cables with intrinsically safe (IS) signals that meet the standard [10] for use in potentially explosive atmospheres. Cables must have good shielding. Treat unused conductors of multicore intrinsically safe signal cables in accordance with [10].

5.5.2.6 Preventing the formation of unwanted current loops

When connecting the device to other devices, there should be no closed conductive loops for the flow of any balancing currents. These are caused by a difference between the potentials in the remote parts of the installation. In conductive loops (mostly ground loops), interfering currents are induced from HF interfering fields, which weaken the efficiency of cable shielding.

Connect the cable shield only on one side, in this case on the side of the corrector or electronic logger (see Fig. 18). For cables connected to the corrector/logger internal terminals passing through a metal gland, the shield has to be conductively connected to the metal part of the cable gland (see Fig. 20), i.e. essentially connected to the converter box - see Section 5.6.1. Do not connect the shield at the other end of the cables.

The connected shield of all the cables inside the corrector via cable glands is conductively connected to the metal body of the pressure sensor. Grounding is realized by connection to the gas pipeline via a 6 mm impulse tube of the gas supply to the pressure sensor.

Note - external pressure sensor

If the device uses an external pressure sensor instead of an internal pressure sensor, connect the sensor cable shield to the corrector in the cable gland. The shield on the sensor side is conductively connected to the sensor body (provided by the manufacturer) - see Section 5.6.1.

5.5.2.7 Cable concurrence

The set of EN 50 174 standards lays down requirements for the distance of metallic cabling of data and information lines and cabling of power distribution (a combination of shielded and unshielded cables). The following is generally recommended:

- Lay power cables (230/400 V) separately from signal cables (24 V, analog/digital signals), preferably at a distance of 20 cm or more or use closed metal cable trays with a shielding partition
- Use cables with sufficient insulation and shielding
- Use cables with sufficient cross-section

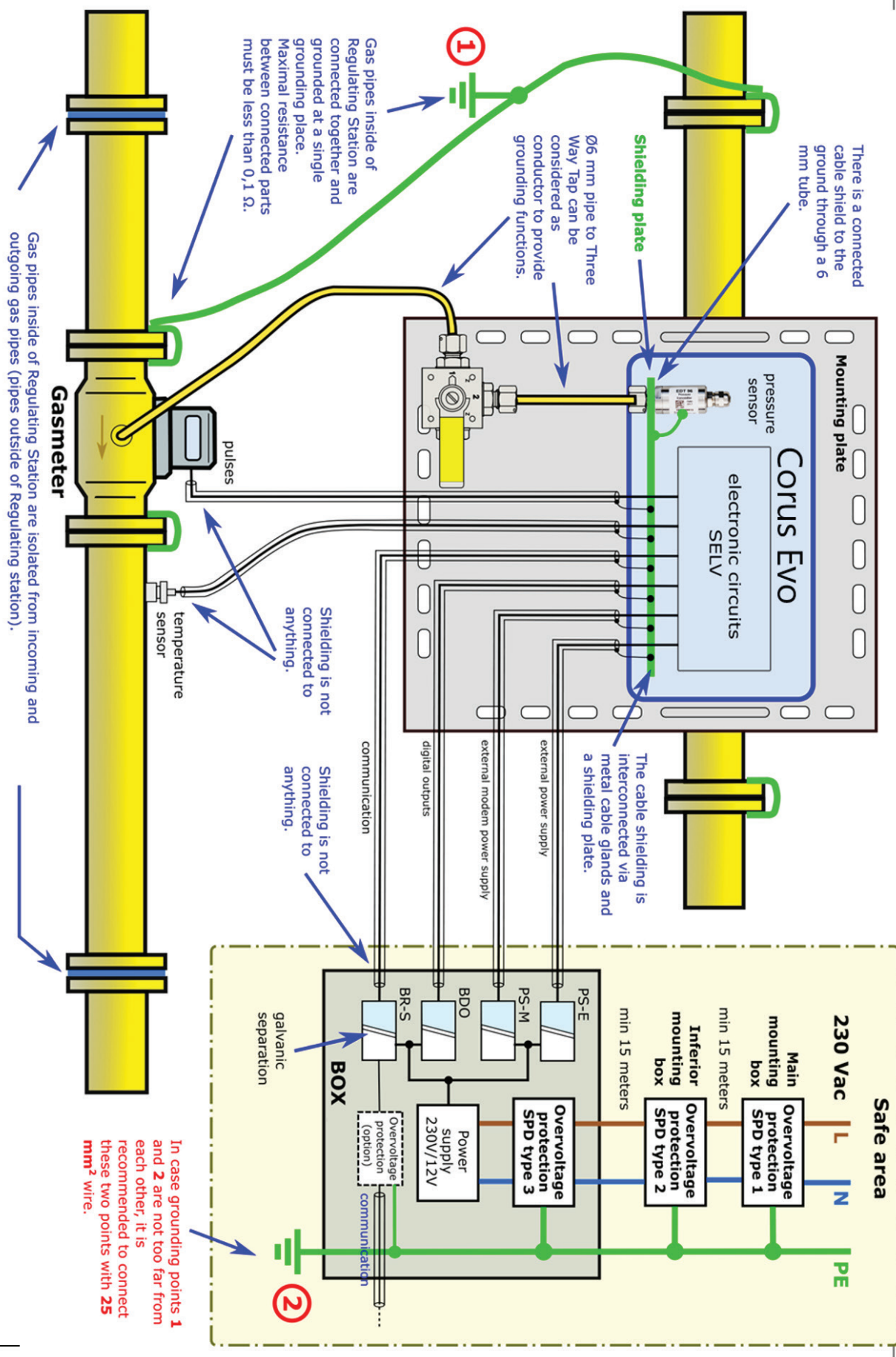


Fig. 18 Installation of a corrector with external power supply, digital outputs and remote communication, emphasizing EMC

5.6 Electrical connection

Electrically connecting a corrector with different types of gas meters and connecting binary inputs, digital inputs and pressure and temperature transducers are all described below.

Connection of an external power supply is discussed in a separate chapter 6 Power supply of the device.

Likewise, communication connecting is discussed in a separate chapter 7 Communication with the device.

For the described connections to work properly, the device should also be set up correctly. The device can be set up either with utility SW [38], see section 10.4, or from the device keypad (see Section 8).

5.6.1 Opening and closing the device

To open:

- Loosen the 4 screws **1** on the cabinet cover (Fig. 19)
- Flip open the cover

To close:

- Close the cover
- Screw the 3 cabinet cover screws **1**. The prescribed torque of the cover screws is 0.5 to 0.7 Nm.



Fig. 19 Cabinet cover screws

5.6.2 Connection of cables



Always use shielded cables that comply with the standard to connect the device to other devices [10] .

Connect the shield of all connected cables to the metal body of the cable gland on the device side, as shown in Fig. 20 .

When installing the device and connecting the shield, make sure that no ground loops are formed.

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All cable glands in the device are conductively connected to each other, so the shield of all cables coming into the device is connected at this point. This ensures high resistance to electromagnetic interference.

The following applies:

- In the case of an internal digital pressure transducer (i.e. built into the cabinet body of the device), the metal housing of the transducer is conductively connected to the metal cable glands of the device, i.e. to the shield of the cables fixed in the cable glands of the device.
- The temperature transducer and the external digital pressure transducer (if installed) are connected to the device by a shielded cable, the shield of which is connected to the metal body of the cable gland.
- The metal shank of the temperature transducer is insulated from the cable shield and all other parts of the device.
- The metal body of the external pressure transducer is connected to the cable shield.

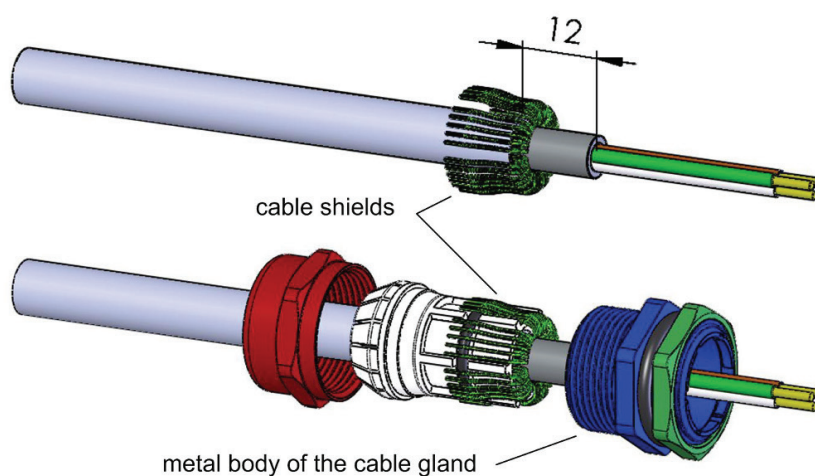


Fig. 20 Shield connection in cable glands

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The device is equipped with size PG7 metal cable glands. They are designed for cables of the following diameters:

PG7	3.0 ÷ 6.5 mm
-----	--------------

The cable glands are arranged as shown in Fig. 21.

The following recommended shielded cables have the specified minimum conductor cross-section. When using larger cross sections, check that the cable diameter matches the used cable gland.



CAUTION!
Seal unused cable glands with a stopper plug.

As delivered, the device has stopper plugs fitted in all unused glands.



CAUTION!

Put and fix wire sleeves on the ends of multi-stranded cables to protect them against their wires fraying.

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Before connecting the cables, first place the sleeves on the stripped ends of the wires and press them with pliers that the sleeve manufacturer recommends.

Wires terminated by the sleeves can be inserted into the terminals without a tool (however, using a tool makes it easier). When removing the wire, slightly push on the protrusion of the clamp and pull the wire out gently.

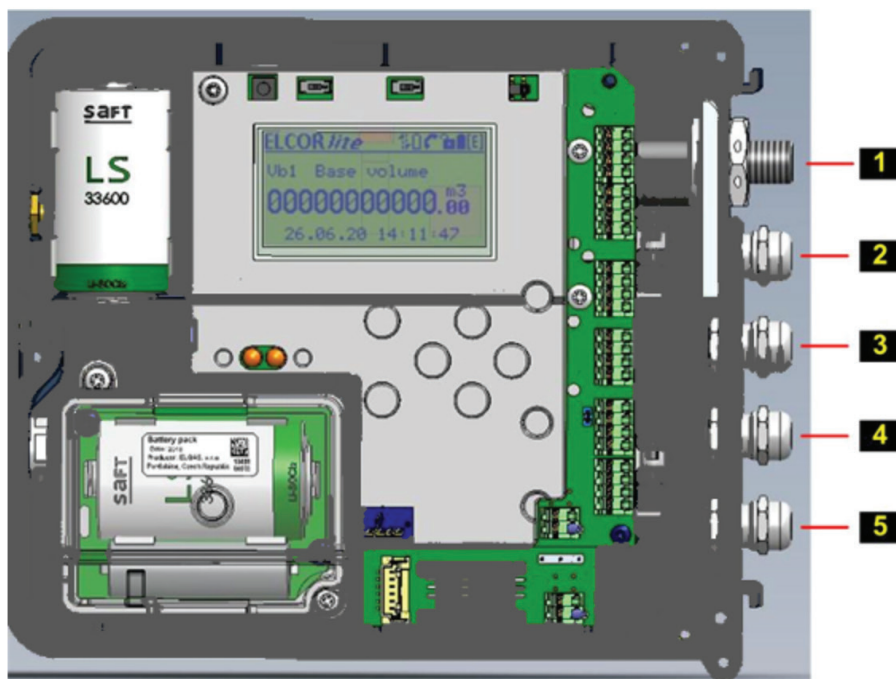


Fig. 21 Arrange cable glands

No.	Cable	Size	No.	Cable	Size
1	Pressure	PG7	4	digital inputs/outputs/communication	PG7
2	Temperature	PG7	5	digital outputs/communication/external power supply	PG7
3	Gas meter	PG7			

Tab. 3 Cable glands - recommended use

Notes:

- To connect the device with other JB devices, LappKabel Unitronic LiYCY cables are also recommended, which meet the requirements for cables for JB circuits. However, other cables that meet the requirements for JB cables according to the standard [10] can also be used. Basic parameters for LiYCY cables are shown in Tab. 4.
- Use UV-resistant cables if they are going to be exposed to direct sunlight.

Unitronic LiYCY parameter	Cable Ø	Value	Note
Inductance	-	0.65 mH/km	
Capacity (core/shielding)	-	160 nF/km	
Wire resistance	0.25 mm ² 0.34 mm ² 0.5 mm ² 0.75 mm ²	79.9 Ω/km 57.5 Ω/km 40.1 Ω/km 26.7 Ω/km	
Minimum bending radius	-	6 x outer diameter 15 x outer diameter	fixed mounting movable mounting
Temperature range	-	-40 °C ÷ +70 °C -5 °C ÷ +70 °C	fixed mounting movable mounting

Tab. 4 Basic Unitronic LiYCY cable properties

5.6.3 Connection of gas meters

5.6.3.1 LF gas meter

Corus Evo Compact is a single-channel corrector. A terminal block marked DIN is intended for the connection of the LF gas meter. The DIN terminal block is hidden under a plastic cover, which the user can secure with his own mark, see (Fig. 1, 11).

The standard is to connect the LF gas meter to the DIN terminal block to the DI1 and GND terminals (an input DI2 or DI3 can also be used to connect an LF gas meter). Observe the correct polarity if the gas meter has a Wiegand sensor.

Corus Evo Compact – LF gas meter	
terminals	connection
DI1	gas meter pulse output (+ pole in case of Wiegand sensor)
GND	gas meter pulse output (- pole in case of Wiegand sensor)

If the gas meter is equipped with a tamper contact, the contact can be connected to any free input DI1 to DI4 of the DIN terminal block.

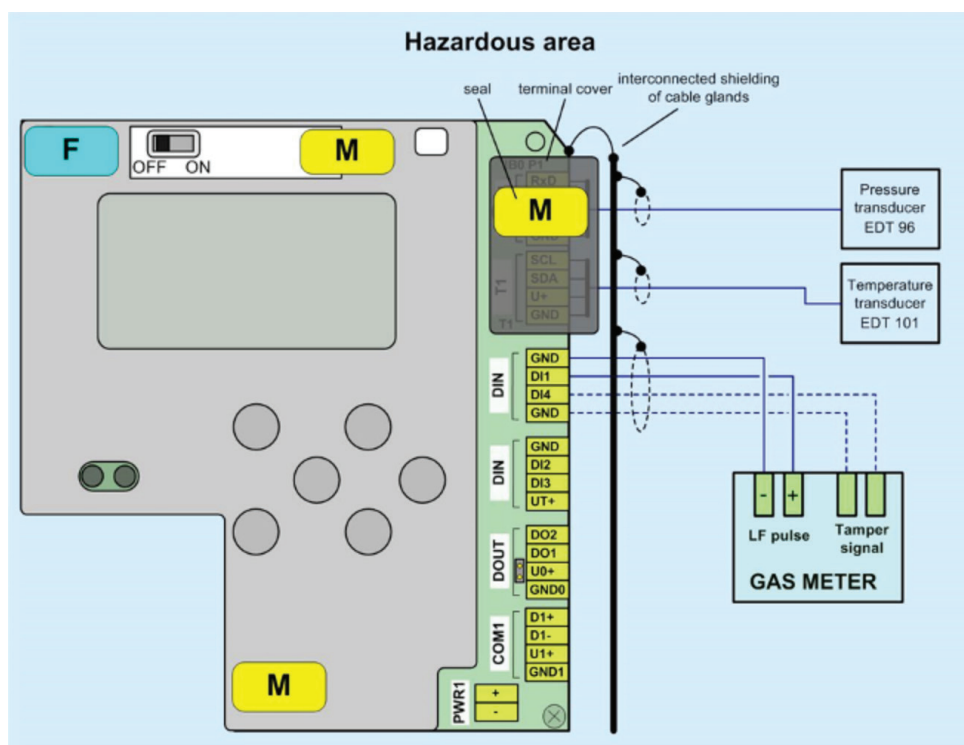


Fig. 22 LF gas meter connection (tamper contact on DI4)

Connection	Cable	Entry (gland)	Recommended type of cable	Cable Ø
Pulse input (LF gas meter)	2-wire shielded	PG7	Unitronic LiYCY 2 x 0.25 Lappkabel	4.5 mm
Pulse input with tamper contact	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.25 Lappkabel	5.0 mm
Pulse input with direction of rotation detection	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.25 Lappkabel	5.0 mm

Tab. 5 Recommended gas meter connection cables

5.6.3.2 LF gas meter with rotation direction detection

Gas meters that also evaluate the direction of rotation (or gas flow direction) are internally equipped with two phase-shifted sensors to detect it. One gas meter sensor would be connected to terminals DI1 and GND and the other to terminals DI4 and GND. The use of a gas meter with the direction of rotation evaluation must be configured in the device. It evaluates the information from the gas meter according to 9.5.3.

Corus Evo Compact – LF gas meter with evaluation of the direction of rotation	
Terminals	Connection
DI1, GND	Pulse output from gas meter
DI4, GND	Pulse output from gas meter with evaluation of the direction of rotation

The remaining inputs DI2 and DI3 can be used to monitor other pulse/binary inputs (including any tamper contact).

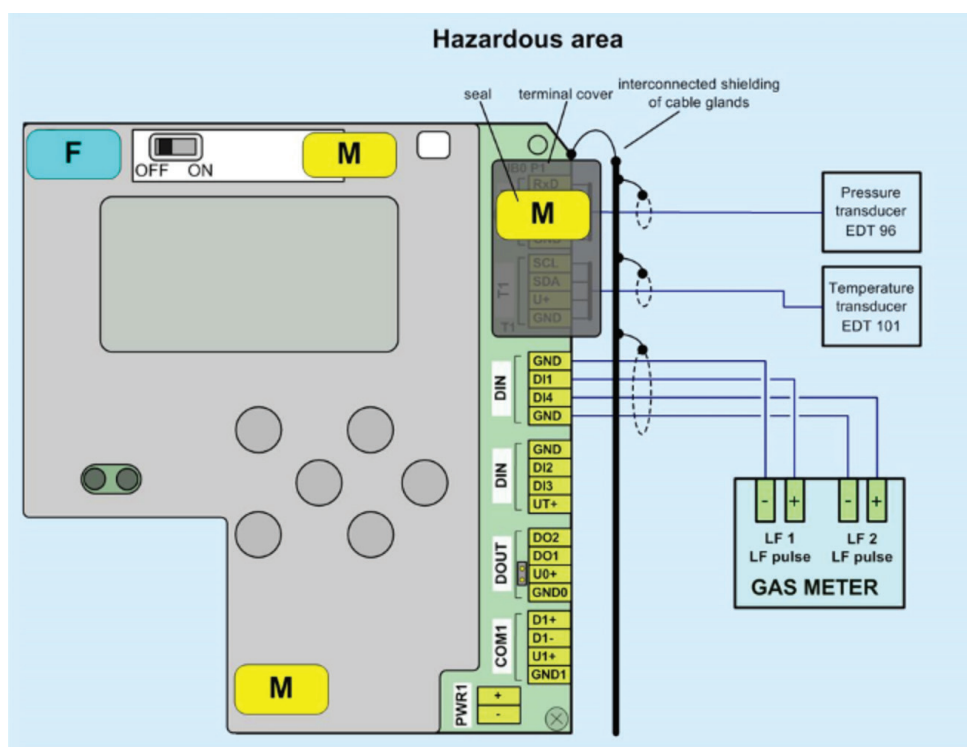


Fig. 23 LF gas meter connection with detection of rotation direction

5.6.3.3 HF TMR gas meter

The device also allows the connection of a high-frequency gas meter with a special rotation sensor HF TMR. This type of gas meter is used in some Asian destinations. No other types of HF gas meters are permitted.

The standard is to connect the HF TMR gas meter (without detection of rotation direction) to the DIN terminal block to the DI1 and GND terminals (an input DI2 or DI3 can also be used to connect an HF TMR gas meter). Observe the correct polarity when connecting. The HF TMR sensor in the gas meter requires power to operate, which is supplied from the UT+ terminal the DIN terminal block.

Configure the device input to use the HF TMR gas meter. The settings are made by utility SW [38] or see section 10.4.

5.6.3.4 HF TMR gas meter with rotation direction detection

HF TMR VF gas meters that also evaluate the direction of rotation (or gas flow direction) are internally equipped with two phase-shifted sensors to detect it. One gas meter sensor would be connected to terminals DI1 and GND and the other to terminals DI4 and GND. The HF TMR sensor in the gas meter requires power to operate, which is supplied from the UT+ terminal the DIN terminal block.

The use of an HF TMR gas meter with evaluation of the direction of rotation must be configured in the device. The settings are made by utility SW [38] or see section 10.4. The device evaluates the information from the gas meter according to 9.5.3.

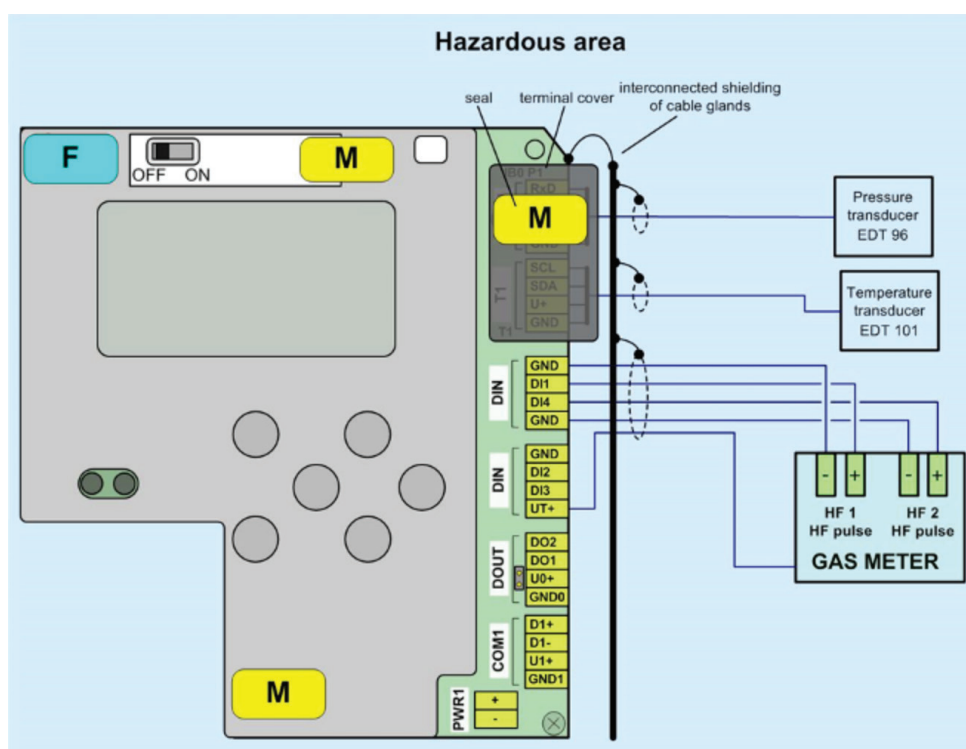


Fig. 24 Connection of HF TMR gas meter with rotation direction detection

5.6.4 Connection of binary inputs

Any unoccupied inputs from DI1 to DI4 can be used to connect binary inputs. All inputs from DI1 to DI4 use a common GND terminal (installed 3 times).



CAUTION!

Signals on all digital inputs (DIN terminal block) are intrinsically safe. The sensors connected to these terminals must be:

- Either intrinsically safe with the corresponding IS parameters; or
- They have to be categorized in the "Simple Device" under [4]; or
- They must be connected via a safety barrier.

Connection	Cable	Gland	Recommended type of cable	Cable Ø
Binary input (single)	2-wire shielded	PG7	Unitronic LiYCY 2 x 0.25 Lappkabel	4.5 mm
Binary input (2x)	3-wire shielded	PG7	Unitronic LiYCY 3 x 0.25 Lappkabel	4.7 mm
Binary input (3x)	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.25 Lappkabel	5.0 mm

Tab. 6 Recommended cables for connecting binary inputs

5.6.5 Connection of digital outputs

The device has 2 digital outputs connected to terminals DO1 and DO2 and a common terminal GND0 on the DOUT terminal block. They are open collector type digital outputs.

In terms of galvanic separation of outputs, the device can be supplied in two versions:

- **Outputs with galvanic isolation (standard design); or**
- **Outputs without galvanic isolation (only on request).**



CAUTION!

Signals from the DOUT terminal block are intrinsically safe, therefore it is necessary to connect common devices via a separating safety barrier (B DO module).

Digital outputs DO1 and DO2 can be set by the user as follows:

- LF pulse output (both pulse switching and delay times are programmable); or
- Binary output; or
- Analog output via a CLO module (current loop 4 ÷ 20 mA); or
- Special HF calibration output for a HF TMR gas meter.

Output settings are made by utility SW [38]

5.6.5.1 Standard output design (outputs with galvanic isolation)



Galvanic isolation of digital outputs

Output circuits from the corrector connected to terminals DO1 and DO2 are galvanically isolated from the other internal circuits in the corrector. Therefore, to ensure the output circuits function, connect the outside supply voltage to the U0+ terminal of the DOUT terminal block. A B-DO barrier supplies the voltage if one is used.



Do not install the jumper next to terminal U0+ of the DOUT terminal block!!

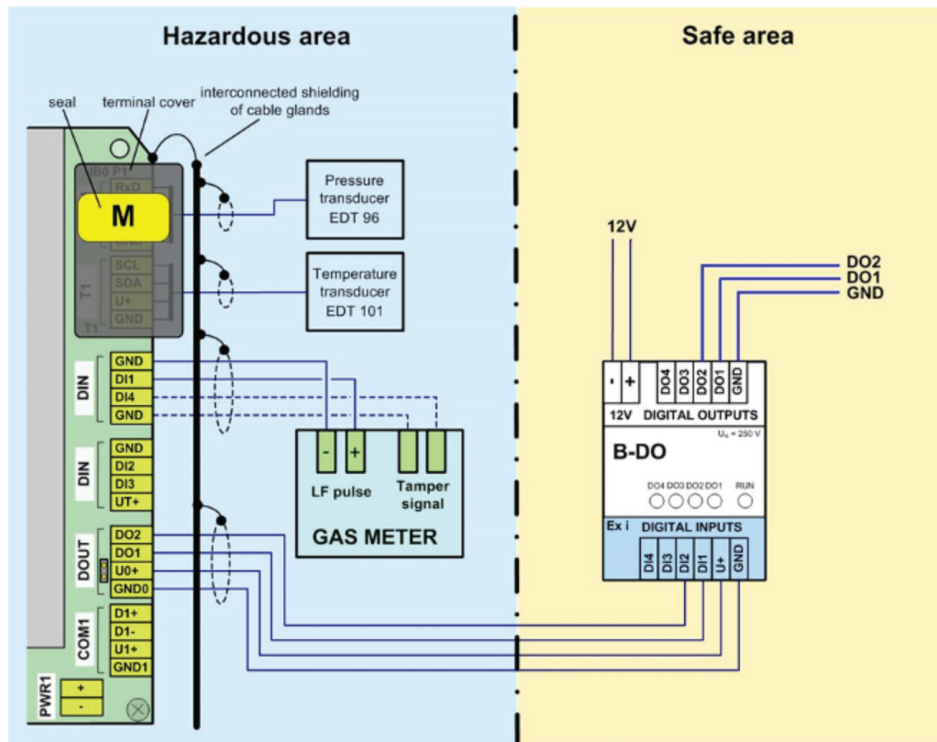


Fig. 25 Digital outputs connection via B-DO isolation barrier

If a 4-20 mA analog output is required, connect the CLO module to the digital output (DO1, DO2) via the B-DO isolation barrier (Fig. 26).

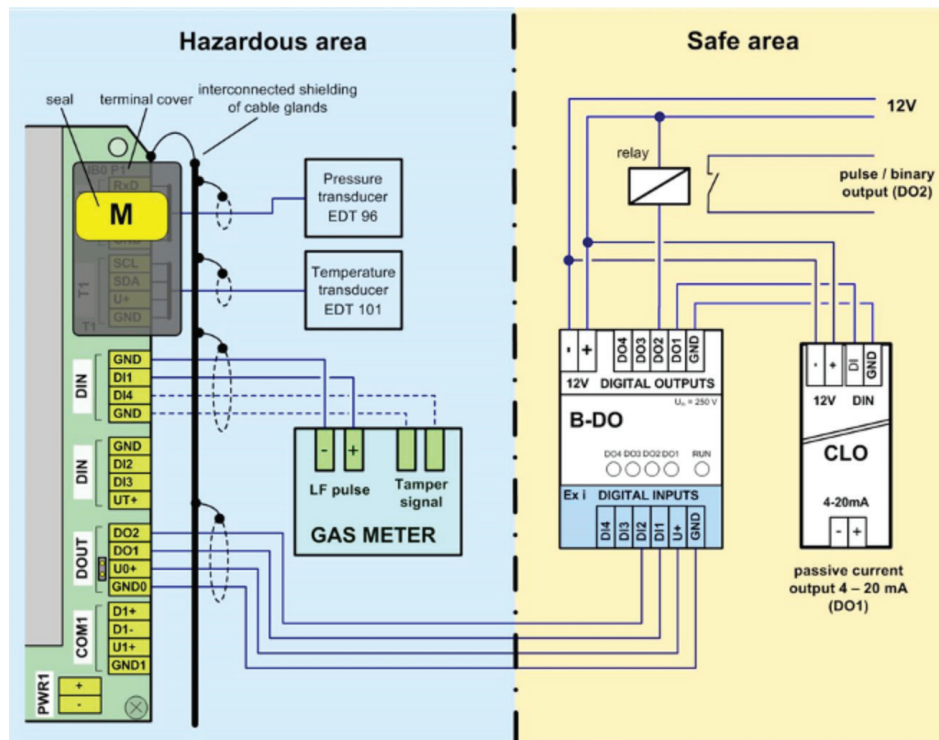


Fig. 26 Connection of analog outputs via B-DO isolation barrier with CLO module

Connection	Cable	Gland	Recommended type of cable	Cable Ø
Digital output (single)	3-wire shielded	PG7	Unitronic LiYCY 3 x 0.25 Lap-pkabel	4.7 mm
Digital output (2x)	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.25 Lap-pkabel	5.0 mm

Tab. 7 Recommended cables for connection of digital outputs to the B-DO module

5.6.5.2 Special output design (outputs without galvanic isolation)



If a device with outputs without galvanic isolation is required, this requirement must be specified when ordering the device.

Because the output circuits of the corrector are in this case powered directly from its internal battery, no external power supply is used and neither is the U0+ terminal in the DOUT terminal block (internally disconnected even if it is installed). In this version, the jumper position at terminal U0+ of the DOUT terminal block is not fitted. An example of the connection with a B-DO module is shown in Fig. 27.

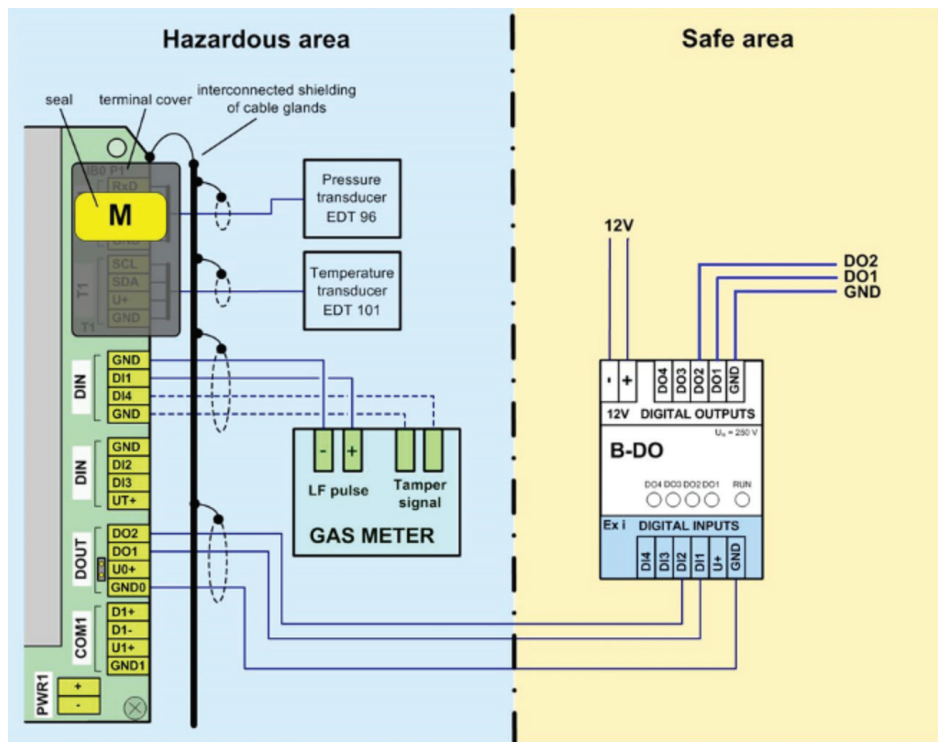


Fig. 27 Digital outputs connection for an output design with no galvanic isolation

5.6.6 Connection of pressure and temperature transducers

These transducers are connected to the motherboard in terminal blocks T1 and IB0 P1.

If the gas volume corrector has metrological approval (MID), there is a metrological channel and therefore the connection is secured by a cover and provided with a MID security mark (see Fig. 1, position 9).



CAUTION!

The intrinsically safe internal communication bus is connected to block terminals T1 and IB0 P1. Disconnect the device power supply (external power supply and battery) if the terminal blocks are going to be handled.

EDT125 pressure transducer, terminal block IB0 P1

Terminal block IB0 P1		EDT 125 Pressure transducer (internal and external design)
terminal	signal	wire color
RxD	RxD	White
TxD	TxD	Yellow
U+	U+	Brown
GND	GND	Green

Tab. 8 Connection of EDT 125 pressure transducer wires

Temperature transducer EDT124, terminal block T1

Terminal block T1		EDT 124 Temperature transducer
terminal	signal	wire color
SCL	SCL	White
SDA	SDA	Yellow
U+	U+	Brown
GND	GND	Green

Tab. 9 Connection of EDT 124 temperature transducer wires

The manufacturer supplies both the EDT 125 pressure and EDT 124 temperature transducers calibrated in the entire measurement range. Calibration and correction data are stored in the transducer's internal memory when the transducer is calibrated and the resulting measured data, including corrections, are passed to the device's control unit.

Nevertheless, the device is equipped with optional one-point or two-point adjustment of the transducer using the supplied SW [38]. This option is protected by a metrological switch provided with a metrology mark. In the case of a converter without MID metrological verification or an electronic data logger, the transducer adjustment is accessible to the user.

5.7 Commissioning

The device is delivered either in operating state with the battery connected or in off state with the power supply battery disconnected.



ATTENTION!

If the device is delivered without inserted modem battery cells, the modem battery cells must be installed immediately after delivery, otherwise there is a risk of discharge and destruction of the supercapacitor!

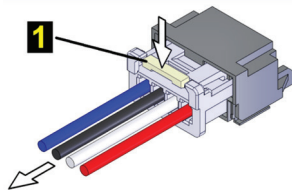
Before inserting the cells, it is necessary to check the voltage of the supercapacitor and follow the procedure for replacing the battery cell - see paragraph 6.2.1.



CAUTION!

All the connectors used in the device contain a **mechanical safety lock 1** to prevent accidental disconnection.

To unplug the connector, first press the lock to disable protection against disconnection and then pull the connector gently out of the socket. Never pull on the cable only, there is a risk of damage.



To re-connect, plug the connector in gently so that the lock snaps into place. Then check for proper connection by pulling the cable slightly.

The device is delivered with pre-set configuration parameters. However, after the device has been assembled mechanically and electrically, some parameters will still have to be set to ensure the gas meter operates properly, possibly other parameters.

Basic operations for putting the device into operation:

- **Connection of the batteries**
- **Checking (or setting) the system time of the device**
- **Setting of supply point identification**
- **Setting of temperature and pressure spare values**
- **Setting the gas meter constant and other parameters (incl. gas meter, alignment of the primary volume counter with the counter on the gas meter)**
- **Setting the method of gas compressibility calculation**
- **Setting the gas composition**
- **Diagnostics check, possible elimination of device errors, initialization of the summary status**
- **Resetting archives for storing device data**

These basic operations can be performed either from the device keypad (Section 8) or from a PC with a service program [38]. When using a PC, connect the device to the computer, preferably using an HIE 04 infrared head (although any other communication channel can be used). If necessary, the service program can be used to set other parameters of the device (i.e. other inputs, pulse outputs, setpoints and communication).

5.7.1 Connecting the device battery

The graphic device display is shut off in the default settings. The display light comes on when the Enter key is pressed down for at least 2 seconds.

If the device is delivered in off mode (nothing is displayed after pressing Enter for more than 2 seconds), the battery pack **3** is disconnected from the device. Plug the battery cable's connector **1** into the motherboard connector **2** to put the device into operation. This can also be done in potentially explosive atmospheres.

When the battery is connected, the device will automatically be in operating state.

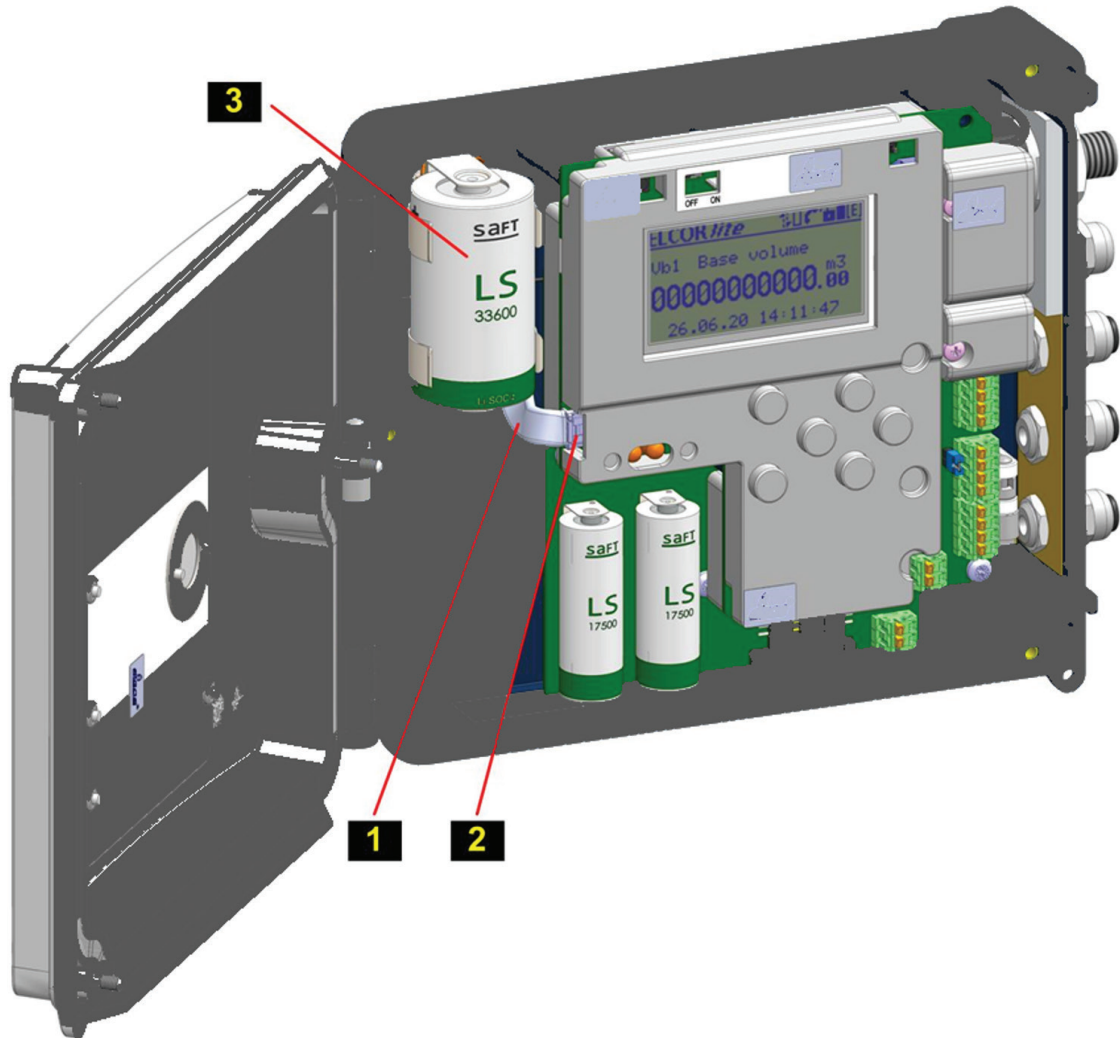


Fig. 28 Device battery connection

Note:

If the device is going to be stored for a longer time, remove the battery from the device or at least disconnect it by pulling out the battery connector.

6 Power supply of the device



Both the device battery and the modem battery pack can be replaced in potentially explosive atmospheres.

Batteries/battery packs may only be replaced by trained personnel.

Use only the specified type of battery/power pack.



CAUTION!

Danger of explosion if an incorrect type of battery is used! Only batteries specified by the manufacturer may be used in the device (see Section 3.9 and 3.10). They are approved by the testing laboratory for this device and meet specifications for potentially explosive atmospheres.



ATTENTION!

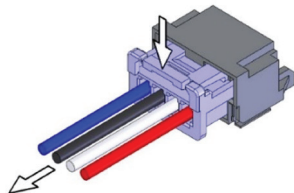
If the device is delivered without inserted modem battery cells, the modem battery cells must be installed immediately after delivery, otherwise there is a risk of discharge and destruction of the supercapacitor!

Before inserting the cells, it is necessary to check the voltage of the supercapacitor and follow the procedure for replacing the battery cell - see paragraph 6.2.1.



CAUTION!

All the connectors used in the device contain a safety lock against unwanted disconnection. To unplug the connector, first press the lock to disable protection against disconnection and then pull the connector gently out of the socket.



Never pull only on the cable, there is a risk of damage. To re-connect, plug it in gently so that the lock snaps into place. Then check by pulling the cable slightly.



Discharged batteries are categorized as hazardous waste. WEEE Directive (2002/96/EC) and national legislation prohibit the throwing out of batteries with household waste. Discharged batteries are covered by take-back systems. Therefore, it is necessary to return the discharged batteries to a collection point or to an authorized recycling site for waste electrical and electronic equipment.

6.1 Device power battery



If battery capacity drops to 10% before expected discharge, the device will alert you of the need to replace the battery (error message **E9**, see Tab. 26).

The device is powered by a lithium battery (size D cell) with a nominal voltage of 3.6 V, **SAFT LS33600 type**, or **EVE ER34615C type**.

Note:

For devices equipped with a modem module, the modem module is not powered by this battery; it is power supplied by its own battery.

During the operation of the device, the consumed battery capacity is calculated. The current battery capacity is stored in the internal memory of the device.

The factors affecting **battery life** of a device are:

- HW configuration of the device - installed modules, connected devices (sensors)
- SW configuration of the device - setting the measurement period for individual variables
- device operation mode (communication, display on the screen, ...)
- in case of frequent communication via internal modem, setting the speed to COM0
- climatic conditions in which the device is operated
- type and capacity of the power battery (battery manufacturer)

Backup battery life is influenced by the following factors:

- the duration for which the main EVC battery is not connected
- climatic conditions in which the device is operated

Note:

If the main battery (measuring part) is connected to the device, then no current is drawn from the backup battery – the backup battery only self-discharges.

The following life of power battery and backup battery of the device (or EVC module) apply under these conditions:

Defined mode for the declared life of the power battery and backup battery:

- measurement frequency once a 30-second
- frequency of writing to the data archive once an hour
- Input pulses from the gas meter with frequency $f \leq 10$ Hz
- output pulses generated with frequency $f \leq 1$ Hz
- operational communication (local or remote*) with the device for 2 minutes per day
- service communication (local or remote*) with the device for 5 min per week
- local device operation (keyboard, display backlight) for 5 minutes per week
- firmware update (locally or remotely) once a year
- ambient temperature: -25°C to 70 °C
- power supply battery EVC: SAFT LS33600, or EVE ER34615C

** in case of an internal modem, speed set to COM0 57600 Bd*

a) Corus Evo Compact - basic version

(i.e., graphical or segment display with backlight, RS485/RS232 communication)

Battery life	Display activated only during device usage (graphical/segmented)	Display permanently on (segmented only)
SAFT LS33600	14 years	12 years
EVE ER34615C	10 years	8 years

Backup battery life: 16 years of backup (15 months of operation without the main EVC battery)

Tab. 10 Corus Evo Compact power supply battery life (basic version)

a) Corus Evo Compact – simplified version

(i.e., using only a segment display without backlight, without RS485/RS232 communication)

Battery life	Display activated only during device usage (segmented)	Display permanently on(segmented)
SAFT LS33600	15 years	13 years
EVE ER34615C	11 years	9 years

Backup battery life: 16 years of backup (15 months of operation without the main EVC battery)

Tab. 11 Corus Evo Compact power supply battery life (simplified version)

Note:

If you need to operate the device with a higher current consumption than in the defined mode, it is necessary to count on more frequent replacement of the power supply battery or use an external power supply.

6.1.1 Backup battery

The battery backs up important functions either when the main battery is discharged or while it is being replaced. The back-up battery is located in a holder on the EVC module board under the module cover. In the case of a legal metrology instrument with metrological verification, the back-up battery can be replaced by an authorized service center after violation of the official and production security mark. Only the specified battery type must be used.



CAUTION!

The backup battery must be replaced outside of potentially explosive atmospheres!

Only the specified battery type must be used.

Under the conditions specified in Section 6.1, the life of the back-up battery is 16 years. The backup time is 15 months if the power pack is disconnected for a long period of time (without a power supply from an external source).

6.1.2 Replacing the power supply battery

It is advisable to disconnect the discharged battery as soon as possible.



The device indicates a discharged battery with error message E9 in its diagnostics (see Section 8.9.5).

i

All data stored in device archives and parameter settings are saved in non-volatile (energy-independent) memory and will remain saved and intact even if the device is disconnected from the power supply, including if the backup battery is disconnected.

i

The device measures neither pressure nor temperature while the battery is disconnected, but it does count incoming LF pulses (however, it does not perform pulse recalculation, which is performed only after the power supply battery has been re-connected) and real-time clock operation is ensured.



The LS33600 battery can be replaced in potentially explosive atmospheres.

Battery replacement procedure:

If the LS33600 battery is spent, remove the battery cell **3** (Fig. 29) from the holder and replace it with a new one

When the battery is connected, the device will automatically be in operating state.

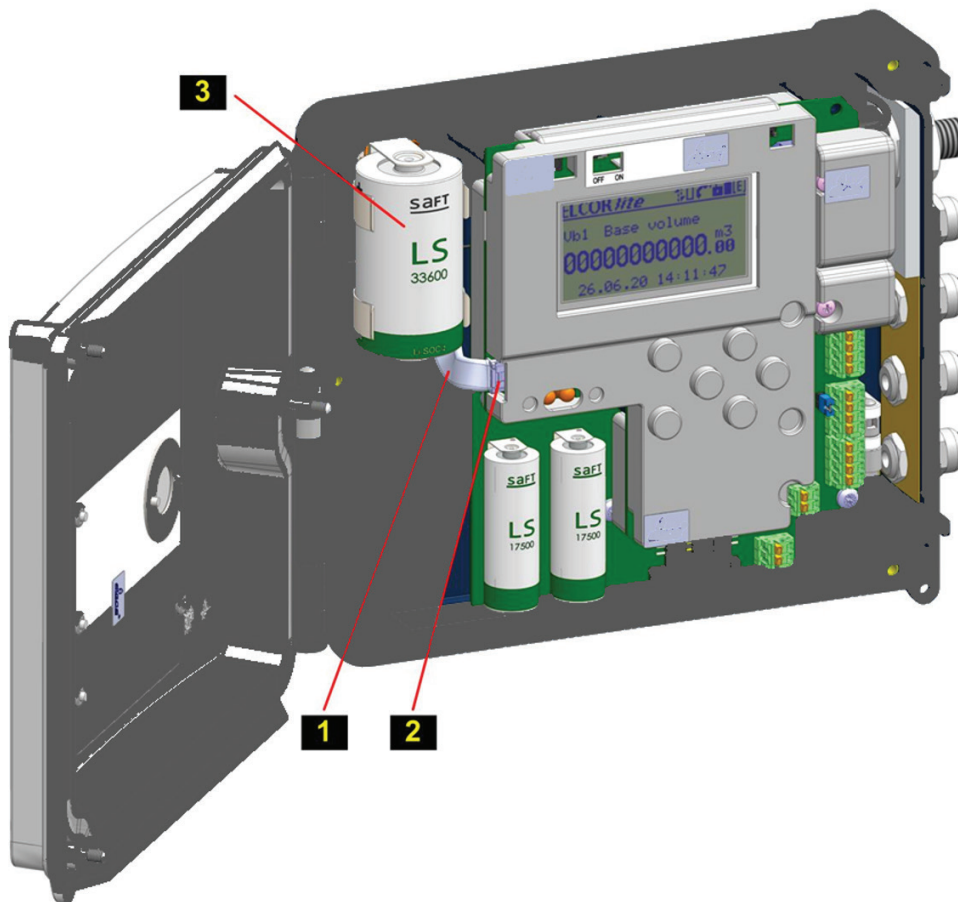


Fig. 29 Device power battery



After inserting a new battery into the device, it is necessary to enter the battery replacement information into the device using the service SW [38], otherwise the life of the new battery will not be displayed correctly.

6.2 Modem power battery

The internal modem is powered by a separate battery pack (BP) that contains a battery cell. The type of battery pack used depends on the internal modem. The battery pack is connected to the internal modem board with a cable with a connector. The LTE-CatNB modem is an exception, where the power batteries are located directly on the modem board.

Consumed battery capacity is measured and calculated while the modem is operating. Current battery capacity is stored in the battery pack's EEPROM memory (for an LTE-CatNB modem, it is stored in the EEPROM on the modem board).



A discharged modem battery is indicated by error message E27 in the device diagnostics and low modem battery voltage by warning message W30 (see Tab. 26 and Tab. 27). The meaning of these messages:
W30 ... low modem battery voltage, voltage dropped below 3.1 V (6.2 V for HBL-04U batteries)
E27 ... modem power failure, the modem battery voltage has dropped below 2.8 V (5.6 V for HBL-04U batteries) and the modem is blocked from turning on.

In the overview of power supply batteries for individual modems (Tab. 12), their battery life is provided for two communication modes. Battery packs that use a supercapacitor are indicated in the third res. fourth column.

Battery packs marked with the letter "U" at the end of their designation have battery cells placed in a holder and can be user-replaceable. This also applies to the batteries in the holder of the LTE CatNB modem, which are directly mounted on the modem board.

For these battery blocks, [alternative installation](#) can be used either by these [SAFT cells](#) or [EVE battery cells](#).



Other types of cells not listed in Tab. 12 are not approved in terms of explosion safety and must not be used!

Type of the modem	Battery pack (BP)	Cell connect in BP	Supercapacitor	Used battery cell in BP	nominal voltage /capacity	operating temperature °C	Lifetime *) years	
							1x/day 15 s	2x/day 15 s
GPRS	HBL-03U	in holder	•	1 x SAFT LS33600	3,6 V/17 Ah	-25 ÷ +70	10	7
GPRS	HBL-03U	in holder	•	1 x EVE ER34615C	3,6 V/19 Ah	-25 ÷ +70	9	6
GPRS	HBL-03E	soldered	-	1 x FRIWO M20Ex	3,6 V/12 Ah	-40 ÷ +70	6	3,5
LTE-CatM1	HBL-03	soldered	•	1 x SAFT LS33600	3,6 V/17 Ah	-25 ÷ +70	10	7
LTE-CatM1	HBL-03U	in holder	•	1 x SAFT LS33600	3,6 V/17 Ah	-25 ÷ +70	10	7

LTE-CatM1	HBL-03U	in holder	•	1 x EVE ER34615C	3,6 V/19 Ah	-25 ÷ +70	9	6
LTE-CatM1	HBL-03E	soldered	-	1 x FRIWO M20Ex	3,6 V/12 Ah	-40 ÷ +70	6	3,5
LTE-Cat1	HBL-04U	in holder	•	2 x SAFT LS26500	7,2 V/7,7 Ah	-25 ÷ +70	7	5
LTE-Cat1	HBL-04U	in holder	•	2 x EVE ER26500C	7,2 V/8,5 Ah	-25 ÷ +70	7	5
LTE-CatNB	cell in holder on modem board		•	2 x SAFT LS17500	3,6 V/7,2 Ah	-25 ÷ +70	11	8,5
				2 x EVE ER17505	3,6 V/7,2 Ah	-25 ÷ +70	9	7

Note: The HBL-03E battery pack has an extended temperature range of -40 °C ÷ 70 °C.

Tab. 12 Overview of internal modem power batteries

*) Battery pack life

The data given in Tab. 12 in the 1st and 2nd column of the lifetime section applies to the following communication mode:

- Once a day (twice a day) data transmission (call to the dispatch center), transmission time 15 seconds
- Once a week service window (30 minutes ON, on average 1 minute of communication every week)
- Central Europe temperature profile
- Min. signal strength 60 %

Besides operating mode, battery life also depends on the signal strength at the place of use and the ambient temperature:

- Battery life decreases with higher ambient temperature (approximately 90 % at 50 °C, 80 % at 70 °C).
- Battery life decreases with lower ambient temperature (approximately 85 % at 0 °C, 60 % at -25 °C).
- Battery life decreases with decreasing signal strength (approximately 60 % at 15 % signal strength).



CAUTION!

The GSM signal strength is stored in the daily archive by default.

If the customer cancels the storage of the GSM signal strength in the daily archive, the battery life guarantee cannot be accepted in case of a claim!

6.2.1 Replacing the modem battery



CAUTION!

In a Zone 1, Zone 2 environment, it is only permitted to replace the complete battery pack with another.

Battery packs, if sealed by the manufacturer, must not be disassembled for safety reasons.



CAUTION!

Replacing the battery cell in the holder of an enclosed modem battery pack is not permitted in potentially explosive atmospheres!

Danger of explosion!

Note:

For the **LTE-CatNB** modem, there is an exception for the replacement of battery cells - the replacement of battery cells is allowed even in an explosive environment.

The device automatically checks the condition of the modem battery pack every 2 minutes. Any replacement of the modem battery pack will therefore be automatically registered within 2 minutes or after the device has been reset.

6.2.1.1 Replacing the battery pack (BP)

a) Replacing the battery pack (except HBL-04U)

- Press the lock and gently pull the cable to disconnect the connector **3** of the modem battery pack **1** (see Fig. 30).
- Loosen the fixing screws **2**.
- Remove the battery pack and replace it with a new one. Tighten the fixing screws **2**.
- Connect the battery pack cable with connector **3** to the modem board.

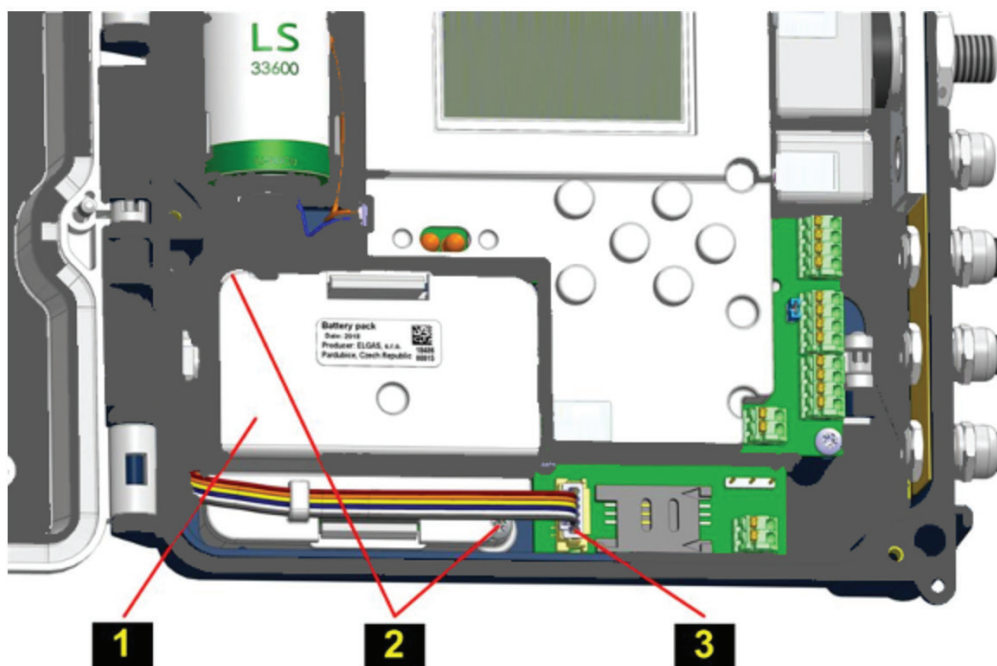
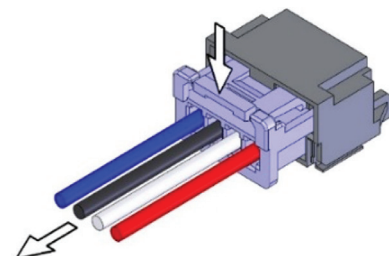
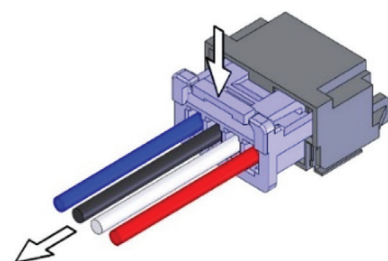


Fig. 30 Internal modem battery power

b) Replacing the battery pack HBL-04U (see Fig. 31)

- Press the lock and gently pull the cable to disconnect the connector **1** of the EVC battery pack.
- Press the lock and gently pull the cable to disconnect the connector **2** of the modem battery pack HBL-04U.
- Loosen the fixing screws **3**.
- Unscrew the screw **4** (under the manufacturer's seal) and the screw **5** of the



EVC module.

- Lift up the EVC module, remove the battery pack and replace it with a new one, put the EVC module back. Screw in the fixing screws **3**.
- Screw in the screws **4** and **5** of the EVC module.
- Connect the battery pack cable with connector **2** to the modem board.
- Connect the EVC battery pack cable with connector **1** to the EVC module board.

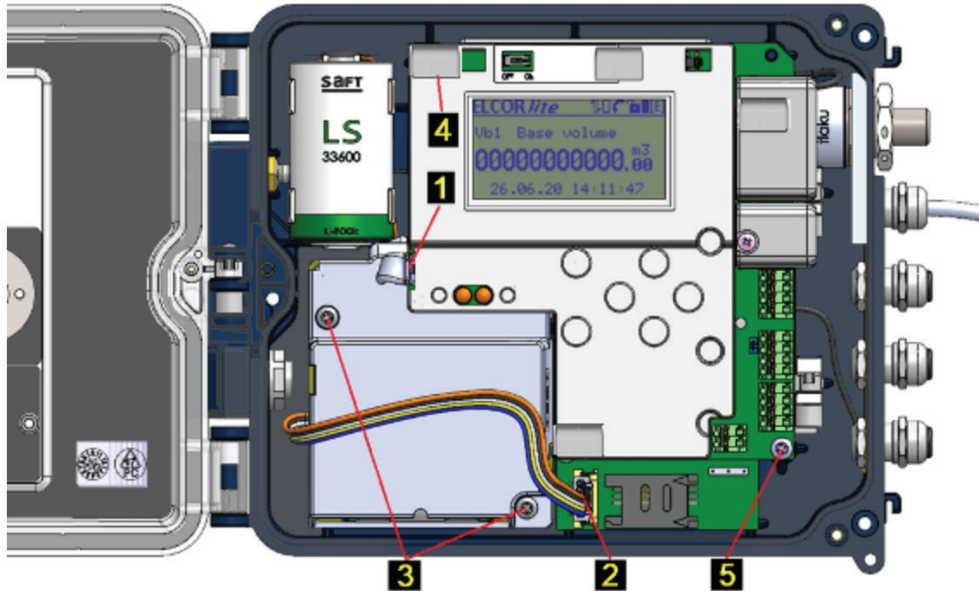


Fig. 31 Battery power supply for internal modem LTE-Cat1

6.2.1.2 Replacing the battery cell in a closed battery pack (BP)

These are battery packs HBL-03U, HBL-4U in which the battery cells are located in the holder and are therefore replaceable.



The HBL-03U and HBL-04U battery packs use a combination of a battery cell and a supercapacitor. Replacement of the battery cell in BP is possible only if the voltage of the modem BP has not fallen below the critical limit of 2.2 V (for HBL-03U), resp. 4.4 V (for HBL-04U). The current value of the modem voltage can be found on the device display from the current (actual) values.

If the BP voltage of the modem falls below the value of 2.2 V (HBL-03U), resp. 4.4V (HBL-04U), the supercapacitor will be damaged and the entire battery pack must be replaced.



CAUTION!

The replacement of the battery cell located in the holder of the closed battery pack for powering the modem must be performed outside the potentially explosive atmospheres!

Follow these steps:

- First, disconnect the battery pack and remove it from the device (see the previous section).
- **Place the removed battery pack away from potentially explosive atmospheres!**
- Only afterward, replace the battery cell located in the BP holder.
- Close the battery pack and reinstall it back in the device.



The prescribed torque of the screws for attaching the battery packs to the device is 0.7 Nm.



After inserting a new battery cell into the holder in the BP modem and connecting the BP to the device, it is necessary to enter information about replacing the modem battery into the device using the service SW [38], otherwise the life of the new modem battery will not be displayed correctly.

6.2.1.3 Replacing the battery cell in the LTE-CatNB modem board holder

Battery replacement for the LTE-CatNB modem (unlike all other modems) is permitted in potentially explosive atmospheres.



ATTENTION!

The LTE-CatNB modem is powered by a combination of a battery cell and a supercapacitor located directly on the modem board. The battery cell is located in the holder and is removable. The supercapacitor is soldered into the board and protected by a non-removable cover.

Replacement of the battery cell on the modem board is only possible if the modem voltage has not dropped below the critical 2.2 V threshold. The current value of the modem voltage can be found on the display of the device from the actual (instantaneous) values.

If the power supply voltage of the LTE-CatNB modem drops below 2.2 V, the supercapacitor will be damaged and the entire modem board must be replaced!



After inserting a new battery cell into the holder on the modem board, it is necessary to enter information about replacing the modem battery into the device using the service SW [38], otherwise the life of the new modem battery will not be displayed correctly.

6.3 External power supply

The device can be powered from an external intrinsically safe source. If the device is equipped with an internal modem, it can also be equipped with an external power supply for the modem.



The device's external power supply provides no power to the internal modem. It requires its own external power supply.

External power supply is recommended if the operating mode of the device or modem is set so that it has the effect of increasing the current consumption from the batteries and thus shortening their life.

i

The device battery must be inserted and connected even if external power is used.

In the event of a failure of the external power supply, the power supply of the device and the power supply of the modem are automatically switched to the power supply batteries in the device, which in this case function as a backup power supply.

The external power supply of the modem and its relation to the current use of the modem batteries is described in paragraph 6.3.2.

6.3.1 External power supply of the converter (EVC device module)



Caution

In terms of external power supply of the device, the device is supplied in two versions:

- with the possibility of external power supply (standard)
- without external power supply (optional)

An intrinsically safe PS-E (PS-E/A) power supply is intended for external power supply of the device.

Power from an external intrinsically safe PS-E power supply provides power to the PWR1 terminals. The intrinsically safe PS-E power supply has to be located outside potentially explosive atmospheres. The intrinsically safe PS-E power supply is designed for connection to a 12 Vdc power supply. In the event of an external power supply failure, the power supply battery of the corrector functions as power backup.

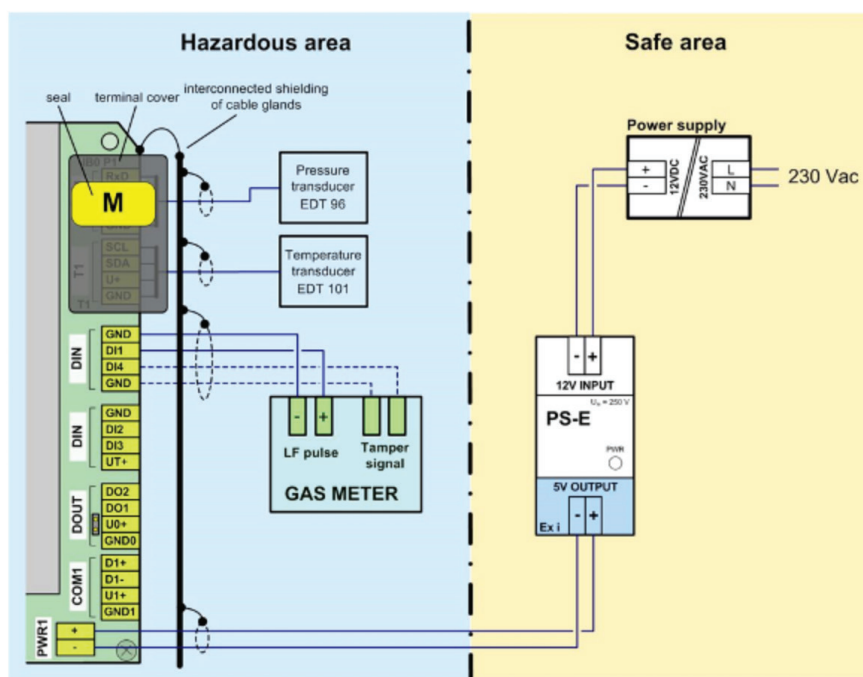


Fig. 32 External power supply of the corrector (EVC module)

Connection	Cable	Gland	Recommended type of cable	max. length	Cable Ø
External power supply of corrector (separate)	2-wire shielded	PG7	Unitronic LiCY 2 x 0.75 Lap-pkabel	30 m	6.0 mm

Tab. 13 Recommended cable for external power supply of the corrector

6.3.2 External power supply of the internal modem



Caution

In terms of external power supply of the internal modem, the modem is supplied in two versions (depending on the equipment of the modem board):

- with the possibility of external power supply (standard)
- without external power supply (optional)

external power		JB power supply	
		power supply type	installation of the power supply
devices (EVC)		PS-E, PS-E/A	outside the environment with a risk of explosion
internal modem	2G GPRS, LTE-CatM1, LTE-CatNB	PS-M1, PS-M1/A	outside the environment with a risk of explosion
	LTE-Cat1	PS-M, PS-M/A	outside the environment with a risk of explosion

Tab. 14 External power supply, necessary components



Caution

An intrinsically safe PS-M1 power supply is designed for external power supply of internal modems (with the exception of LTE-Cat1 modem). It is not possible to use an intrinsically safe PS-M power supply!

The exception is the LTE-Cat1 modem where a PS-M source must be used.

External power supply is recommended if the operating mode of the modem is set so that it has the effect of increasing the current consumption from the battery and thus shortening its life.

An external power supply for the modem is recommended:

- When there is frequent communication (more than once a day),
- When the modem is required to be ON for a longer time than specified in Section 6.2.

Power from an external intrinsically safe source is fed to the PWR2 terminals located on the modem board. The intrinsically safe PS-M1/PS-M power supply is designed for connection to a 12 Vdc power supply. The intrinsically safe power supply must be located outside potentially explosive atmospheres.



The following applies to the use of modem power batteries when the modem is powered externally:

- **GSM/GPRS and LTE-CatM1**
 - Modem battery power block may/may not be connected
- **LTE-Cat1**
 - Modem power battery **cannot be connected**
- **LTE-CatNB**
 - The modem power supply battery cells must always be fitted, otherwise there is a risk of destroying the capacitor.

In the event of an external power failure, the modem battery acts as a power backup. The exception is the LTE-Cat1 modem, where the modem battery cannot be used in case of external power supply.

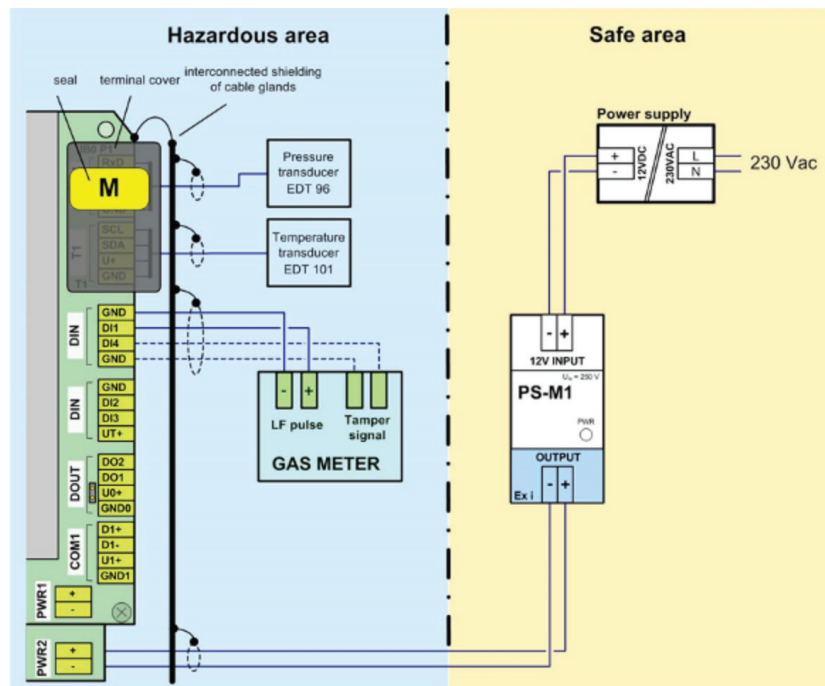


Fig. 33 External power supply of the internal modem from the PS-M1

When power is supplied externally to the internal modem from the IS PS M1 (PS-M in the LTE Cat 1 modem), a 0.75 mm² cross-section wire cable is prescribed for the Corus Evo Compact. The table shows the maximum length of this cable.

Connection	Cable	Gland	Recommended type of cable	max. length	Cable Ø
External modem power supply (separate)	2-wire shielded	PG7	Unitronic LiYCY 2 x 0.75 Lap-pkabel	10 m	6 mm

Tab. 15 Recommended cable for external power supply of the internal modem

If power is going to be supplied externally both to the corrector and the internal modem, it is possible to route both external power supplies with a single common cable and so only one cable gland of the Corus Evo Compact may be used for both signals. In this case, it is necessary to use a cable with a core cross-section of 0.5 mm², as the PG7 cable glands installed in the device allow the use of a cable with a maximum diameter of 6.5 mm.

Connection	Cable	Gland	Recommended type of cable	max. length	Cable Ø
Externally powered corrector and modem	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.5 Lap-pkabel	10 m	6.3 mm

Tab. 16 Recommended cable for combined external power supply of the device and the internal modem

7 Communication with the device

There are three interfaces for communication with the device:

- Optical interface designed for an infrared head (e.g. HIE-04)
- RS485 metal interface (according to the device assembly) at terminal block COM1
- Built-in modem (different types according to the assembly)

i

All listed communication interfaces work independently and they can communicate simultaneously and with the same priority.

Different communication speeds and protocols can be set for each interface.



CAUTION!

Signals on RS232/RS485 interface communication terminals on the device's COM1 terminal block are intrinsically safe. Common communication devices connected to the device must be connected via a suitable communication barrier (B-RS).

Speed settings and the communication protocol type for each interface can be shown on the device display. It is also possible to change the settings from the device keypad (see par. 8.7 and A2.1).

i

Combining an internal modem and an external modem connected to the communication line (COM1 terminals) via an isolation barrier is permissible.

Communication speeds

Interface	Communication speed range
Optical interface for infrared head	9 600 Bd ÷ 115 200 Bd
RS232/RS485 communication line	2 400 Bd ÷ 115 200 Bd
internal modem (internal speed between corrector device and modem)	9 600 Bd ÷ 115 200 Bd

Tab. 17 Communication speed ranges

Communication protocols

The device is equipped with several communication protocols in the current firmware version. It can be expanded with other protocols according to customer specifications. The following default protocols are implemented:

- iFLAG,
- MODBUS RTU
- MODBUS TCP
- MODBUS IGD
- M900
- GAZ MODEM

(other communication protocols are being readied)

iFLAG

This is the native protocol for the device. A complete set of functions implemented for it is available. The service SW, [38] uses solely this protocol. The IFLAG protocol is only nested in another data link layer (the "tunnel") if there is a need to switch to another data link layer.

MODBUS

If MODBUS protocols are used, the MODBUS register map has to be uploaded to the device. The map assigns numerical addresses to individual measured and calculated quantities stored in the device's internal memory. The device is normally delivered without a loaded MODBUS map. The Modbus map can be requested from the device manufacturer and downloaded with the user utility SW [38] into the device. There are several Modbus map variants, depending on the device's configuration and the options available on the connected PLC.

Device addressing

The communication protocols use so-called "addresses" to communicate with the device and these have to be declared for each device. They should be set for each device in its parameters. The device address can be set either from the device keypad (Section 8.7) or using the utility SW [38].

The device address is numeric and consists of two parts, designated in the parameters as Network address1 and Network address2. If more than one device is connected to the communication line, the addresses must be set so no collision occurs.

The iFLAG communication protocol uses both parts of the address, while the MODBUS communication protocol uses only Address1.

Range of communication address (network address) of the device		
	Address1	Address2
Communication protocol iFLAG	0 ÷ 65 535	0 ÷ 255
Communication protocol MODBUS *)	10 ÷ 247	Not use

*) Communication addresses 1 to 9 are reserved for the device's internal parts

Tab. 18 Range for setting the communication addresses of the device

7.1 EN 62056-21 (IEC-1107) optical interface

The front wall of the enclosure has a window for communication via an optical head, which is placed on the window and fixed by a magnet. The optical head can be an HIE-04 with a USB connection to the PC. After it is attached, the device switches from standby mode into a mode that can receive data. Depending on the setting, the device remains in this state either until the attached optical head has been removed from the communication interface or until the previously set time limit since the last communication expires (timeout within 1 to 255 seconds). The timeout can be read and changed using the parameter "Deactivate IR head after [s]" (in SW WINCOR EVO [38] in Pro settings, menu Parameters-> General-> Other).

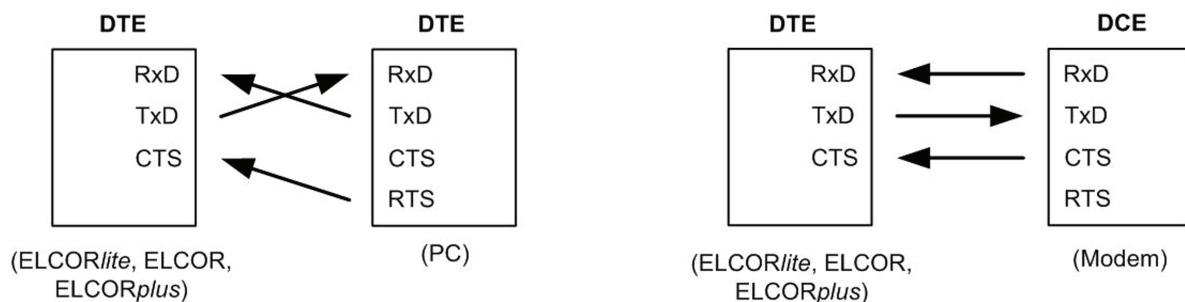
7.2 COM1 communication interface, RS485

Two types of data transmission devices are distinguished: DTE - Data Terminal Equipment and DCE - Data Communication Equipment.

The Corus Evo Compact is a DTE device.

Depending on whether the same type of device (i.e. DTE) or a DCE type device is connected, either a cable with a crossed connection or a cable with direct connection is used (generally applies to RS232 and Ethernet). For example, a PC is a DTE device, while a modem is a DCE device.

The diagram below applies to RS232 interfaces:



Corus Evo Compact devices are connected via an external B-RS (mod R) or B-RS/A (mod R) module. The connection with the PC and the modem will look like this:

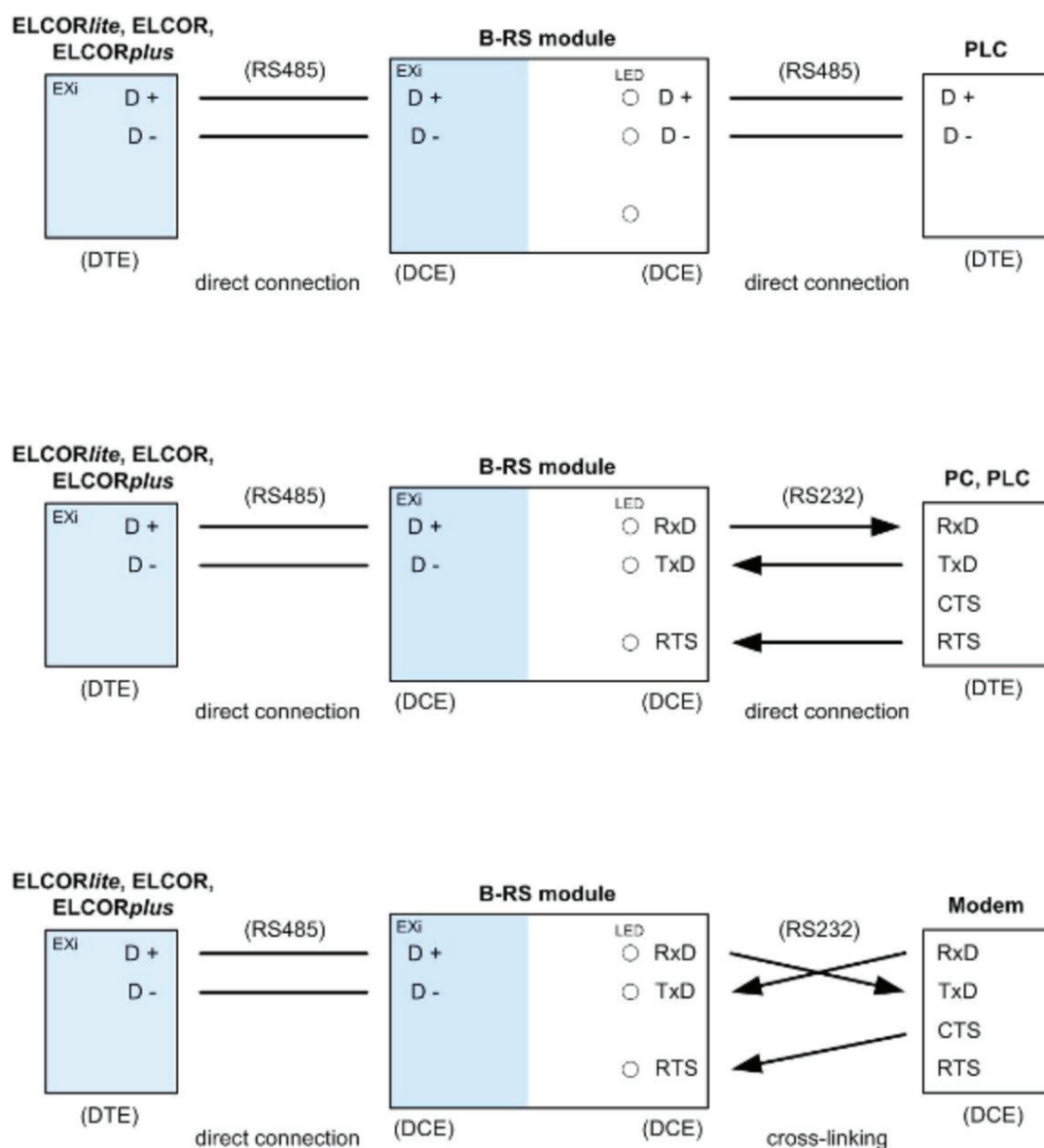


Fig. 34 Principle of connection with a PC, PLC and external modem via a B-RS module

7.2.1 RS485 communication connection



Caution

In terms of communication with the device via a metal line, the device can be supplied in three versions (depending on the equipment of the board):

- With the possibility of communication via an RS485 line (standard)



CAUTION!

The signals at all communication terminals of the device are intrinsically safe. Common communication devices connected to the device must be connected via a suitable communication barrier (B-RS, B-RS/A).

The communication cable is connected to the COM1 terminal block.

Terminal block COM1
installed communication in- terface
RS485
Signal
D1+
D1-
U1+
GND1

Tab. 19 Assignment of the terminals of the COM1 terminal block according to the installed interface

Communication inter- face	Cable	Cable gland	Recommended type of cable	Max. length	Cable Ø
COM1 - RS485	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.34 Lap- pkabel	100 m *)	5.7 mm

*) Cable length may be limited at higher communication speeds

Tab. 20 Recommended cables for RS485 communication

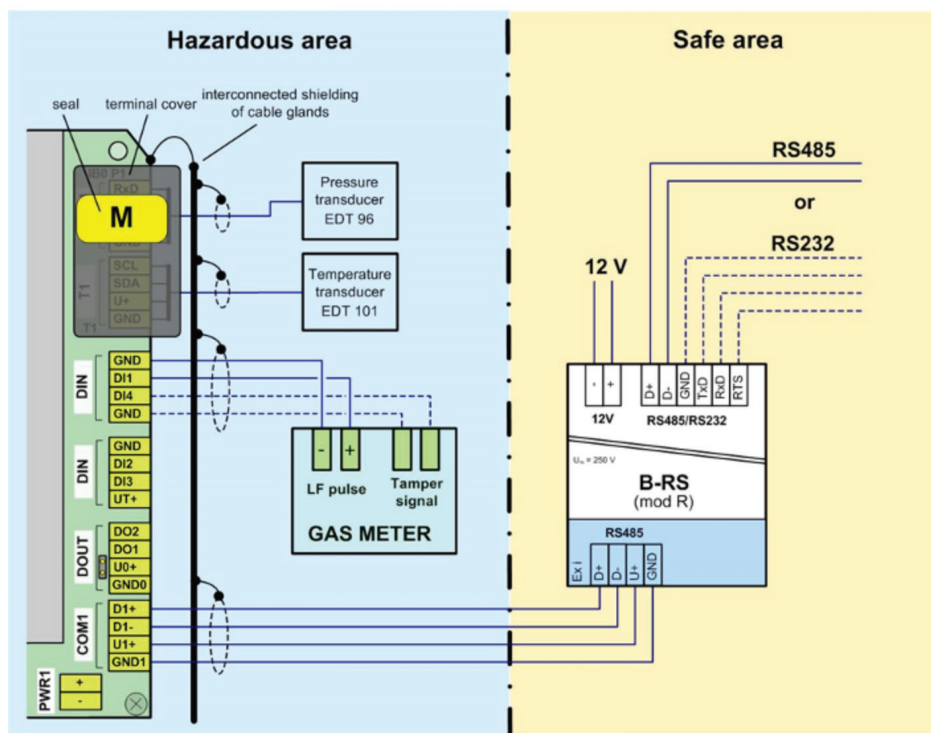


Fig. 35 Communication via RS485 using a B-RS module (mode R)

7.3 Internal modem



CAUTION!

Devices with and without internal modems have different explosion classifications!

The device with the internal modem must not be used in a Zone 0 environment!

Device may be supplied with an internal modem or without a modem. The following types of internal modems are available:

Modem	Network type	Battery pack (BP)	used battery cell in BP (cell size)
M2G GSM/GPRS	2G	HBL-03U	1x SAFT LS33600 (D), or 1x EVE ER34615C (D)
M2G GSM/GPRS	2G	HBL-03E	1x FRIWO M20Ex (D)
LTE-CatM1	4G	HBL-03U	1x SAFT LS33600 (D), or 1x EVE ER34615C (D)
LTE-CatM1	4G	HBL-03E	1x FRIWO M20Ex (D)
LTE-Cat1	4G	HBL-04U	2x SAFT LS26500 (C), or 2x EVE ER26500C (C)
LTE-CatNB	4G	----	1x SAFT LS17500 (A), or 1x EVE ER17505 (A)
		----	2x SAFT LS17500 (A), or 2x EVE ER17505 (A)

Tab. 21 Overview of supplied internal modems and batteries

More detailed technical data on modems and their battery power are provided in Tab. 12 and in Sections 3.10 and 6.2.

Using the service SW [38] the modem can be set to one of the data transmission modes listed in Tab. 22. The GSM/GPRS modem (2G) allows only GPRS communication and sending SMS, but does not allow dial-up CSD connection. For all modems, data transfer can be initiated both by calling the dispatching station to the device (PULL) and by the device towards the dispatching station (PUSH). An exception is a narrow band modem (LTE-CatNB), which supports calling to the dispatch station (PUSH) only.

Modem	Network type	Types of data communications
M2G GPRS	2G	GPRS
		GPRS+SMS (text)
LTE-CatM1	4G	LTE-M
		LTE-M + SMS (text)
		LTE-NB*)
		LTE-NB*) + SMS (text)
LTE-Cat1	4G	LTE
		LTE + SMS (text)
		GPRS
		GPRS + SMS (text)
LTE-CatNB	4G	LTE-NB*)
		LTE-NB*) + SMS (text)

*) Only upward calling (PUSH), with no possibility to switch on the service window

Tab. 22 Data transmission options for individual modems

The minimum recommended RSSI signal strength for communication is -85 dBm (i.e. 45 %). Below this value, the device will indicate error No. 10 on the display (see Sections 8.8.3, Tab. 25)

The integrated modem antenna is located on the outside on the left side of the device and is protected by a removable cover. An external antenna can be used if the signal at the installation site is poor.

Note on the SIM card

The modem requires a SIM card to operate. No card is delivered with the device. The internal modem allows data transmission either in GPRS or LTE mode. The SIM card for the respective data transfer mode must be obtained by the user from his mobile operator.

Basic information about the status of the modem connection and signal strength is shown on the device display using icons (see Tab. 23). In addition, some additional auxiliary information about the modem's current status can be displayed on the device display. It can be opened from the device keypad by selecting the menu at SYSTEM DATA->Communication. The following information can be displayed (for more details see Section 8.8.3):

- Numerical code of the last error of the modem and when it occurred. The numerical codes of errors and what they mean are shown in Tab. 25
- Assigned current IP address, if in GPRS mode
- Signal strength (in %) at the device's installation site

In addition, it is possible from the keypad if needed (especially for service purposes):

- To power on the GPRS/LTE modem
- To initiate GPRS/LTE call from the device to the master system (if this call option is set in the device parameters)
- To initiate sending of an SMS

7.3.1 Installing a SIM card in the modem

The device is delivered without a modem SIM card. Before using the modem, insert a SIM card obtained from the operator. The SIM card holder is for a miniSIM card.



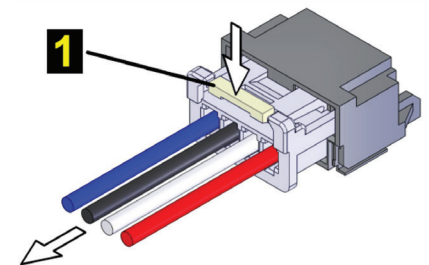
WARNING!

Before starting the installation (or replacement) of the SIM card, it is necessary to **disconnect the power supply of the converter (EVC)**, i.e., external power supply (if used), and the device's power supply battery. This prevents the device from turning on the modem during the SIM card installation.

This is especially **necessary** for devices **with LTE-CatNB modem**, where the described disconnection of the modem power supply is incomplete because the **capacitors** used are soldered to the modem board and thus remain connected to the modem. In the event of accidental modem power-on without its power supply, this could lead to their destruction.

SIM card insertion/removal procedure:

- If there is an external power supply for the modem, disconnect it from the PWR2 terminals **2** - see Fig. 36.
- Press the connector lock **1** and disconnect the modem battery connector **3** by pulling the wires slightly.
- Push the cover of the SIM card holder **4** gently in the direction of the arrow **A** and flip it to a vertical position **B**.
- Insert the SIM card **5** into the grooves of the cover of the holder in direction **C** and fold back the holder cover to the board, pushing it in the opposite direction **A** towards the connector **3** until you hear a click. The SIM card is now secure in the holder.



CAUTION!

Before inserting the SIM card into the grooves of the holder cover, check the correct **orientation of the SIM card** according to its beveled corner (see Fig. 36). The metal contact surfaces on the SIM card must face the PCB.

When inserting/removing the SIM card into/from the holder, do not use force to avoid damaging the holder and the contact surfaces.

Improper SIM installation will cause the modem not to communicate!

- Connect the modem battery connector **3**. If the modem has an external power supply, connect the external power supply wires to the PWR2 terminals **2** of the modem's external power supply.

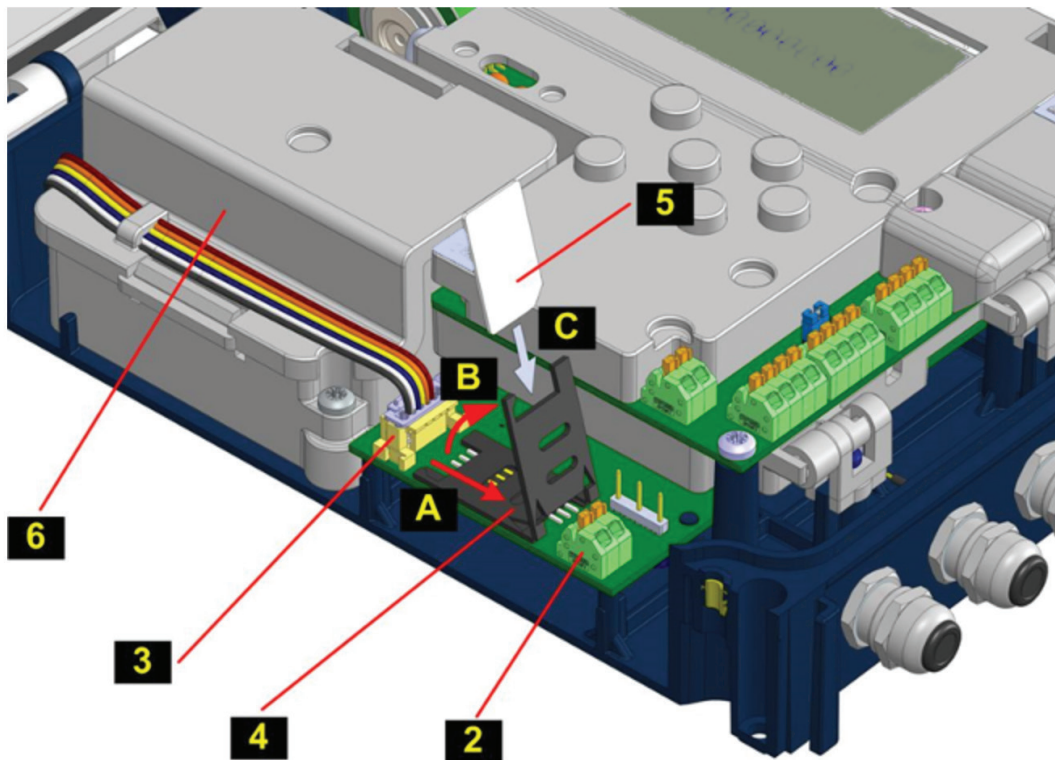


Fig. 36 SIM card in the device

7.3.2 Replacing the internal modem

The internal modem is located on a separate board under the motherboard (EVC module) - see Fig. 1. Depending on the type of the modem installed the battery pack for powering the modem is located either to the left of the modem board or directly on it. The antenna connected to the modem is located on the outside on the left side of the box under a removable cover. An antenna cable connects it to the modem. The cable is connected to the modem board using a miniature coaxial connector and terminated at the other end with a panel connector (the bushing in the left side wall) for connecting the antenna.

The following describes the removal of the modem from the device and the installation of the modem into the device, including the installation of the antenna connector.



CAUTION!

Trained worker with appropriate electrical qualification can remove/install the internal modem. No voltage should be applied while working on the device. Disconnect the following power supplies:

- External power supply of the corrector and modem (if used)
- Corrector power battery
- Modem power battery

7.3.2.1 Removing the internal modem from the device

1. Disconnection of all supply voltages of the device (Fig. 37)

If the device has an external power supply, disconnect it from the PWR1 terminals, and if there is an external power supply for the modem, also disconnect it from the PWR2 terminals.

- Disconnect the EVC battery, connector **1**
- Disconnect the modem battery, connector **2**

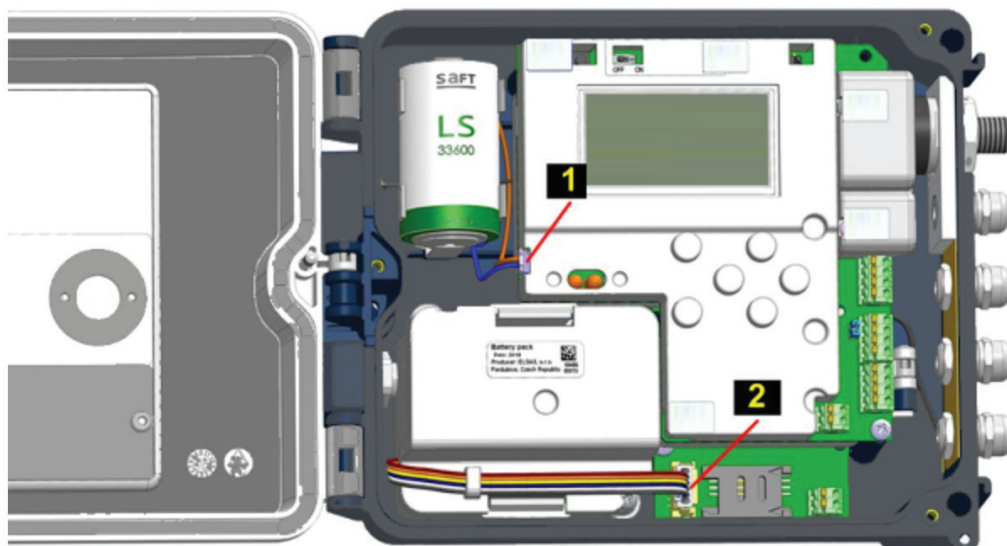


Fig. 37 Replacing the modem - disconnecting the power supply

2. Releasing the EVC module (Fig. 38)

- Unscrew the bolt **3** (under the manufacturer's seal) and the opposite screw **4**.
- Flip the EVC module out to a vertical position (Fig. 39, position **5**).

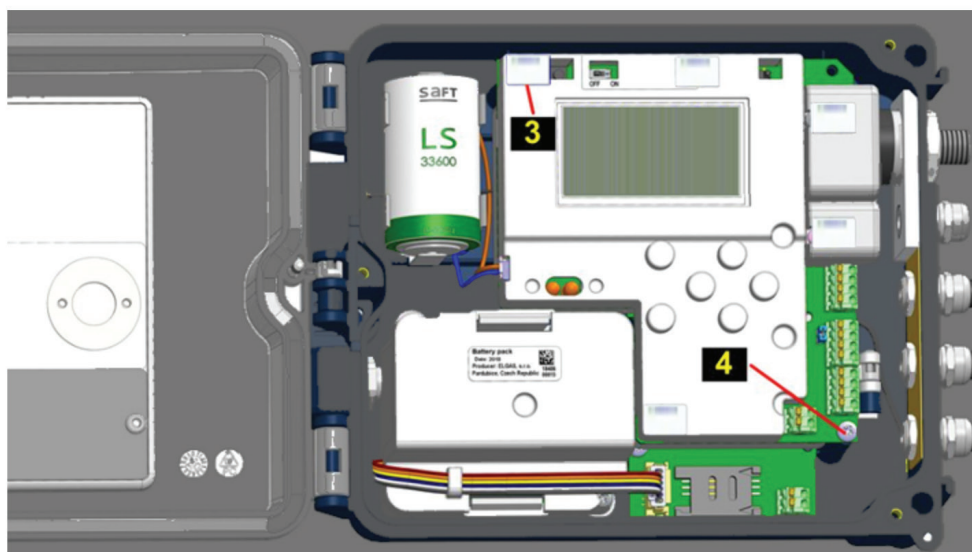


Fig. 38 Replacing the modem - releasing the EVC module

3. Disconnecting the Antenna (Fig. 39)

- Carefully disconnect the antenna cable **6** terminated with the miniature coaxial connector **7**. Carefully slide the miniature connector **7** vertically away from the board.
- Release the antenna cable from the clips **8**.

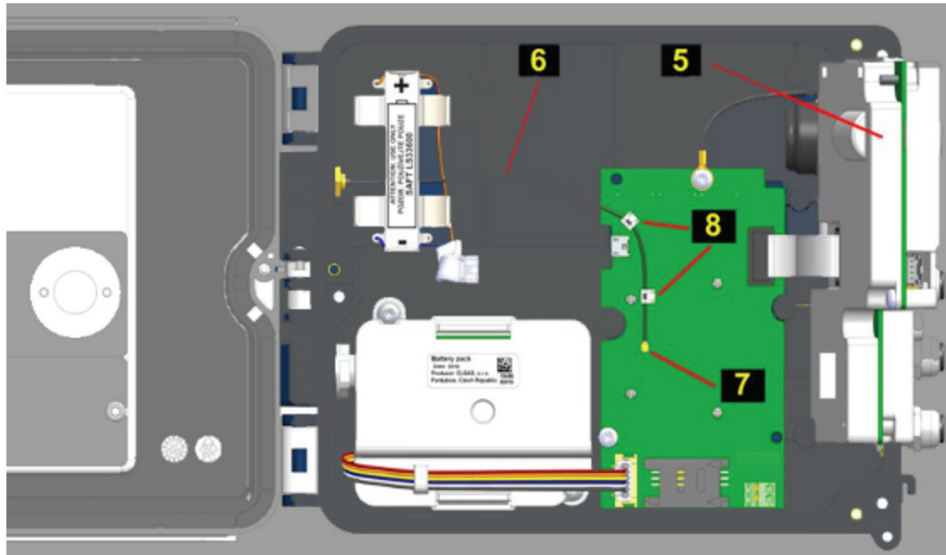


Fig. 39 Disconnecting the antenna

Antenna cable **6** is identical for all types of supplied internal modems and antennas. It is therefore not necessary to remove it from the device when replacing the modem with another type.

Note:

If the requirement arises to dismantle and remove the antenna cable from the instrument, the antenna cover must first be removed as per paragraph 7.3.3 (if the cover is used), the antenna nut **3** (see Fig. 46) loosened and the antenna unscrewed. After loosening the fixing nut **4** of the cable connector, the antenna cable connector can be slid out towards the instrument.



Warning!

The hole after the removed connector of the antenna cable must be sealed with a blanking plate with appropriate instrument protection, so that the overall protection of the device specified in paragraph 3.2 of the technical parameters is not violated!

4. Removing the Internal Modem Board (Fig. 40)

- Disconnect the flat cable **9** from the modem board connector by sliding the connector outward from the modem board. This connector does not have a cable pull-out safety.



Warning!

Be careful when pulling the cable out of the modem board connector to avoid tearing it out of the plastic connector body.

- Remove the screws holding the modem board to the bottom of the enclosure, screw **10** and screw **11** with common shield connection cable. Then remove the modem from the device.

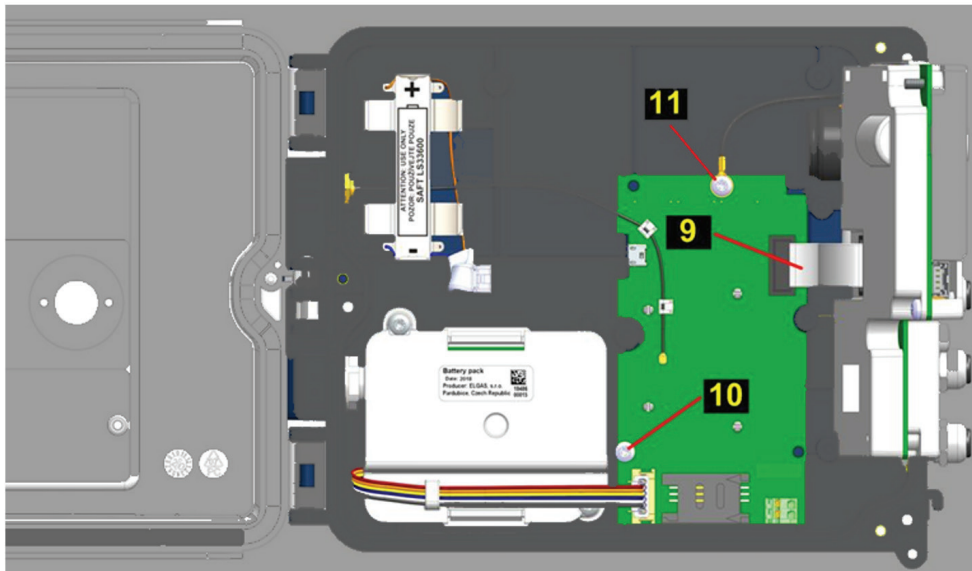


Fig. 40 Replacing the modem - removing the modem itself

7.3.2.2 Installing the internal modem

If you are installing a modem in a device that was delivered without a modem, you need to proceed from point 1 of the following description. In the case of modem replacement, after removing the original modem, proceed from point 5.

1. Disconnecting power to the device

- If an external power supply is used, disconnect the power supply from the PWR1 terminals.
- Disconnect the EVC power supply battery, connector **1** (Fig. 37).

2. Tilting the EVC module

- see point 2 of the previous description of dismantling (paragraph 7.3.2.1)

3. Removing the plug for the antenna connector hole (Fig. 41)

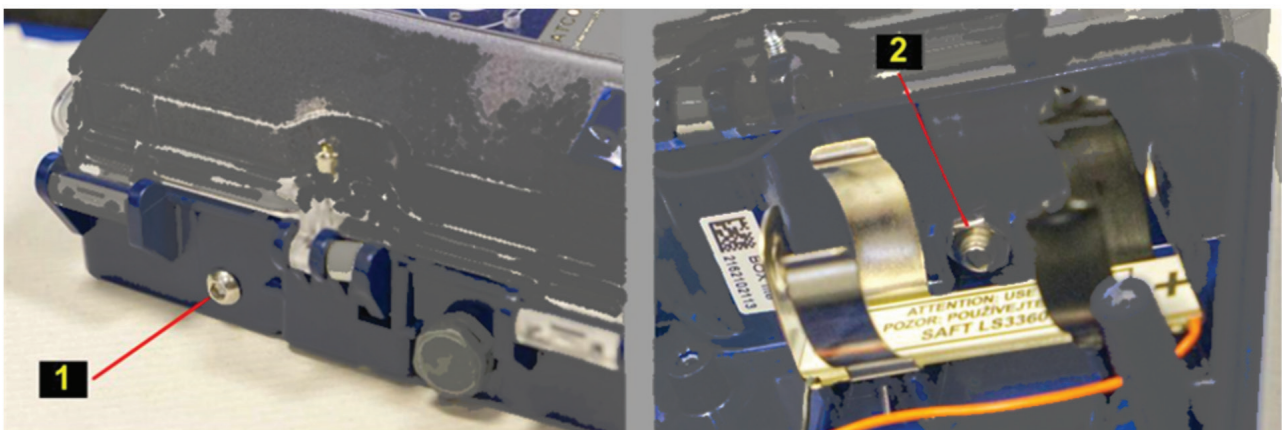


Fig. 41 Blanking plug for the modem antenna outlet

An Allen key and a flathead screwdriver are required to remove the blanking plug **1**. Use the flathead screwdriver to engage the nut **2** of the blanking plug from inside the device and unscrew the blanking plug with the Allen key.

4. Installation of the antenna cable (Fig. 42)

Antenna cable **1** and antenna **6** are supplied in the modem kit. The antenna cable is the same for all supplied modem types.



Warning!

The antenna is specific for each type of modem.
Beware of confusion, the manufacturer/supplier of the antennas does not label them in any way and visually the antennas for each modem type differ slightly!

Insert the end of antenna cable 1 with the miniature connector (see Fig. 39, position 7) from the left side under the battery holder of the device (from the side of the device towards the modem board). The panel connector 2 has a sealing O-ring 3 fitted to provide the required instrument protection. Push the panel connector of the antenna cable with the O-ring fitted through the hole in the side of the cabinet from the inside and fix it from the outside with the fixing nut 5 with the fan metal washer 4 (supplied with the cable). Tighten the nut with feeling (tightening torque 0.45 Nm) with the mounting side wrench No. 8.



Warning!

Install the antenna connector carefully so that the overall instrument protection (IP 66) as specified in paragraph 3.2 of the technical data is not compromised!

Screw the antenna 6 supplied with the modem to the antenna connector.
The next procedure is the same as for replacing the modem with another one.

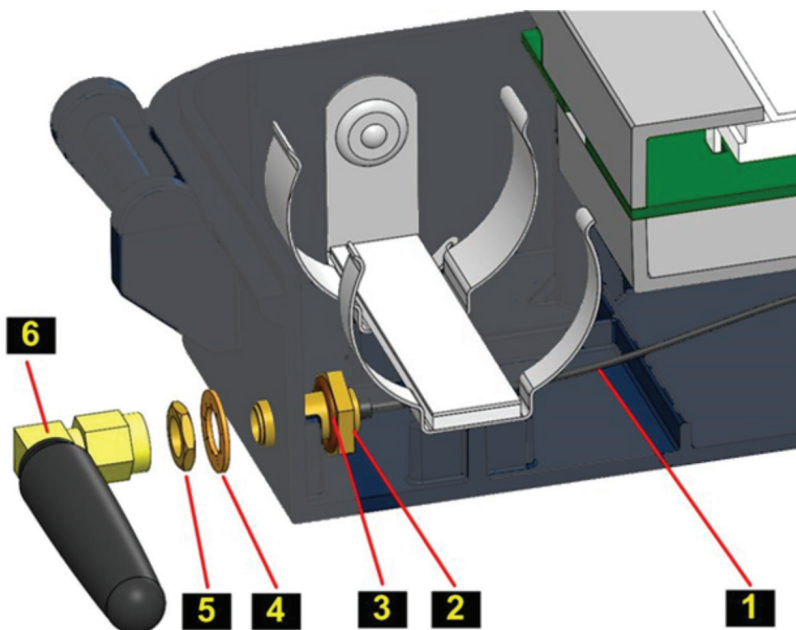


Fig. 42 Installation of the antenna connector

5. Installing the internal modem module (Fig. 43)

- Insert the modem into the unit so that the two tabs on the columns on the bottom of the cabinet fit into the holes 12 in the modem board, thus fixing the position of the modem.
- Screw the modem to the bottom of the cabinet with two screws 10 and 11. Before screwing screw 11, first thread the modem ground cable loop 13 and the fan washer onto the screw.
- After shaping (see below), insert the other end of the ground cable 13 into the hole of the side connector 14 on the EVC board (the connector is located under the cover).



Warning!

First shape the modem ground cable **13** so that the other end of the cable, which is inserted into the side connector **14** of the EVC board (see Fig. 44), points straight into the connector and does not exert lateral force on the connector on the EVC board, otherwise the connector may be damaged!

Connector **14** on the EVC board is designed to be self-locking and once the cable is plugged into this connector, the cable cannot be removed from this connector!

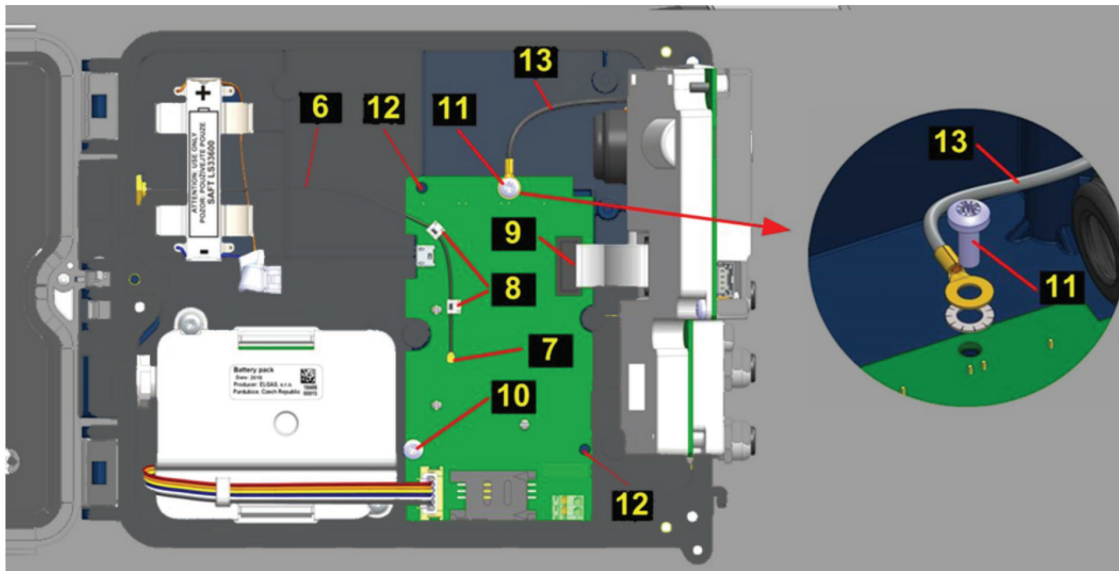


Fig. 43 Installing the modem

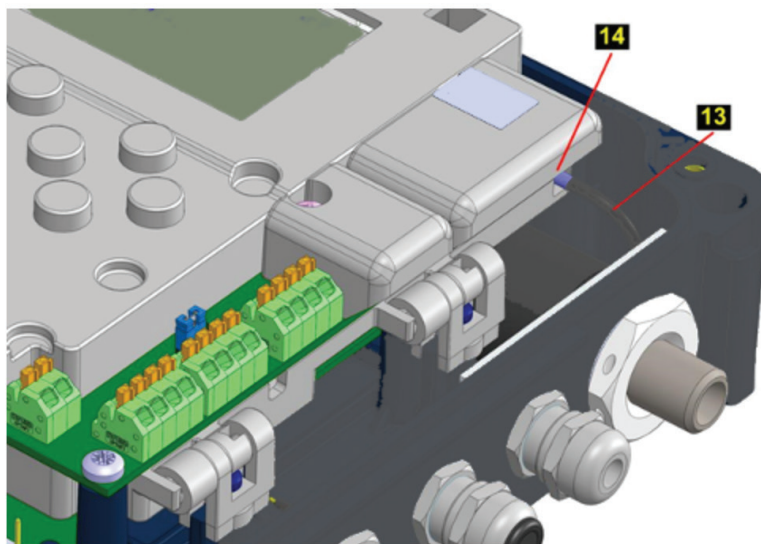


Fig. 44 Output of the modem ground cable from the EVC module connector

- Connect the other end of the antenna cable to the coaxial mini-connector **7** of the modem. Take extra care when inserting the mini-coaxial connector **7** of the antenna cable into the connector on the modem board to avoid damaging it. A properly plugged connector may rotate freely from side to side, verify by pushing lightly on the cable from the side.
- Connect the modem board to the EVC board with the flat cable 9 grey. If this cable is supplied with the modem, use the supplied cable instead of the original cable. The orientation of the cable does not matter (the ends are interchangeable).

6. Installing the modem battery

- Select the correct battery pack for the type of modem installed (see Tab. 21). Insert the modem battery pack into the unit and secure it with the screws **2** (see Fig. 30).

Note:

In the case of the LTE-CatNB modem, the batteries are included in the modem board.

7. Folding and fixing the EVC module

- Fold the EVC module to the modem and fix it with two screws (see Fig. 38). Insert the SIM card into the SIM card holder on the modem board (see paragraph 7.3.1).

8. Connecting the power supply of the device and the internal modem

- Connect the power battery of the device.
- Connect the battery pack cable with the connector to the modem board.
- If an external power supply for the device or modem is used, connect it.

9. Internal modem settings

Use the service software [38] to set the modem parameters.

7.3.3 External antenna connection

At locations with poor signal quality, the internal antenna can be disconnected and an external, more powerful antenna connected outside the device.

The external antenna (not included as standard accessory) has to be compatible with the type of modem used in the device and the frequency band.

1. Removing the antenna cover and disconnecting the internal antenna

- If the device is going to be fitted to the mounting plate (or a wall), loosen the screw **1** (Fig. 45) that fixes the device to the mounting plate and also the modem's internal antenna cover.

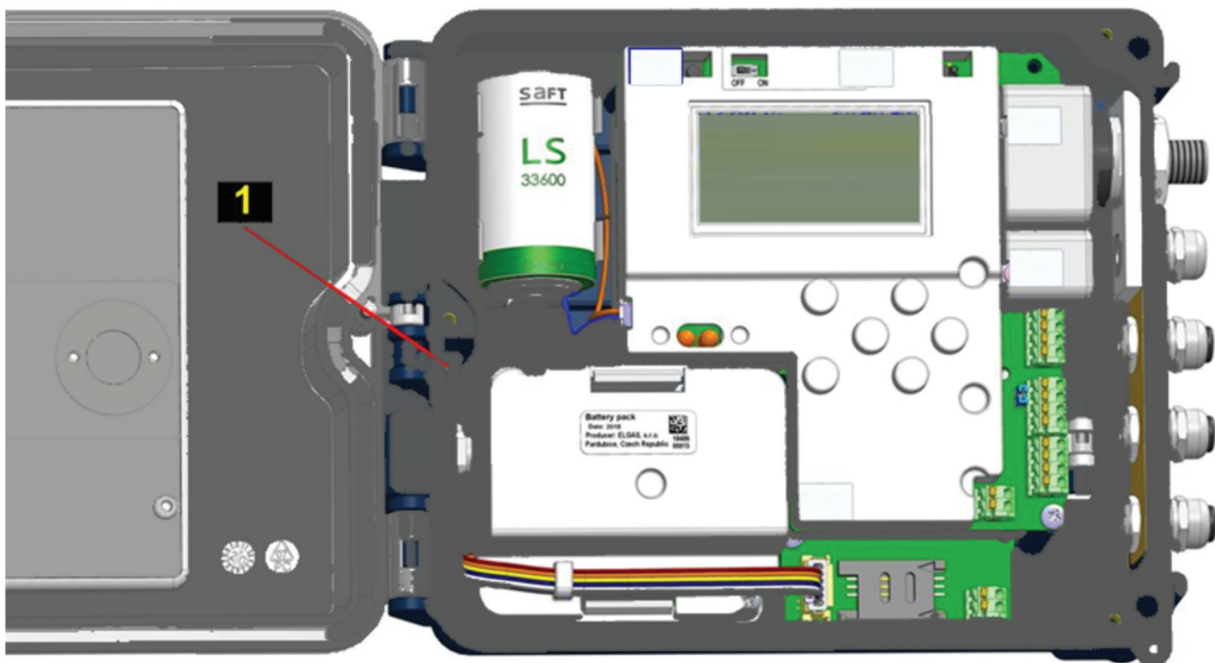


Fig. 45 Releasing the internal antenna cover

- Press the latch **2** of the antenna cover (Fig. 46) and pull it to the side to remove the cover.
- The connector for the antenna is fitted to the enclosure wall with a fixing nut **4**. Loosen the antenna nut to unscrew the internal angle antenna **3**.

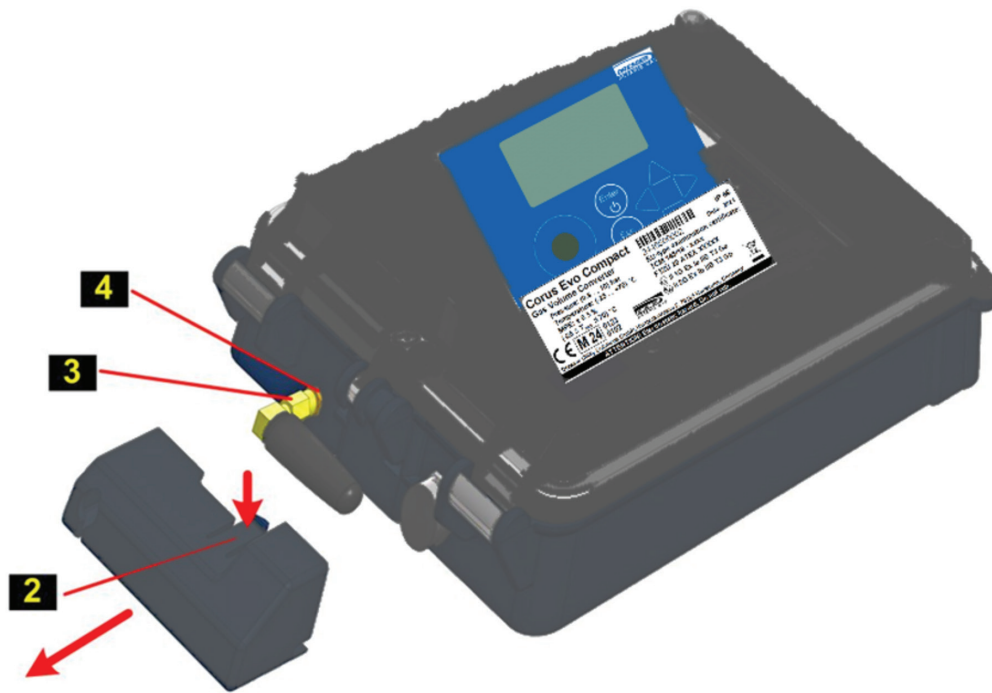


Fig. 46 Replacing the modem - removing the antenna

2. External antenna connection

- Instead of the internal antenna, screw the external antenna cable to the connector.
- The panel connector in the wall of the cabinet, intended for connecting the antenna, is of the SMA (female) type, while both the internal antenna connector and the cable for the external antenna are SMA male.
- Finally, put back the internal antenna cover **2** and tighten the fixing screw **1**.

Warning:

When designing the installation, when using an external antenna, especially if it is located outside the hazardous area, measures must be taken to reduce the effects of lightning strikes. (see EN 60079-14 and EN 62305-3).

7.4 External modem - possible use

An external modem can be connected to the device at the RS485 device's communication output (at terminal block COM1).

In any case, the external modem must be connected to the device via a safety barrier (B-RS module).

If allowed by the external modem, its communication parameters can be set using the service SW [38], like with the internal modem.

7.5 Encrypting data

The iFLAG and CTR protocols have this optional feature and for this purpose, the device contains cryptographic keys. It uses symmetric AES encryption with a key length of 128 bits. The packet of transmitted data additionally includes the type of encryption key and control signature. The signature confirms the authenticity of the key and consequently permits the decrypted data to be used. A standard error response provides information about any incorrectly decrypted data. The keys can only be modified at the highest security level and no keys from an unencrypted packet will be accepted.

Implemented protocols include the ability to block a device response if it has been queried by an unencrypted packet. It responds to such queries with a standard error packet.

8 Device operation

The device is not equipped with a power switch. It automatically switches to operating mode when a power pack is inserted in it. The device registers LF pulses from the gas meter even if the power pack is removed.

A 6-key keypad is used to operate the device and select the display of measured and other values. Values are displayed either at a graphic resolution of 128 x 64 pixels or on a segment display.

When it operates on batteries, the graphic display turns off 30 seconds after the last key has been pressed.

The display lights up when the key



has been pressed for 2 seconds.

If the device is powered by an external source, the display will be permanently lit (adjustable in the device parameters).

i

Segment display is permanently on even when the device is powered by batteries.

The keypad is the same, whether the device has a graphic display or segment display.

Display properties and operation for a segment display device are described in the appendix "Device design with segment display".

The selection of the displayed data is performed using the device menu. The display of menu items depends on the set parameters of the device. The contents of some menu items can be user-configured.

Display features (graphic display)

- Automatic updating of data in the display every 1 second.
- Autorepeat - holding down the key automatically generates the keystroke, a feature useful, for example, when viewing archives
- Display without diacritical marks
- The display switches to the basic display after a set idle time, in compliance with Section 6.3.1.5 of EN 12405-1+A2. The time for the display to switch to basic is adjustable via parameters.
- To simplify operation by untrained users, the option to display actual values gradually by pressing a key **Enter** is included. Before that, you must first go to the top level of the menu by pressing the key **Esc** several times.
- To save energy, the device's graphic display turns off after 30 seconds when the device is running on battery power and lights up again when a key is pressed.

8.1 Keypad

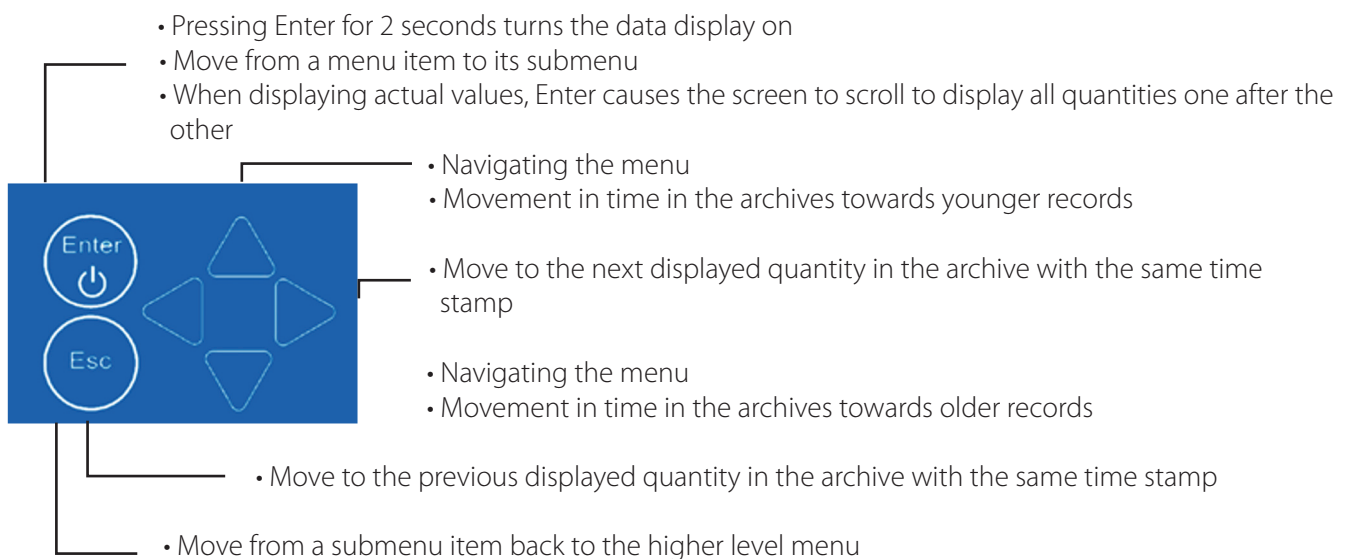


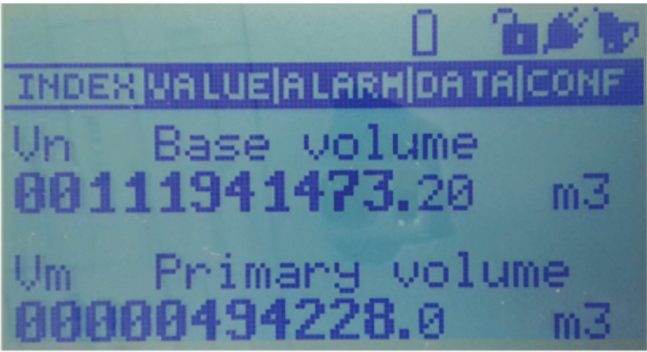
Fig. 47 Key functions

8.2 System menu

The operation of the device is based on the selection of items from the menu. For the purposes of further explanation, we call the basic items of the main menu the highest, by nesting in these items we go to the lower levels of the menu (submenu).

If the display has been off for a longer time, the home screen will appear with a volume Vb value.

Home screen (initial display)



The first line in the top right corner displays icons indicating the device's basic status.

Pos.	Meaning	Symbol	Description
1	Device status (sum status)		The compressibility is being calculated or the firmware is verified after the remote download update
			The device works flawlessly
			An error has occurred in the device
			The device has generated a warning message
2	Power state of the device		The external power supply of the device is connected
			Battery charge status 100 %
			Battery charge status 75 ÷ 91%
			Battery charge status 58 ÷ 75 %
			Battery charge status 42 ÷ 58 %
			Battery charge status 25 ÷ 42 %
			Battery charge status 8 ÷ 25 %
			Battery charge status 0 ÷ 8 %

3	Status of the service and metrological switch		Writing to the device disabled (both the service and metrological switches are in the OFF position)
			Writing to the service area enabled (service switch is ON)
			Blinking - Writing to the metrological area enabled (metrological switch is ON)
4	Status of the modem, signal strength		The modem is off or not set in the parameters
			The modem is registering (connecting) in (to) the network
			Modem connected, signal strength 0 ÷ 25 %
			Modem connected, signal strength 25 ÷ 50 %
			Modem connected, signal strength 50 ÷ 75 %
			Modem connected, signal strength 75 ÷ 90 %
			Modem connected, signal strength 90 ÷ 100 %
5	Power state of the internal modem		External power supply of the modem connected
			Battery charge status 100 %
			Battery charge status 75 ÷ 91 %
			Battery charge status 58 ÷ 75 %
			Battery charge status 42 ÷ 58 %
			Battery charge status 25 ÷ 42 %
			Battery charge status 8 ÷ 25 %
			Battery charge status 0 ÷ 8 %
6	Communication status		Communication via internal modem or via optical head
			Communication via the modem or the head disabled
7	Operating mode		Not configured
			Maintenance
			Normal

Tab. 23 Display status icons

8.3 Main menu

The selected menu item is highlighted inversely on the display.

The navigation between menus is done with left and right arrows, then up and down arrows.

8.4 Actual values menu

By pressing the key **Enter** the actual values are displayed. To scroll through the displayed data, use the arrow up  and down  keys .

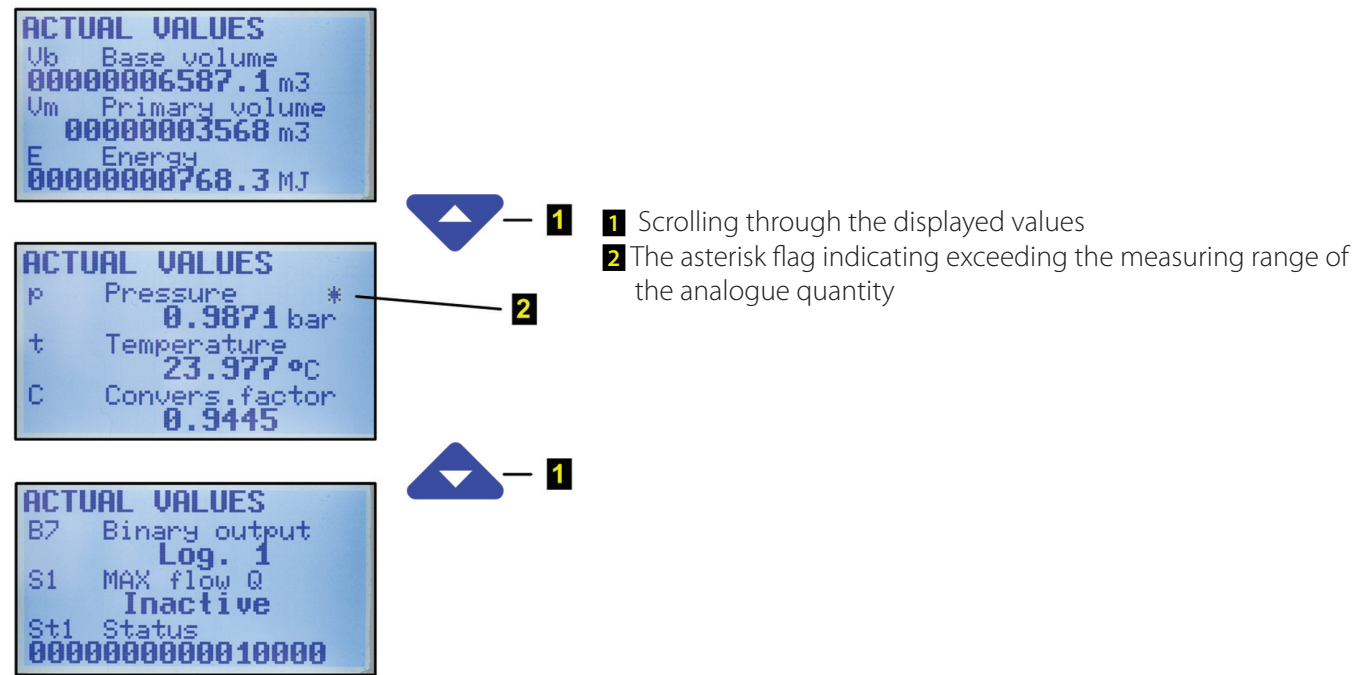


Fig. 48 Example of actual values display

8.5 Archives menu

The way of displaying data is the same for data, daily, monthly and binary archive and is evident from the attached image.

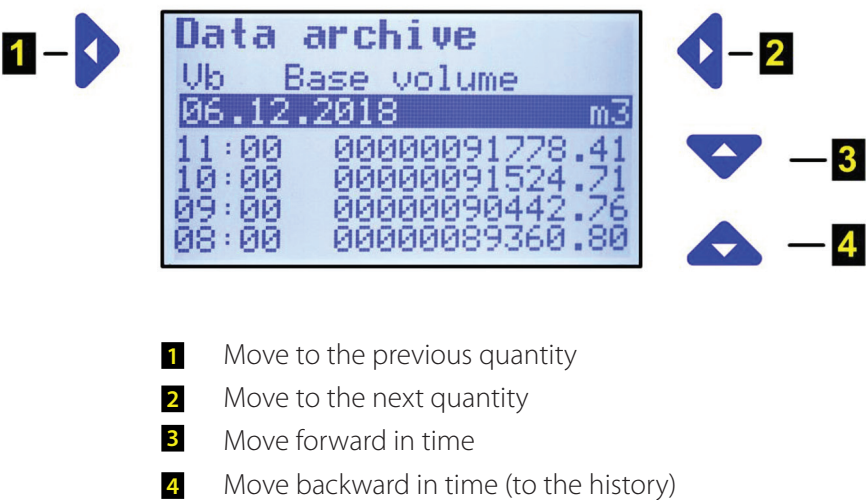


Fig. 49 Navigation in archives (archiving frequency once an hour)

The binary archive is displayed in the same way, only the records are not saved with the archiving frequency, but when the state of some of the archived quantities has changed.

To stop viewing the archive, press **Esc**



- 1** Moving forward in time
- 2** Moving backward in time (to the history)
- 3** Moving to the next information at the selected time
- 4** Moving to the previous information at the selected time
- 5** ID of the user that made the setting
- 6** Settings made at the selected time (4.12.2018, 13:45:37)

Fig. 50 Display of the settings archive



- 1** Moving forward in time
- 2** Moving backward in time (to the history)
- 3** Moving to the next information at the selected time
- 4** Moving to the previous information at the selected time
- 5** Device status (1st part of the status word)
- 6** Device status (2nd part of the status word)

Fig. 51 Display of the status archive

8.6 Device parameters menu

The following parameters are displayed in the **Communication** menu:

- Address (network address1, network address2)
- IR head (baud rate, communication protocol)
- Serial COM0 (baud rate, communication protocol, communication device)
- Serial COM1 (baud rate, communication protocol, communication device)

The following data are displayed in the **Service Parameters** menu:

- Serial number of the device
- Device identification
- Application FW, version and checksum (CRC)
- Metrological FW, version and Checksum (CRC)
- FW Loader, version and checksum (CRC)
- Memory size [byte]
- Station Identification

Scroll through the display using the  and  keys. The end of the data is indicated by a mark „<“ on the display.

The **Conversion** menu displays the following data:

- **Conversion**
 - Conversion according to the standard
 - Reference pressure p_b
 - Reference temperature t_b
 - Compressibility Z_b
 - Gas composition items (displayed depending on the selected conversion standard)
- **C Conversion Factor**
 - Conversion type
 - Spare temperature
 - Spare pressure
 - Spare compressibility
 - Standard
 - Pressure range
 - Temperature range

The **Input Parameters** menu displays the following data:

Vm (gas meter)

- Marking of input terminals
- Gas meter constant k_p [imp/m³]
- Serial number of the meter

t EDT 124 (temperature measurement)

- Transducer communication address
- Measuring range
- Serial number of the temperature sensor

p EDT 125 (pressure measurement)

- Transducer communication address
- Pressure range
- Serial number of the pressure transducer

The **Modules** menu displays the following data about the installed modules:

- Module ID
- Module name
- Module SN

8.7 Device configuration menu

This menu lets device parameters be set directly from the keypad.

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Device parameters set from the keypad can be protected:

- With the service switch (to write, the switch must be in the ON position)
- With a password (see Section 10.6.2 for more details)

If the service switch is set to OFF, the message "DEVICE CONFIG Not possible" appears on the display.

The following parameters can be set:

Service parameters	- Station Identification - Gas hour
Communication	- Address - IR head - COM0 – Internal modem - COM1 – RS485/232 ... (the baud rate and communication protocol are set separately for each communication)
Gas composition	- N2 concentration - CO2 concentration - Combustion heat - Relative density ... (the parameters depend on the calculation method selected)
Date/Time	HH:MM/DD:MM:YYYY
Volume parameters (Totalizers 1,2)	- kp Gas meter constant [imp/m ³] - Vm Primary volume (-Vb Volume at base conditions) - Vs spare primary volume (- Vbs spare volume at base conditions) (- E Energy) (- Es spare energy) - Serial numbers of the gas meters - Qmax Max. gas flow rate
Archive reset	Data archive Daily archive Monthly archive Billing archive Binary archive Extreme archive (Settings Archive) (Status Archive) (Gas composition archive)
Work mode	normal (standard)
Save parameters	Entering the changed parameters in the device

To edit a parameter, press the  or  key to move it to the first row on the display (the parameter is highlighted). Start editing by pressing the Enter key.

The edited position in the row is indicated with . The parameter editing keys have the following functions:

	selection of the edited position in the row
	select and insert an alphanumeric character (space, 0 to 9, A to Z, and a to z)
	end parameter editing

Saving the Parameters

Once the parameters are edited, the changes need to be entered in the device. To do this, select "Save Parameters". The message "Valid Data" confirms that the device parameters have been successfully saved.

Totalizer values and Current time are saved immediately after they have been entered. A confirmation dialog is displayed before the value is saved and, when it is confirmed, the value is stored in the appropriate register.

8.8 System data menu

- About device
- Device reset
- Communication
- Frozen values

8.8.1 About device

Default system parameters are displayed by pressing . In addition, the  and  keys display additional data (digital inputs and outputs, etc.).

8.8.2 Device reset

The command is non-destructive. Device reset jumps the program to the start address and re-initializes the entire metering system. During this operation, the contents of all archives and the states of all gas volume counters V and Vb do not change. Also, all other set parameters do not change. Execution of the command is independent of the service switch position.

8.8.3 Communication

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This option makes it possible to:

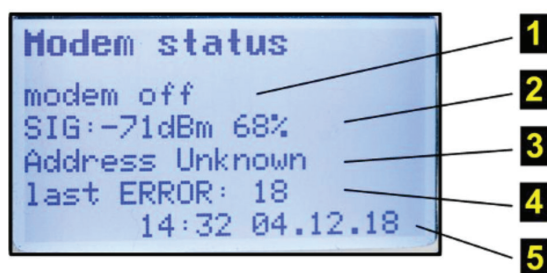
- **View important information about the modems** connected to the device (the modem must be set in the device parameters),
- **Verify that the modem settings are correct by simple testing of the connection** to the master communication point (modem) of the dispatch center (regardless of the set modem switching on and calls controlled by the device's internal timers).

When communicating via modem, some diagnostic information are displayed.

The first step is to select the modem (the device can connect no more than 2 modems, one internal and one external, via the RS232/485 communication line). The following options can be chosen for each of the selected modems.

8.8.3.1 Modem status

The current status of the modem appears in the 2nd row of the display. The rows below contain additional information.



1 Modem status	
modem not present	the modem is not enabled in the device parameters
modem off	the modem power is off
modem turn on	the modem was connected to power (by software-the internal control signal connected the modem power supply)
modem initialization	the device is sending initialization commands to the modem
modem on	the modem is on and initialized
modem connected, 2G connected	the modem is logged on the network
modem disconnecting	the modem is logging off of the network and turning off ⁹⁾
2 Signal strength ¹⁰⁾	
Information about signal strength at the location of the device. The Modem Status command does not measure the signal strength. If this information appears on the display, it is the data ascertained at the time when the modem last logged on to the network. The strength is stated in dBm and in %. Comparison table - see Tab. 24. Further information also in paragraph 6.2	
3 IP address	
For GPRS communication, the IP address of the device is displayed.	
4 Modem error ¹⁰⁾	
The code of the last modem error is displayed if an error occurred. The meaning of the error according to its numeric code is specified in Tab. 25 .	
5 Error date and time ¹⁰⁾	
For modem error, the date and time of the last error is displayed.	

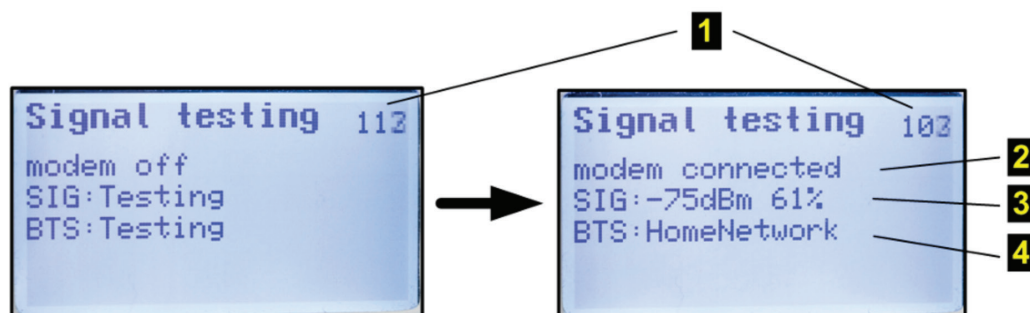
9) If communication via a modem is in progress, the modem will not be switched off until the ongoing communication is completed.

10) After the RESET command of the device (see section 8.8.2), or after changing the settings of some important modem parameters, this information is reset.

8.8.3.2 Signal testing

Selecting this option (the modem must be set in the device parameters and can be turned off), lets the device turn on the modem power supply, initialize the modem and measure the signal strength after connecting to the mobile network. (It runs in the sequence **2** modem off, modem on, modem init, modem connected). The time limit for measuring the signal **3** is 120 seconds.

The minimum recommended RSSI value for GPRS communication is -85 dBm (i.e. 45%). Below this value, the device displays error number 10 (see Tab. 25). In addition, low GSM/GPRS signal levels significantly reduce the modem's battery life.



Note:

The number **1** in the top right corner of the display shows the time in seconds to when measurement ends.

RSSI [dBm]	-51	-61	-71	-81	-91	-101	-113
RSSI [%]	100,00	83,87	67,74	51,61	35,48	19,35	0,00
RSSI [rel]	31	26	21	16	11	6	0

Tab. 24 RSSI signal strength conversion table between dBm, percentage and relative units

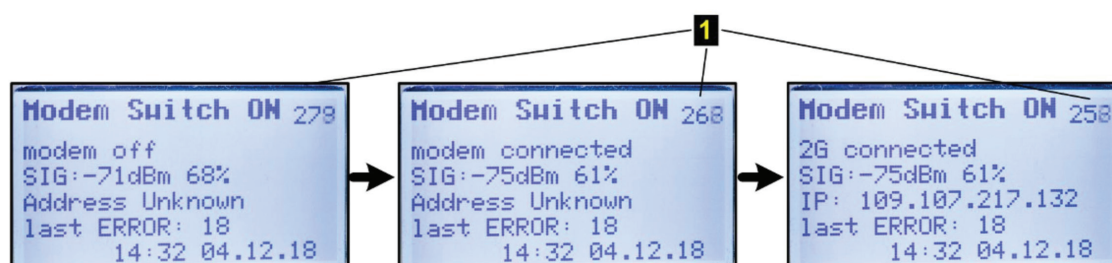
Code	Error description
General Errors	
0	modem without error indication
1	modem does not respond
20	modem returns "ERROR"
SIM card errors	
2	PIN code requested, but not stored in the configuration data
3	PIN code requested, incorrect PIN code stored in the configuration data
4	PIN blocked, PUK code requested
5	SIM card is not inserted
GSM network registration errors	
6	registration in the GSM network takes longer than usual (> ~ 20s after the modem is turned on)
7	not registered in the GSM network, not searching for the network currently
8	registration in the GSM network disabled (e.g. no active roaming and no home operator available)
9	registration in the GSM network impossible for unknown reasons
10	low GSM signal level ≤ -85 dBm (the error is saved only if the modem is registered in the GSM network)
Initialization errors	
11	incorrect initialization command entered in the configuration data (in service software [38] Initialization or Special Initialization field)

Dial-up errors	
12	GPRS or GSM/CSD cannot be dialed, or the connection that has already been established fails due to error reasons (the modem returns "NO CARRIER", "BUSY" or "NO DIALTONE")
PPP protocol errors - errors in connecting to GPRS	
13	LCP protocol error
14	PAP protocol error (the user name and password may be incorrectly set, but in practice and in the wrong setting this phase is performed and ends up in the IPCP phase)
15	CHAP protocol error (the username and password may be incorrectly set, but in practice and in the wrong setting this phase is performed and ends up in the IPCP phase)
16	IP address allocation error (may also be caused by a wrong username and password)
TCP protocol errors	
17	TCP session error - RST packet sent
18	error opening TCP session in Client mode - failed connection to remote server
SMS errors	
19	SMS could not be sent

Tab. 25 Modem error codes

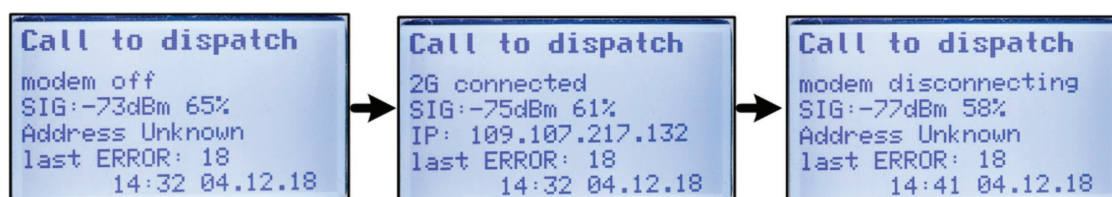
8.8.3.3 Power on modem

This option turns the modem on for 5 minutes (i.e. 300 seconds; the seconds remaining until the modem turns off **1** is shown in the top right corner of the display). This command is useful for testing communication when setting up the device (essentially it simulates the function of the internal parameter "Timer - Service Window" described in the parameterization of the device using the TELVES program).



8.8.3.4 Call to dispatch

If the device is configured to call the dispatch center, this command verifies that the device call to the master system is correct (applies both to dial-up connection and GPRS mode). This option basically simulates the function of the internal parameter "Timer - Call Window". Modem states (switching on, initializing, connections...) that the modem goes through gradually appear in the first row of the display until the connection is terminated. When the connection is established, the device sends the calling data frame to the master station, which should accept it if the settings are correct. Afterward, the modem terminates the connection and turns off.



8.8.3.5 Modem battery

It displays the modem's battery charge level as a percentage of fully charged and the current battery voltage. If the battery is disconnected, the message "Communication Error" ("Comm.error") appears.



8.8.4 Frozen values

This option freezes the actual values displayed. Use this option if measured data have to be copied manually.

8.9 Diagnostics menu

The "Diagnostics" menu displays the status of the corrector. Errors are indicated with the prefix "E" and the identification number, while the prefix "W" is used for warnings. For a complete list of error and warning messages see Section 8.9.5.

Technical assistance in troubleshooting

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Contact technical support staff if for any reason there are any problems with how the device operates. Contacts are available at <http://www.dresserutility.com>. Provide as much information as possible about your device and connections to other devices to help find a solution to the problem. Diagnostics and solving the problem will be very easy if you send us by e-mail the *.dt_all diagnostic file obtained from the device via the service SW [38].

8.9.1 Current status

This menu displays the device's current status. Press the "right arrow" key to display all current corrector errors and warnings in sequence.

8.9.2 Summary status

The summary status monitors all active error states (individual status bits of device) **that have occurred since the last summary status reset**. This means that the states of the device that have been removed by the operator or have disappeared in time are also stored here (a typical example is exceeding the pressure limit).

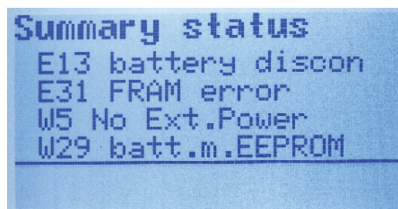


Fig. 52 Example of a summary status display

Basic summary status information is also displayed as an icon (see Section 8.2) on the device home screen.

8.9.3 Summary status reset

Selecting this option with the device keypad or the "Summary Status Reset" option from the "Setup-Diagnostics" menu in the PC service SW resets the summary status, i.e. current status is set according to actual status. The service switch must be ON to enable the reset. If it switched to OFF, a message appears that the reset cannot be performed.

8.9.4 Device test

Selecting this menu item lets the device test its internal state and displays a list of detected errors and warnings. Testing of the device runs for several seconds and does not affect its measuring and archiving operations. The command executes independently of the position of the service switch. The notification is displayed during the test.

8.9.5 Device errors display

Error messages are displayed in the "Actual Status", "Summary Status" and "Device Test" menus. Auto-diagnostics runs regularly with a full test of the device once a day and a sensor swap test either every hour or irregularly when the device is turned on. The test can also be triggered by selecting the "Device Test" function on the keypad.

An abbreviated form of total diagnostics is displayed in the right corner of the top-level menu display in the form of icons (see Section 8.2). It is the sum of the individual states and, in each case, the abbreviation with the highest priority is displayed. Starting with the highest, the priority order is Err, Wrn and OK. More detailed diagnostic information can be displayed using the service SW [38]. An overview of the indicated Err messages is included in Tab. 26, and the Wrn messages is provided in Tab. 27.

Displayed Message	bit	Description
E0 program CRC	0	Firmware checksum error.
E1 loader CRC	1	Loader checksum error.
E2 parameter CRC	2	Device parameter checksum error.
E3 memory error	3	Device memory error.
E4		- not used -
E5 setting archive full	5	The number of changes made to the device configuration has filled the archive capacity. The device is still working, only the parameter changing is blocked. It can be unblocked in ASC only.
E6 transd. replacement	6	Unauthorized replacement of the sensor or modification of its parameters has been made.
E7 trans. communication	7	Error in communication with the sensor.
E8 transd. error	8	Transducer error.
E9 battery discharged	9	The EVC battery is discharged (the remaining battery capacity is about 10%).
E10 compress. table	10	Error in compressibility table calculation due to input parameters.
E11 compressibility error	17	The compressibility cannot be calculated due to the limitation of the scope of the standard used for the compressibility calculating in the measured gas temperature and pressure.
E12		- not used -
E13 battery disconnected	19	Battery is disconnected
E14 P1 under limit	32	Pressure range exceeded (1st channel)
E15 P1 above limit	33	
E16 P1 error	36	Pressure transducer error
E17 T1 under limit	37	Temperature range exceeded (1st channel)
E18 T1 above limit	38	
E19 T1 error	41	Temperature transducer error

E20 P2 under limit	48	Pressure range exceeded (2nd channel)
E21 P2 above limit	49	
E22 P2 error	52	Pressure transducer error
E23 T2 under limit	53	Temperature range exceeded (2st channel)
E24 T2 above limit	54	
E25 T2 error	57	Temperature transducer error
E26 time synch.	4	RTC synchronization error, adjustment by > 2 h was required.
E27 mod.bat.capacity	15	The modem battery is discharged (more in paragraph 6.2)
E28 encoder error	20	Encoder error (SCR or NAMUR)
E29 CRC metrolog.	22	CRC error of metrological part of the FW
E30 CRC tables	23	CRC error in password or encryption key table
E31 FRAM error	26	FRAM memory error
E32 FLASH error	27	FLASH memory error
E33 bar sensor error	46	Integrated barometric transducer error

Tab. 26 Status – List of error messages (Err indication)

Displayed message	bit	Description
W0 transd. warning	11	Warning alert on one of connected modules and transducers. Details can be found by reading the parameters of the modules and transducers.
W1		- not used -
W2 battery	13	Memory error in battery pack.
W3 overcurrent	14	Current overload occurred
W4		- not used -
W5 network failure	16	Mains power supply failure
W6	21	- not used -
W7 tamper contact 1	24	Tamper contact 1 active.
W8 tamper contact 2	25	Tamper contact 2 active.
W9 P1 min. limit	34	Pressure user limits exceeded (1st channel)
W10 P1 max. limit	35	
W11 T1 min. limit	39	Temperature user limits exceeded (1st channel)
W12 T1 max. limit	40	
W13 Q1 min. limit	42	Flow rate at measurement conditions user limits exceeded (1st channel)
W14 Q1 max. limit	43	
W15 Qb1 min. limit	44	Flow rate at base conditions user limits exceeded (1st channel)
W16 Qb1 max. limit	45	
W17		- not used -
W18		- not used -

W19 P2 min. limit	50	Pressure user limits exceeded (2nd channel)
W20 P2 max. limit	51	
W21 T2 min. limit	55	Temperature user limits exceeded (2nd channel)
W22 T2 max. limit	56	
W23		- not used -
W24		- not used -
W25		- not used -
W26		- not used -
W27		- not used -
W28		- not used -
W29 EEPROM m.bat	18	Memory error of the modem battery
W30 m.battery voltage	12	Modem battery voltage low (more in paragraph 6.2)
W31 communication error	28	Communication error
W32 user cover	29	Housing cover opened
W33 ext.power supply of modem	61	External power supply to the modem has failed
W34 metrol.switch	62	Metrological switch is ON
W35 user switch	63	Service switch is ON
W36 volume diff	47	Volume limit has been exceeded when comparing volume counters
W37 mtrl cover	60	Cover of metrological part of the device was opened
W38 RTC setting	58	The system time has been set
W39 volume setting	59	The primary volume has been set
M0 Not configured	30	The device is in Not configured state
M1 Maintenance	31	The device is switched to Maintenance state

Tab. 27 Status – List of warning messages (Wrn indication)

8.9.6 Device status word

The device's current status is stored in its 64-bit status word. Each of the monitored states (e.g. temperature error, pressure error, battery status, etc.) is assigned a fixed bit in the status word. The state of each bit indicates whether the status occurred or not.



If any monitored bit changes, the entire status word will be stored in the status archive with a time stamp.

The device's status word is also stored in the data, daily and monthly archives. These records store information about whether the bit has reached the active state during the archiving interval. The assignment of a specific status word bit to each monitored event is shown in Tab. 26 and Tab. 27. When viewing the status in the device archives with the utility SW [38], the status word will be already displayed in a decoded readable form.

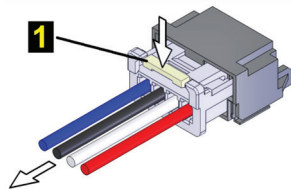
9 Technical description of the device



CAUTION!

All the device's connectors contain a mechanical safety lock **1** to prevent accidental disconnection.

To unplug the connector, first press the lock to disable protection against disconnection and then pull the connector gently out of the socket. Never use excessive force that pulls only on the cable, there is a risk of damage.



To re-connect, plug the connector in gently so the lock snaps into place. Then check for proper connection by pulling the cable slightly.

9.1 Principle of function

9.1.1 Conversion using state equation

The device obtains gas flow data through pulses (N) from an LF or HF sensor located in the meter. The volume under measurement conditions (V) is calculated from the number of pulses (N) and the gas meter constant (k_p).

The device receives additional data on the flowing gas - gas temperature (t) and absolute pressure under the measurement conditions (p) - from the temperature and pressure transducers. This data is used to calculate the conversion factor (C), which is influenced by other factors: absolute temperature at base conditions (T_b), absolute pressure at base conditions (p_b) and gas compressibility factors at base conditions (Z_b) and measurement conditions (Z).

Volume under measurement conditions (operating volume):
$$V = \frac{N}{k_p}$$

Gas compressibility factor:
$$K = \frac{Z}{Z_b}$$

Conversion factor:
$$C = \frac{p}{p_b} * \frac{T_b}{(t + 273.15)} * \frac{1}{K}$$

Volume at base conditions:
$$V_b = V * C$$

The compressibility factor of the gas expresses the deviation of the natural gas properties from the properties of the ideal gas. By setting the parameters, a specific method according to a specific standard (AGA NX-19 mod, AGA8-G1, AGA8-G2, SGERG-88, AGA8-DETAIL, GOST 30319.2, or GOST 30319.3) can be selected for the compressibility factor calculation. For gases other than natural gas, a constant compressibility value can be used. If the value of pressure or temperature exceeds the limit of the standard selected to calculate the compressibility, the device calculates the compressibility using a spare compressibility value.

From the input pulse frequency, the device calculates the real-time gas flow by mathematically filtering the incoming signal.

Operating flow:

$$Q = \Delta V / \Delta t \text{ [m}^3/\text{h]}$$

where:

ΔV increase in operating volume

Δt time between the pulses with accuracy of one hundredth of a second

The instantaneous flow rate displayed on the corrector screen is updated every 10 seconds.

Flow rate under base conditions:

$$Q_b = C * \Delta V / \Delta t \text{ [m}^3/\text{h]}$$

Note on base conditions

Base conditions are the conditions officially established for converting the gas quantity measured. These conditions are established differently depending on the country.

For example, in the Czech Republic:

Absolute gas temperature $T_b = 288.15 \text{ K}$ (i.e. $t_b = 15 \text{ }^\circ\text{C}$)

Absolute gas pressure $p_b = 101.325 \text{ kPa}$

9.1.2 Spare volume values

To calculate the gas volume under error conditions (i.e. due to transducer error, deviation of the value from the working range or device error), the device implements spare volume counters under measurement conditions (V_s) and spare volume under base conditions (V_{bs}). These counters are coupled with appropriate volume counters under normal (correct) conditions.

A detailed description of the device's behavior under normal (correct) and error conditions is described in Section 9.5.2

9.1.3 Conversion of volume to energy

The device allows to convert the amount of gas taken into the amount of energy taken E , which allows its use as **an energy conversion device according to EN 12405-2**. The conversion of volume to energy uses combustion heat H_s . Only with the AGA8-DETAIL method is the value of combustion heat H_s calculated by the device according to EN ISO 6976:2016. With other methodologies, the fixed value of combustion heat H_s is used (this value can be changed by the user). It is therefore possible to define reference conditions ($t_1 / t_b, p_b$) for the combustion heat H_s in the device. The calculation is made by adding increments of volumes dV_b (and dV_{bs}) multiplied by the actual value of combustion heat H_s .

$$dE = H_s \times dV_b, \quad dE_s = H_s \times dV_{bs}$$

The device contains two additional counters for measurement in energy units: the energy counter E and the energy spare values counter E_s .

During the configuration, the energy measuring unit can be selected from the following list: MJ, kWh, Btu.

Warning:

Changing the unit does not convert the absolute value of the counter E (E_s). Additional increments are already read with respect to the new measuring unit.

When the device calculates energy (H_s is activated in the device parameters), the reference conditions must be in accordance, i.e.:

- p_b, t_b to convert the volume V to volume V_b
- p_2, t_2 for combustion heat to calculate E

The rule $p_2 = p_b$ and $t_2 = t_b$ is applied here. This setting is checked by the user program and does not allow parameters to be saved if the conditions do not match.

The basic scheme of energy calculation is shown in Fig. 53.

Combustion Heat H_s (for energy calculation purposes)

The combustion heat conditions t_1 / t_b under which natural gas is sold are prescribed by each state's energy law; t_1 is the reference ambient temperature during combustion, t_b is the reference temperature of V_b volume of combusted gas.

Note:

E.g. in the Czech Republic applies according to the Energy Act No. 458/2000 Coll. § 98a par. 1, letter a) and Decree of the Ministry of Industry and Trade No. 108/2011 Coll. (amended 2017) §1 par. 3., that the combustion heat in kWh / m³ is stated at a reference combustion temperature of 15 °C.

In order to ensure the correct conversion of the consumed amount of V_b (t_b , p_b) to energy units, it is necessary:

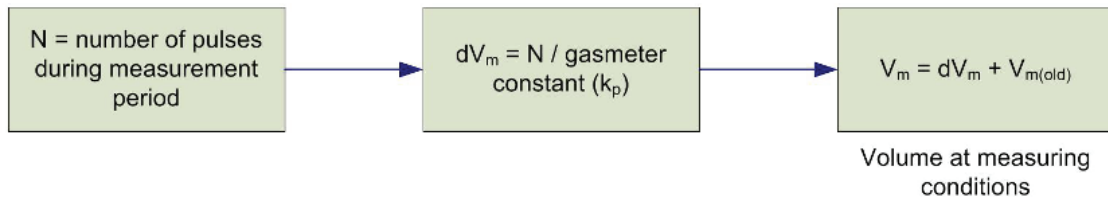
- Enter the value of combustion heat H_s into the device in the appropriate units
{ H_s value is usually obtained easily as an output from chromatograph analysis under conditions (t_1 , p_1 ; t_b , p_b) enacted in the relevant country (e.g. H_s 15/15 is used in the Czech Republic)}
- Select the appropriate t_1/t_b conditions are selected from the device menu.

If the chosen methodology is AGA8-Detail:

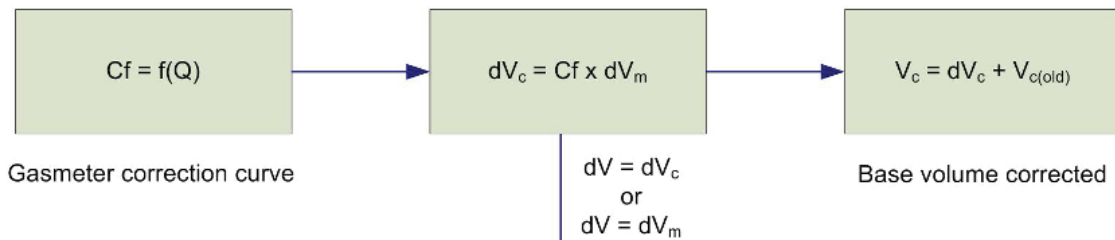
- Select conditions t_1/t_b .
- The combustion heat value is not entered (it is calculated by the device according to ISO 6976 from the specified gas composition). H_s (t_1/t_b) is published after the "actual values" are read.

For other methodologies, the H_s value has to be entered manually.

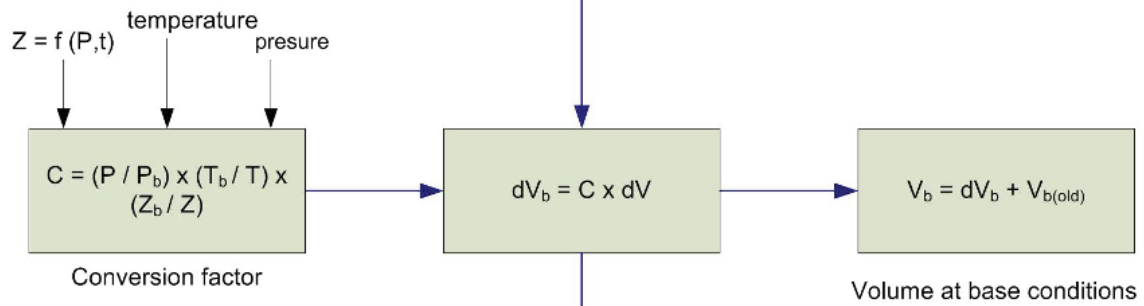
1. Basic measurement of primary volume



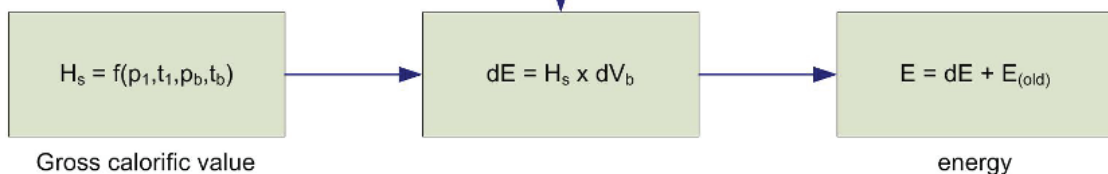
2. Application of gasmeter correction



3. Volume correction under standard condition



4. Conversion of standard volume onto energy



LEGEND:			
C	conversion factor	T	absolute temperature at metering conditions
Cf	correction factor	T _b	absolute temperature at base conditions
dE	incremented energy	V	volume V _m or V _c
dV	addition dV _m or dV _c	V _b	volume at base condition (standardized volume)
dV _b	addition base volume	V _{b(old)}	standard volume at the end of previous measurement period
dV _c	addition corrected primary volume	V _c	corrected volume at metering conditions
dV _m	addition primary volume	V _{c(old)}	corrected volume at the end of previous measurement period
E	energy	V _m	volume at metering conditions (primary volume)
E _(old)	energy at the end of previous measurement period	V _{m(old)}	primary volume at the end of previous measurement period
H _s	gross calorific value	Z	Gas compressibility factor at metering conditions
P	absolute pressure of gas	Z _b	Gas compressibility factor at base conditions
P _b	absolute pressure at base conditions		
p ₁	air pressure in which is defined burning of gas	t ₁	air temperature in which is defined burning of gas

Fig. 53 Calculation scheme for volume and energy

9.2 Measuring temperature

The device measures temperature with a digital transducer EDT 124 with a semiconductor temperature sensor.

Mechanically, the transducer consists of a sensor in a 5.7 mm diameter stainless steel shank with a standard length of 50 mm (120 mm optionally) from which a cable is routed. The transducer's electronics are also contained inside the shank.

The data from the sensor are processed by a microprocessor that corrects nonlinearity based on calibration data stored in EEPROM memory during the manufacture of the transducer. The transducer communicates with the device via the I2C communication interface.

The temperature measurement range is either -25 °C to +70 °C or -40 °C to +70 °C. The measurement period is common to both temperature and pressure measurements and can be set by user between 1 and 30 seconds. The temperature measurement units are selectable.

The temperature sensor is protected against replacement by the manufacturer's mark (metrology mark) and the sensor can only be replaced at an Authorized Service Centre (ASC).

9.3 Measuring pressure

Pressure is measured with a digital EDT 125 transducer. The transducer contains a piezoresistive silicon sensor with a durable stainless-steel diaphragm. The device electronics corrects the non-linearity and temperature dependences of the pressure transducer based on the calibration data stored in the transducer memory. The pressure transducer's measuring range must be specified when the device is ordered. Manufactured pressure ranges are specified in Section 3.6.3.2.

The measurement period is common to both temperature and pressure measurements and can be set by user between 1 and 30 seconds. The pressure measurement units are selectable.

The pressure transducer is protected against replacement by the manufacturer's mark (metrology mark) and can only be replaced at an Authorized Service Centre.

9.4 Calculating compressibility

9.4.1 Converting PTZ and TZ

The compressibility factor is calculated from the gas composition specified in the parameters using one of the following methods implemented in the device: AGA NX-19-mod, SGERG-88, AGA8-G1, AGA8-G2, GOST 30319.2, GOST 30319.3 and AGA8-DETAIL.

The chemical composition of the gas is chromatographically analyzed and the output includes the physical properties of the gas calculated in compliance with ISO 6976, but in conditions preferred for billing purposes (relative density d at temperature t_b and pressure $p_b = 101.325$ kPa, heat of combustion H_s at t_1/t_b and pressures $p_1 = p_b = 101.325$ kPa).

That is why a calculator is built into the utility SW to convert the physical properties of gas to the conditions required by the methods for calculating the compressibility factor:

- relative density d at temperature $t_b = 0$ °C and pressure $p_b = 101.325$ kPa,
- heat of combustion H_s (applied by methods SGERG-88 and AGA8-G1) at a burning temperature of $t_1 = 25$ °C and a pressure $p_1 = 101.325$ kPa / gas temperature $t_b = 0$ °C and a gas pressure $p_b = 101.325$ kPa.

Note: abbreviated in references as H_s (25/0)

The compressibility factor $K = Z/Z_b$ is calculated for each measuring period.

With regard to the required accuracy of the device, the use of compressibility calculation methods is limited to the pressure and temperature ranges shown in Tables Tab. 28 and Tab. 29 below:

Measuring pressure range	Method			
	AGA NX-19 mod	SGERG-88	AGA8-G1 AGA8-G2	AGA8-DETAIL
80 ÷ 520 kPa	-25 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
80 ÷ 1000 kPa	not usable	-25 ÷ +70 °C	-25 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
80 ÷ 2000 kPa	not usable	-25 ÷ +70 °C	-25 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
200 ÷ 1000 kPa	not usable	-25 ÷ +70 °C	-25 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
400 ÷ 2000 kPa	not usable	-25 ÷ +70 °C	-25 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
400 ÷ 7000 kPa	not usable	-10 ÷ +70 °C	-10 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
700 ÷ 3500 kPa	not usable	-10 ÷ +70 °C	-10 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C
1400 ÷ 7000 kPa	not usable	-10 ÷ +70 °C	-10 ÷ +70 °C	-25 ÷ +70 °C, optional -40 ÷ +70 °C

Tab. 28 Limitation of the scope of validity of compressibility calculation standards (AGA, SGERG)

Measuring pressure range	Method	
	GOST 30319.2	GOST 30319.3
100 ÷ 520 kPa	-23.15 ÷ +70 °C	-23.15 ÷ +70 °C
100 ÷ 1000 kPa	-23.15 ÷ +70 °C	-23.15 ÷ +70 °C
100 ÷ 2000 kPa	-23.15 ÷ +70 °C	-23.15 ÷ +70 °C
200 ÷ 1000 kPa	-23.15 ÷ +70 °C	-23.15 ÷ +70 °C
400 ÷ 2000 kPa	-23.15 ÷ +70 °C	-23.15 ÷ +70 °C
400 ÷ 7000 kPa	-10 ÷ +70 °C	-23.15 ÷ +70 °C
700 ÷ 3500 kPa	-10 ÷ +70 °C	-23.15 ÷ +70 °C
1400 ÷ 7000 kPa	-10 ÷ +70 °C	-23.15 ÷ +70 °C

Tab. 29 Limitation of the scope of validity of compressibility calculation standards (GOST)

9.4.1.1 Spare compressibility

For the set method, each calculation checks whether the measured value of pressure and temperature lies within its applicability range. If a value is outside this range, spare compressibility (to be more specific, the spare compressibility rate K) is used for the conversion. The spare compressibility value has to be entered when the device is configured (Fig. 54).

The screenshot shows the 'Compass' software interface. The top bar includes 'Station identification: Test PWR4, :'. Below it are four main buttons: 'Connect to device', 'Device configuration', 'Data reading', and 'View data from file'. A secondary bar contains 'Connect to device' and 'Parameters'. The 'Parameters' bar is expanded, showing a list of categories: 'Volume conversion (metrology)', 'Transducers', 'I/O terminals', 'Communication ports', 'Data structure', 'Internal parameters', 'SetPoints', and 'System parameters'. Under 'Transducers', the 'Conversion factor' category is selected. The 'Convers.factor C' configuration window is open, showing fields for 'Name' (Convers.factor), 'Mark' (C), and 'Decimal place' (4). It also has 'Pressure input' (P1, 29 [PSI]) and 'Temperature input' (T1, 60 [°F]). The 'Compressibility' dropdown is set to 'Calculated', and the 'Spare const. value' is set to '1'. A red box highlights the 'Calculated' dropdown and the '1' value, with a red arrow pointing to it and the text 'The entered value is used as a spare value.'

Fig. 54 Setting the spare compressibility value K to calculate C (SW Wincor Evo)

9.4.2 Converting PT and T

If the device has to be set up as a PT or T corrector, then it will not calculate gas compressibility, but instead a fixed constant value will be used as a compressibility rate K to calculate the conversion factor. The constant value of the compressibility rate K is set in the device for the parameter C (Fig. 55). For the value "Compressibility" it is necessary to set "Constant value" instead of "Calculated". The range of the entered constant K is not limited.

The screenshot shows the 'Compass' software interface. The top bar includes 'Station identification: Test PWR4, Serial nu'. Below it are four main buttons: 'Connect to device', 'Device configuration', 'Data reading', and 'View data from file'. A secondary bar contains 'Connect to device' and 'Parameters'. The 'Parameters' bar is expanded, showing a list of categories: 'Volume conversion (metrology)', 'Transducers', 'I/O terminals', 'Communication ports', 'Data structure', 'Internal parameters', 'SetPoints', and 'System parameters'. Under 'Transducers', the 'Conversion factor' category is selected. The 'Convers.factor C' configuration window is open, showing fields for 'Name' (Convers.factor), 'Mark' (C), and 'Decimal place' (4). It also has 'Pressure input' (P1, 29 [PSI]) and 'Temperature input' (T1, 60 [°F]). The 'Compressibility' dropdown is set to 'Constant value', and the 'Spare const. value' is set to '1'. A red box highlights the 'Constant value' dropdown and the '1' value, with a red arrow pointing to it and the text 'The entered value is used as a constant value.'

Fig. 55 Setting the constant compressibility value to calculate C (SW Wincor Evo)

9.5 Measurement and calculation of volumes

The following counters for each channel are used in the instrument to measure and calculate the volumes:

V_m	-	Volume counter under the measurement conditions (primary volume)
V_c	-	Corrected volume under the measurement conditions (volume corrected based on the correction profile of the meter)
V	-	Volume V_m or V_c
V_s	-	Operating volume counter at error conditions (spare primary volume)
V_b	-	Volume counter at base conditions
V_{bs}	-	Base volume counter at error conditions

9.5.1 Calculating the conversion factor C for volume conversion

As stated in Section 9.1.1, the following relation applies to the calculation of the volume under base conditions:

$$V_b = V * C$$

The following applies to the conversion factor:

$$C = \frac{p}{p_b} * \frac{T_b}{(t + 273.15)} * \frac{1}{K}$$

Thus, in addition to the compressibility rate K of the gas and the reference conditions (p_b , T_b), the conversion factor C depends on the gas pressure p and the gas temperature t .

9.5.1.1 Gas pressure - measured or fixed value

By default, the measured value of the gas pressure p in the pipeline by the pressure sensor is used to calculate C . In some special cases, the value entered into the device as a constant when configuring the device can be used for the calculation instead of the measured pressure value. Then we talk about a spare or constant value of pressure.

Spare pressure value p_s

This value is automatically used instead of the measured value of gas pressure when so-called "error conditions" occur, like in the following cases:

- The measured gas pressure is outside the measuring range, or
- An error has occurred and the measured gas pressure value is not available

Constant pressure value p

The constant pressure value is used if the device is not equipped with a gas pressure measurement transducer (T-corrector). The use of a constant value must be set manually in the device parameters. The constant pressure value can be set between 80 and 1000 kPa.

Setting of spare and constant pressure value

The spare pressure value p_s and the constant pressure value p are in fact one common value entered in the device parameters. If it is to be used as a constant value, it is necessary to select a constant value for the pressure parameter on the parameter card C (conversion factor) instead of the measured value P . The size of the spare or constant pressure is entered in the field "Spare const. value". The set value should be as close to the real value of the gas pressure in the pipeline as possible.

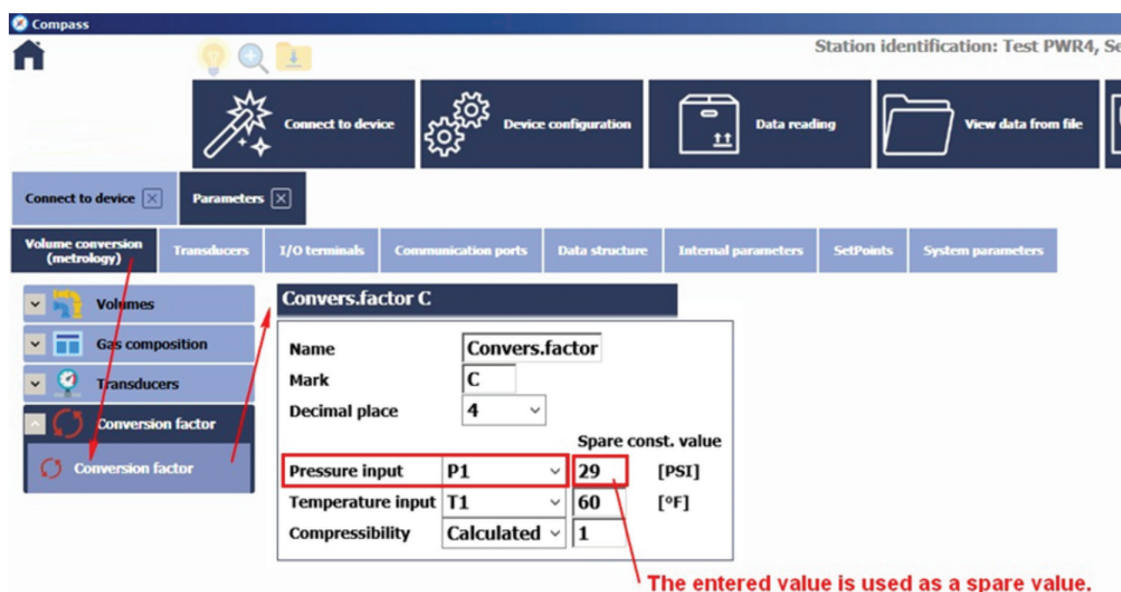


Fig. 56 Setting the spare pressure value (SW Wincor Evo)

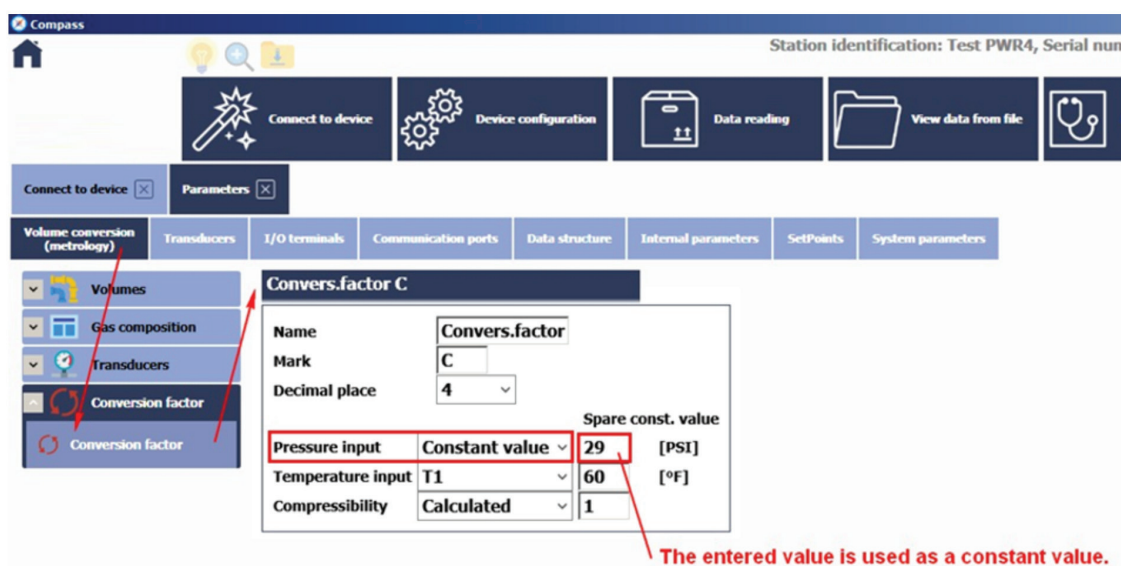


Fig. 57 Setting the constant pressure value (SW Wincor Evo)

The size of the spare value can be changed after the service switch has been turned to the ON position. Switching "measured value P / constant value" is protected by a metrological switch.

9.5.1.2 Gas temperature - measured or fixed value

By default, the value of the gas temperature t in the pipeline measured by the temperature sensor is used to calculate C . In some special cases, the value entered into the device as a constant when configuring the device can be used for the calculation instead of the measured temperature value. Then we talk about a spare or constant value of temperature.

Spare temperature value t_s (T_s)

This value is used automatically instead of the measured value of gas temperature when the so-called "error conditions" occur, like in the following cases:

- The measured gas temperature is outside the measuring range, or
- An error has occurred and the measured gas temperature value is not available

Constant temperature value t (T)

The constant temperature value is used if the device is not equipped with a gas temperature measurement transducer. The use of a constant value must be set manually in the device parameters.

Note:

This option is not allowed if the instrument is delivered as a legal metrology instrument with MID approval (certificate TCM 143/25 –6003).

Setting spare and constant temperature values

The spare temperature value t_s (T_s) and the constant temperature value t (T) are in fact one common value entered in the instrument parameters. If it is to be used as a constant value, it is necessary to select a constant value for the temperature parameter on the parameter card C (conversion factor) instead of the measured value t . The size of the spare or constant temperature is entered in the field "Spare const. value". The set value should be as close to the real value of the gas temperature in the pipeline as possible.

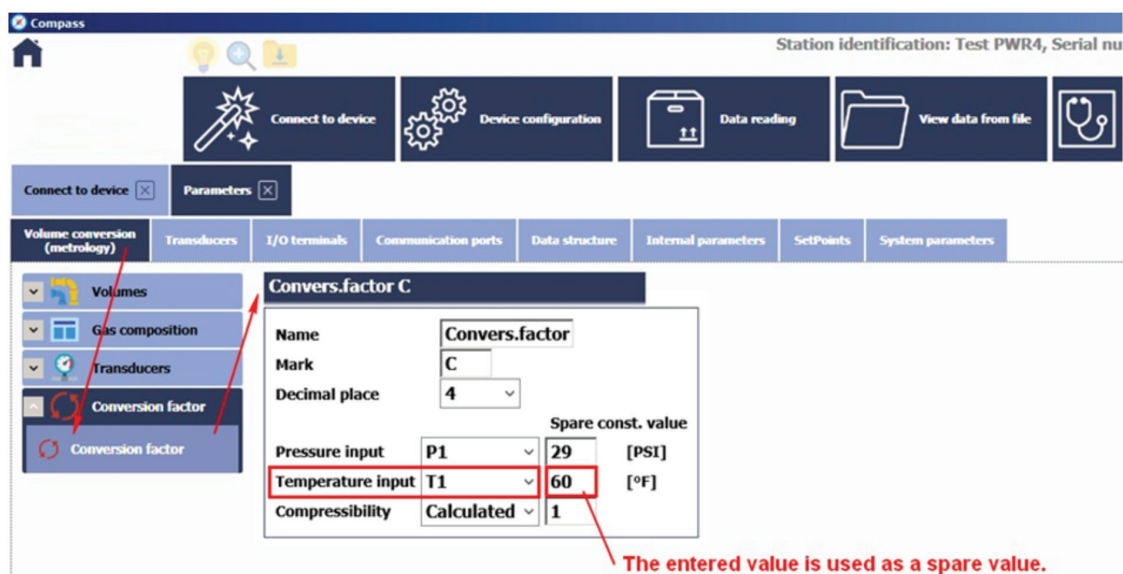


Fig. 58 Setting the spare temperature value (SW Wincor Evo)

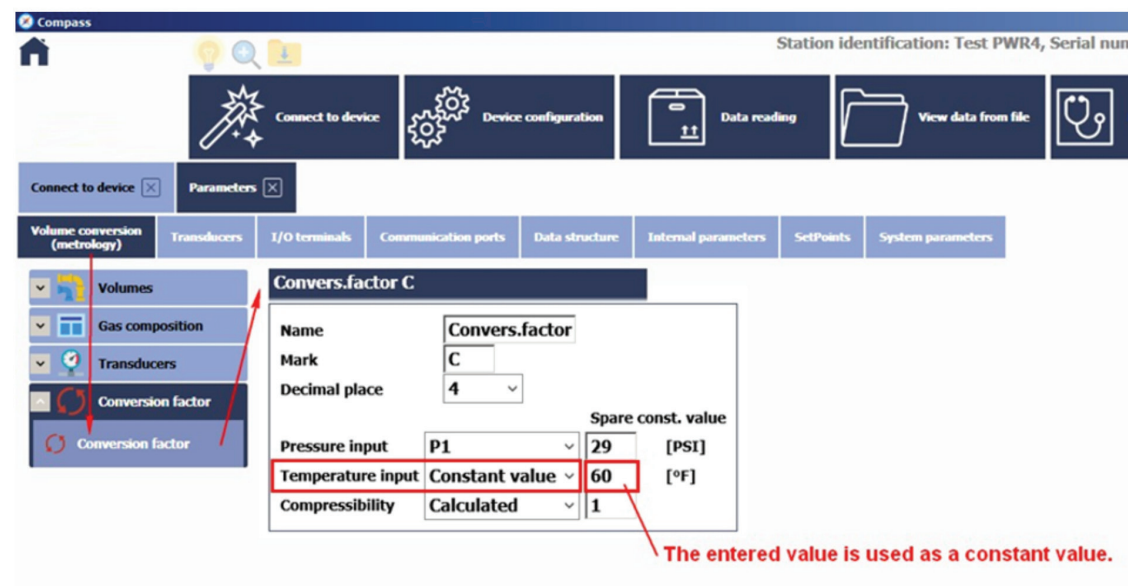


Fig. 59 Setting the constant temperature value (SW Wincor Evo)

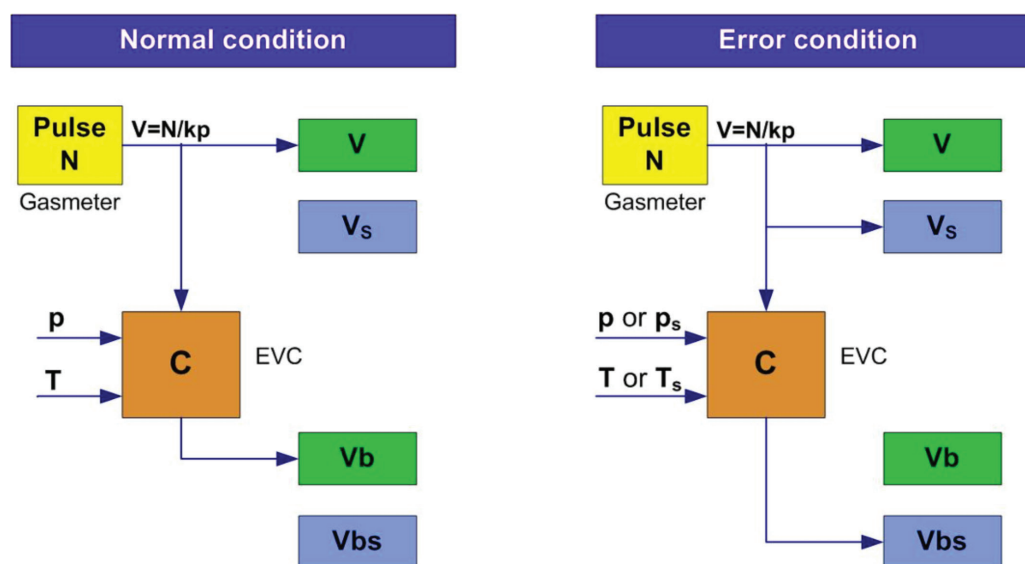
The size of the spare value can be changed after the service switch has been turned to the ON position. Switching "measured value T / constant value" is protected by a metrological switch.

9.5.2 Action when error conditions occur

When error conditions occur, the device simultaneously with the counting of pulses to the volume counter under the measurement conditions (V) starts counting pulses to the spare volume counter under the measurement conditions (V_s). Volume values at base conditions (V_b) cease to be counted in the volume counter at base conditions (V_b) and start to be calculated from spare pressure or temperature values and stored in the spare volume counter at base conditions (V_{bs}). Under this condition, the values are not stored in the volume counter under base conditions (V_b).

A device error condition occurs when one of the following conditions is true:

1. The measured gas pressure is outside the measuring range - a spare pressure value p_s will then be used to calculate the conversion factor C ; or
2. The value of the measured gas pressure is not available - a spare pressure value p_s will then be used to calculate the conversion factor C (e.g. in the event of a sensor error); or
3. The measured gas temperature is outside the measuring range - a spare temperature value t_s will then be used to calculate the conversion factor C ; or
4. The value of the measured gas temperature is not available - a spare temperature value t_s will then be used to calculate the conversion factor C (e.g. in the event of a sensor error); or
5. If the measured value p or t is outside the scope of applicability for the set calculation standard (see Section 9.4.1 and Tab. 28, Tab. 29) while calculating the volume under base conditions and neither p nor t is outside the measuring range, the spare compressibility will be used to calculate the conversion factor C .



Symbol		Meaning
N	-	Pulses from the meter
kp	-	Gas meter constant [pulse/m ³]
p	-	Measured gas pressure
T	-	Measured gas temperature
ps	-	Spare gas pressure
Ts	-	Spare gas temperature
V	-	Volume counter at measurement conditions (primary volume)
Vs	-	Primary volume counter at error conditions (spare primary volume)
Vb	-	Volume counter at base conditions (corrected volume)
Vbs	-	Base volume counter at error conditions (spare corrected volume)

Fig. 60 Storing pulses in the counters

If spare compressibility is used in the calculation because accuracy of compressibility calculation is deviating outside the value permitted under the selected calculation standard (see Section 9.4.1) and neither p nor t is outside the measuring range, the converted volume is stored in the spare counter.

If the corrected volume V_c is used, the operating volume counter at error conditions V_s can be linked to V_m or V_c .

9.5.3 Respecting the change in the direction of gas flow through the gas meter

A gas meter equipped with two phase-shifted rotation sensors allows detection of gas flow direction.

In the case of evaluating the gas flow with respect to the change of direction, the converter processes the data from the gas meter as follows (Fig. 61):

- If the increments of the operating volume V_m are positive, the standard procedure will be followed when processing the volume data (i.e. increasing the state of the counters V_m and V_b , or V_{ms} and V_{bs}).
- If the direction of rotation of the gas meter changes, the device remembers the state of the operating volume counter V_m (state of the gas meter), at which the gas flow direction was reversed. If the gas flows back, only the value of the operating counter V^m (and V_{ms} if applicable) is updated. The states on all the other counters do not change.
- After the direction changes, the related counters (V_b , V_{bs}) start counting increments again only after reaching the state at which the flow was reversed. The operating volume counter always copies the status of the gas meter.

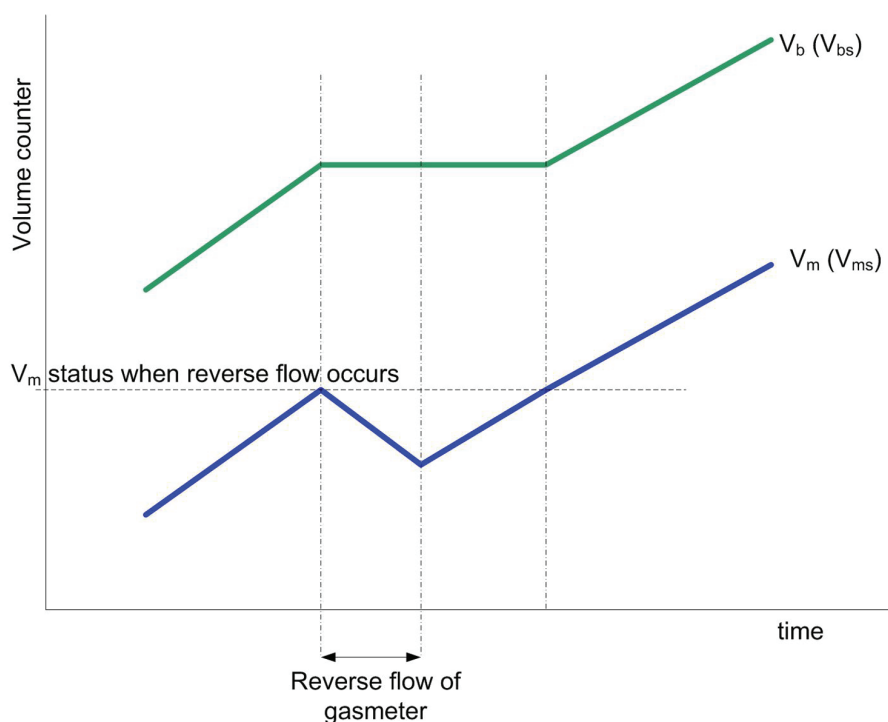


Fig. 61 Processing volumes when rotation of the gas meter is reversed

i

Note:

If the device is set to respect the change in the direction of gas flow, it is possible to turn on a counter in the parameters of the device, in which the amount of gas that flowed only during the return of the gas meter is stored.

9.6 Device software

The device's software (firmware, FW) is divided into 3 parts.

The first part of the firmware, the "Loader", is used to provide the firmware upload when it is updated.

The second part of the firmware, designated the "Metrolog", includes software for the device's metrological functionality, display and keypad control, metrological data security routines and control mechanisms for detecting errors.

The third part of the firmware ("App") contains the remaining firmware such as communication protocols, communication channel management and superstructure functionality.

Each part of the FW is identified by a version number and checksum. The version designation is stored as a string with a decimal number with two decimal places.

The version and CRC checksum for the "Loader" and "Metrolog" are specified in the test report [37] and the versions can only be modified with approval from the notified body. A change in the version number before the decimal point means a major FW change, while a change in the decimals indicates a version with minor changes or bug fixes.

The FW version numbers for the "App" and "Metrolog" can be shown on the device display by pressing Enter button when default menu is displayed ("System data" display). The versions of all three FW parts, including CRC checksums, can be displayed with the service SW [38].

9.6.1 Downloading application firmware using "Remote Download"

In addition to local firmware upload using the "LOADER" method (protected by a metrological mark), the "Remote Download" method can be used. Using this method, new firmware can be remotely downloaded to the device in accordance with the **Welmec 7-2 Extension D** recommendation. The loaded firmware is secured with a **digital signature** separately in each section to check data integrity, authenticity and also the specificity of the device. Upgrading is divided into several phases and delayed start of firmware activation can be set. Information on the processing of each individual phase is recorded in the settings archive.

Downloading the FW is not bound to a specific communication protocol or PC software and can be performed via any communication channel. The firmware is divided into two parts for recording, where either the "App" or the "App" together with the "Metrolog" can be recorded.

The digital signature contained in the application firmware file (*.srec) confirms standard testing at Dresser Utility Solutions and that the "Metrolog" module complies with the valid certificate issued by the relevant notified body.

9.6.2 Storing data in the device

Several memories (processor internal RAM, processor internal FLASH, SPI FRAM and SPI dataFLASH) are used to store data in the device.

All archives and counters are stored in 8MB **non volatile** SPI dataFLASH memory. Important archives, counters and parameters are additionally backed up in other memories. All data are properly secured. Irregular errors are indicated in the device's internal diagnostics. The backup battery in the device backs up RAM and the RTC circuit remains in operation. The pulses are counted at the LF inputs.

10 Function description

The device offers highly variable and user-configurable options for displaying values and storing quantities. Users can decide which quantities should be displayed as actual values and which will be stored in individual archives.

10.1 Designation of quantities

Quantities are designated with the symbols shown in Symbols and Terms at the beginning of this document.

Designation of Quantities

- None of the metrological quantity designations in the single channel device include an index (Index 1 or 2 is used with dual channel devices)
- For other, non-metrological quantities, an index can be used to distinguish quantities of the same type.

User-designated Quantities

- This new feature allows users to define customized designations of quantities. The original designation of the quantities acts as the default designation (shown in blue in the service software. Designation of quantities should be chosen to preserve the uniqueness of the designation. Designation uniqueness is checked by the service software.
- Designation of metrological quantities can only be changed at the ASC level.
- User-designated quantities are used for display purposes in both the device and service software and are exported for use in third-party SW.

10.2 Actual values

For the displayed quantities, the number of displayed places, units and display name can be set by the user. If the measured quantity is in an error state, this state is indicated by the display of an asterisk at the last position in the line of the quantity name.

Example of quantities that can be displayed as actual values:

- Pressure p
- Temperature t
- Operating volume Vm
- Spare operating volume Vs
- Corrected volume Vb
- Spare corrected volume Vbs
- Energy E
- Operating flow rate Q
- Corrected flow rate Qb
- Conversion factor C
- Compressibility factor K
- Device error
- External power supply
- Battery capacity
- Internal temperature

10.3 Archives

Archived values are sequenced in time slots, where each slot includes its time data and the values of the quantities selected for archiving.

The measured and computed quantity values can be stored in the following archives:

- Monthly archive
- Daily archive
- Data archive
- Binary archive
- Limit archive

In addition to these data archives, the device contains also the following archives:

- Status archive
- Billing archive
- Settings archive
- Gas composition archive

Archives with a fixed number of records (monthly, daily, binary, and limit) are stored at the beginning of the device's available memory and data archive is stored in the remaining memory (with the length depending on the size of the remaining memory).

	Data archive	Daily archive	Monthly archive	Limit archive	Binary archive
Analogue quantities					
Analogue input - mean value	yes	yes	yes		
Analogue internal - mean value	yes	yes	yes		
Analogue output - mean value	yes	yes	yes		
Minimum/maximum	yes	yes		yes ²⁾	
Pulse quantities, flow rate measurement					
Primary volume - absolute state	yes	yes	yes		
Corrected volume - absolute state	yes	yes	yes		
Spare primary volume – absolute state	yes	yes	yes		
Spare corrected volume - absolute state	yes	yes	yes		
Max. daily consumption - primary volume			yes ¹⁾		
Max. daily consumption - corrected volume			yes ¹⁾		
Max. hourly consumption - primary volume		yes ¹⁾	yes ¹⁾		
Max. hourly consumption - corrected volume		yes ¹⁾	yes ¹⁾		
Internal counter - absolute state	yes	yes	yes		
Output pulses - pulse deficiency	yes	yes	yes		
Primary flow rate - mean value	yes	yes	yes		
Corrected flow rate - mean value	yes	yes	yes		
Minimum/maximum flow rate	yes	yes		yes ²⁾	
Conversion, gas convertibility factor					
Conversion factor - mean value	yes	yes	yes		
Gas compressibility factor - mean value	yes	yes	yes		
Minimum/maximum conversion, gas compressibility factor	yes	yes		yes ²⁾	
Binary quantities					
Binary input - state	yes				yes
Binary output - state	yes				yes
Setpoints - state	yes				yes
Device and transducer communication errors - state	yes				yes

Binary internal	yes				yes
Other quantities					
Counter/ timer - absolute	yes				
Device status	yes	yes	yes		
Notes:					
¹⁾ The day or hour is stored together with the value (or in combination, where suitable)					
²⁾ The date and time of reaching the minimum/maximum is stored together with the value					

Tab. 30 Quantity archiving options

Archive	Possibility to reset the archive in the device
Monthly archive	By user after enabling writing by the service switch by switching to the ON position (see paragraph 10.6.1)
Daily archive	
Data archive	
Binary archive	
Limit archive	
Billing archive	
Gas composition archive	After switching the metrological switch to the ON position, see paragraph 10.6.1, and using a HW key (Authorized Service Center) – see paragraph 10.6.3.
Status archive	
Settings archive	

Tab. 31 Archive resetting options

10.3.1 Monthly archive

Values are archived once a month at the set "gas" hour (usually 6:00 am). Time data are archived along with values. When the archive is full, new data will start overwriting the oldest data. Here it is possible to store statistical values for gas consumption and analogue quantities (see Tab. 30).

A record dated 01.06. means the statistical values of quantities recorded between the first of May at 6:00 am and the first of June at 6:00 am.

10.3.2 Daily archive

The features are similar to the monthly archive (for the list of options see Tab. 30). Statistical values for gas consumption and analogue quantities can be stored here, too. The values are archived once a day at the scheduled "gas" hour (usually 6:00 am).

A record dated 13.06. means the statistical values of quantities recorded between the 12th of June at 6:00 am and the 13th of June at 6:00 am.

10.3.3 Data archive

Archiving period: between 1 second and 1 hour

Quantities are archived for a defined period, which a user can set. The default value is 1 hour. For state quantities (i.e. binary quantities and status), the occurrence of the active state in the archiving period is archived. For binary inputs, the active state can be set according to the actual parameter setting. Log1 is the active state for setpoints and errors.

10.3.4 Binary archive

The states of binary inputs are archived together with status bits calculated and stored in the system and possible

errors of individual devices. The values will only be archived when the state of a stored binary quantity changes. The record includes time data in seconds.

10.3.5 Limit archive

Archived quantities that have reached a limit (either minimum or maximum) are stored. Both the value and time data are stored. When this archive is initialized, the current measured values of the specific quantities are set in both maximum and minimum registers.

10.3.6 Status archive

The archive stores the date and time of an event change, the status word (64 bits) describing the states of all monitored events in the device and of the operating volume counter V_m and the volume counter V_b at base conditions. Monitored events in the device are listed in Tab. 26 and in Tab. 27.

The archive's contents cannot be displayed directly, but can be viewed via the utility software on a PC.

10.3.7 Settings archive

The settings archive stores parameter changes, especially if they affect the device's metrological properties, except for changes in gas composition and the standard for calculating gas compressibility. The ID of the person who made the change is archived, too. The record contains the time, person's identification, described activity and the new and old parameter values that have been set.

This archive is different from the other archives as it cannot be overwritten. When it is full, no further records can be saved and any further modification of the parameters is impossible. This archive cannot be displayed directly and its contents can only be viewed on a PC. The settings archive cannot be deleted by the user. Only in the ASC is deletion possible.

10.3.8 Billing archive

The device contains a billing archive, which is used to record data from the billing period set in the device parameters. Records in the archive can be made either as a one-off record at a preset time or periodically at intervals of 1, 2, 3, 4, 6 or 12 months. At this time, all current states of the counters of the primary volume and the corrected volume are recorded, both the total counter and the counters of individual tariff bands.

The device allows setting the billing period and the time when the next billing period starts.

10.3.9 Gas composition archive

Changes in the gas composition or in the standard for calculating gas compressibility are recorded in this archive. A time stamp, information on the compressibility used and the size of gas composition items are stored. When the archive is full, new data will start overwriting the oldest data.

10.4 Device parameterization

10.4.1 Parameterization using the service SW

The device allows setting the parameters needed to put the device into operation after its installation directly from the device keypad, i.e. without needing a computer. Section 8.7 describes the procedure.

The device can be fully parametrized using the supplied service SW [38] intended for a PC. In addition to setting up the device, the software also allows reading, viewing, archiving and printing of both actual values and archived contents.

10.5 Other device features

10.5.1 Summer/Winter time (DST)

The device has a time change function (summer/winter time), which can be activated/deactivated by the service SW. When this function is activated, the device automatically changes the time based on the region where it is being used (Europe or USA). At the same time, the deviation from universal time (GMT) should be set for correct operation. The device's archives then distinguish whether the record was archived in summer or winter time.

10.5.2 Time synchronization

The device is equipped with a time synchronization function that allows only the administrator to correct the time within a time deviation of +/- 10 minutes without recording in the settings archive and without generating the warning message W38 in the device status.

Note to the CTR communication protocol:

Time correction is enabled if the deviation is greater than 60 seconds and less than 2 hours and it will be recorded in the status archive. If an attempt is made to change the time by more than 2 hours, then this correction is not enabled and an alarm is generated.

In device parameterization, if the device is equipped with a modem, automatic time synchronization can be set either with the NTP protocol via the GPRS network or with the ETTC protocol via GSM CSD call. The time is synchronized automatically with the 20-day period and, in case of failure, with a 24-hour period. If the synchronization is not successfully completed by the 25th day, an E26 error will be triggered and recorded in the status archive (Tab. 26). The amount of the time deviation detected during synchronization is always evaluated with respect to the frequency of data storage, so that the archives will not be corrupted during synchronization.

10.5.3 Tariff counters

Up to four tariff counters are available in the device to calculate volume on a pre-set time schedule. There are two separate schedules (Tariff Schedule 1 and Tariff Schedule 2) that can be configured independently, but only one can be active at a given time. In these schedules it is possible to assign individual tariffs to certain time periods on individual days and at the same time it is possible to define whether the selected day is a working day, Saturday or Sunday (or a holiday).

Each schedule has its own identification number and it is possible to set the activation time of each schedule separately.

10.6 Protection against changing metrological parameters

The device has metrological and service switches to protect against unauthorized manipulation, especially with data that affects the metrological properties of the device, and uses security by means of a password system. Changes in the device settings and other actions are stored in the settings archive. These elements enable the protection of equipment in accordance with the requirements of EN 12405-1 and beyond.

10.6.1 Switch protection

The device contains two switches, a metrological switch and a service switch.

10.6.1.1 Metrological switch

- This switch protects the device's metrological settings. It is located above the display inside the enclosure (see Fig. 1, position **7**) and is protected by a label secured with the manufacturer's security mark (official metrological mark).

10.6.1.2 Service switch

- This switch is located next to metrological switch (see Fig. 1, position **6**). The user mark can prevent opening of the device and accessibility to the switch, see Fig. 3.

The **service switch** function depends on the function settings in the device parameters. They are set up by the service program (Parameters Menu -> Service Switch Meaning). Here the user can choose how the switch settings will affect the individual groups of device parameters.

This variability addresses the setting of various access options to work with the device (such as remote setting of parameters via the modem).

The user has the option to set one of the three meanings of the service switch using the service SW:

Switch function	Position	Description
Full ¹¹⁾	OFF	Writing parameters into the device is blocked.
	ON	Parameters can be entered into the device.
Non	OFF	The position of the switch is of no significance, writing to the device is possible. The switch protection is suppressed.
	ON	
Partial	OFF	Writing to the device is blocked with the exception of non-metrological parameters (such as archiving frequency, communication parameters, station identification, system time etc.) This setting is suitable for remote data transfers from the device. Protecting the setting with a password is recommended.
	ON	Parameters can be entered in the device (in the same way as in the case of full function).

11) This meaning is preset by the manufacturer (default setting)

Tab. 32 Service switch settings

10.6.2 Device passwords

The device has password protection. The use of passwords may be restricted depending on the communication protocol set. The maximum number of passwords that can be entered in the device is 50. When password protection of the device is enabled (see below), the passwords have to be entered for the serial line or modem communication and also for setting up device parameters with the device keypad. When setting the parameters from the keypad, the list of items that can be edited is limited by the access level permitted.

10.6.2.1 Password groups (applicable for IFLAG, MODBUS, CTR protocols)

Passwords are divided into 5 groups. The "Administrators" group has the widest rights, while users in the "User 3" group have the narrowest rights. Users of a higher-level group have lower-level user rights, as well as some others. Up to 10 passwords can be used in each group (i.e., a total of 50 passwords are available). The passwords are identified by a three-digit numeric designation. The length of each password is limited to a maximum of 6 characters. Users in all the groups can change their own passwords. The group administrator (with the lowest identification number in the group) can change the passwords of the other users in that group. The administrator of the "Administrators" (ID = 801) group can change the passwords of the administrators in the other groups. Depending on the communication protocol used, the following characters can be used for the password:

Communication Protocol	Permitted characters	Note
IFLAG	letters a-z, A-Z, digits 0 to 9	password length 1 to 6 characters case-sensitive
CTR	digits 0 to 9 (the device allows for entering letters, which however are not accepted by the counterpart station)	password length must be 6 characters (the device allows for entering shorter password, which however is not accepted by the counterpart station)
MODBUS	digits 0 to 9	password length 1 to 6 characters

Tab. 33 Password format

i

Turning on password protection:

- Enter the password with identifier ID 801

Turning off password protection:

- Delete the password with identifier ID 801.

Deleting the ID 801 password deactivates the other passwords set in each group, but their settings are not lost. They become active again once password protection is enabled.

Password Group	Password IDs	Description
Administrators	801 to 810	When the metrology switch is set to ON, the metrological properties of the device can be changed: • Loading a new firmware using the "Loader" • Resetting metrological archives (settings archive, status archive, gas composition archive) • Transducer replacement, calibration of the transducer • Creating or removing metrological quantities • Changing the name or prefix of metrological quantities • Setting Tb and Pb • Changing the device state • Changing a restriction • Setting Vb, Vbs • Setting the schedule of the tariff currently active When the metrology switch is set to OFF, it is possible to: • Load a new firmware using the "Remote Download" • Setting the system time of the device if the device is used with CTR protocol (in other cases, the settings can be made for lower-level users)
Maintenance	811 to 820	Switching to the "Maintenance" mode and back to "Normal"

User 1	821 to 830	Depending on the influence of the service switch, the parameters are divided into groups. For the influence of the service switch, see Tab. 32. Parameters influencing metrological properties: • Setting the spare values to calculate the conversion factor • Setting the units for the system quantities (Tb, Pb, combustion heat), of reference conditions for combustion heat calculation • DST mode setting (summer / winter time) • Setting the parameters for storing the billing archive • Unit and constants of the quantity, configuration of the pulse input of metrological quantities • Setting the values for counters of volumes other than Vb, Vbs • Assigning the influence of the service switch to parameter entering • Changing the compressibility calculation method Other parameters: • Adding to or reducing non-metrological quantities • Setting the parameters of non-metrological quantities - name, marking, unit, constants • Saving to the appropriate data archive • Setting the input quantity connection with the output in the form of the user equation • Setting the communication parameters • Setting the descriptive data - station name • Setting the measurement frequency and the archiving frequency
User 2	831 to 840	permits: • Setting the gas composition (via keypad only) • Setting the system time (when using CTR, this setting is only possible for the "Administrators" group)
User 3	841 to 850	• Permits reading data from the device • (does not permit writing to the device) • Setting the access password

Tab. 34 Password groups and their specifications

Notes:

The administrator with password identifier 801 is authorized to:

- Set passwords for other administrators (ID 801 to 810)
- Set passwords with identifiers ID 811, 821, 831 and 841

The first user in each group (ID 801, 811, 821, 831 and 841) is allowed to assign passwords to other users in the same group.

10.6.3 Access levels

Device users can be divided into different access levels for modifying parameters and other operations.

User level

- Common device users are allowed to read all data from the device and to set a large number of parameters. They cannot change parameters directly affecting the device's metrological properties. For more details, see Tab. 35. A service switch along with user mark and a password system can be used to protect against misuse.

Accredited Service Centre (ASC)

- Intended for manufacturer's authorized service center staff, they are entitled to carry out operations that affect the device's metrological properties. These activities require breaking the official mark, switching the metrological switch and using a **special HW key** for the service software [38]. For a description, see Tab. 36.

User Level			
Activities		Service switch	Activities permitted with password protection
Reading data	- Reading actual values of quantities - Reading archives - Reading parameters	OFF, ON	Permitted with password protection off
Non-metrological parameters changes	- Turning archiving of the quantities into the archives on / off - Setting the measurement frequency - Setting archiving frequency of data archive - Changing passwords - Resetting archives - Setting the internal time of the corrector - Setting communication parameters - Setting station identification - Setting the start time of the gas day - Switching displaying the actual values of non-metrological variables on / off - Configuring digital inputs - Configuring digital outputs - User designation of the quantities	ON	Permitted with password protection off
Metrological changes	- Assigning the influence of the service switch on parameter writing - Setting the V and Vs counters - Changing the method of calculating the compressibility factor - Setting the gas composition - Setting units and constants - Setting of temperature and pressure spare values for conversion	ON	

Tab. 35 User access level - for "full" service switch functionality

Authorized Service Centre (ASC) Level			
Activities		Service switch	Activities permitted with password protection
	- All the activities described in the user level - Setting the status bit mask (Diagnostics quantity)	OFF, ON	Note: When using the HW key, the effect of passwords is suppressed, if used with the device.
Metrological changes	- Firmware upgrade - Changing metrological approval variant (NMI, CMI, MID, ...) - Setting the reference temperature - Setting the reference pressure - Setting Vb, Vbs - Configuring metrological quantities (C, K, V, Vb, Vs, Vbs) - Replacing the transducers - One-point or two-point transducer calibration - Reset the settings archive and status archive - User designation of the quantities	ON	Using the HW key designated WGQOI, "Accredited Service" version

Tab. 36 ASC access level

11 Accessories

11.1 External modules

The main function of these modules is to provide an external power supply to the device and to the internal modem, and also to ensure other cooperating devices are properly connected to expand the device's utility features. Since the device is intrinsically safe, the following modules act as a safety barrier (except for the CLO module) for connecting conventional devices.

Dual module design

Most of the modules are available in two versions - basic design and the designation "/A" (e.g. PS-E and PS-E/A) design. Both designs are functionally identical, the only difference being in resistance in terms of intrinsic safety, current consumption and the possibility of galvanic isolation.

Basic design - for normal use, the module is powered with a 12 V supply connected to a 230 Vac power supply (intrinsically safe parameter $U_m = 250V$). The intrinsically safe module terminals are galvanically isolated from the other terminals.

"/A" design - the module has reduced its own current consumption, therefore it is suitable for installations where no 230 Vac power supply is available and which are powered by a battery (intrinsically safe parameter $U_m = 60V$). In this case, the power supply battery must not be charged from a power supply connected to the 230 Vac power supply. The intrinsically safe module terminals are not galvanically isolated.

The external modules are designed for DIN rail mounting into the switchboard. There is a separate manual for the modules [35].

11.1.1 Intrinsically safe sources for external power supply

PS-E PS-E/A	External intrinsically safe power supply for the corrector (powered from 12Vdc mains)
PS-M1 PS-M1/A	External intrinsically safe power supply for internal 2G, or 4G, or NB (powered from 12 Vdc mains)
PS-M PS-M/A	External intrinsically safe power supply for internal 4G LTE-Cat 1 modem (powered from 12Vdc mains)

11.1.2 Separation and communication modules

B-RS mod R B-RS/A mod R	Separation barrier for RS485 (possibility of conversion to RS232)
B-DO B-DO/A	Separation barrier for digital inputs (4x)

11.2 Other accessories

CLO	4-20 mA analogue output module
HIE-04 B	IR head with USB communication interface (max.115 200 Bd)
EDT 124	Temperature transducer
EDT 125	Pressure transducer, internal or external

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13 Software

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14 Trademarks used

{1} IrDA® - trademark of Infrared Data Association

{2} ModBus® - trademark of Modicon

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Appendix A Device design with segment display

A1 Operating the device

The device is equipped with a two-line segment custom-made LCD display with icons for viewing data. The segment display can be supplied either with and without backlighting. It brings the following changes in display features compared to the graphic display normally used:

- Permanent display of data (the display does not switch off) while maintaining the device's specified battery life
- Segment display without backlighting (standard) – display data between -25 °C to +70 °C
- Segment display with backlight – display data even in frost below -20 °C (at an ambient temperature between -40 °C ÷ +70 °C)
- Limitations in the display of some data, worse readability of text data

The device is not equipped with a power switch. If the battery is inserted and connected to the device, the device automatically switches to operation mode and the device display shows continuously. If the battery is disconnected or discharged, the device display goes off.

The device can be equipped with a six-key keypad, the same as in the version with a graphic display, or a two-key keypad. Device settings cannot be made from a two-key keypad.

The keypad is activated by pressing  for more than 2 seconds. When the keypad is activated, the display backlight is activated.

A1.1 Standard display

Actual values of measured and calculated quantities are displayed automatically when the device is operating in standard mode. These quantities are displayed gradually and periodically. The designation of the displayed quantity appears in the first line of the display, while the value is displayed in the second line. The quantities whose values are desired to be displayed can be set by a user.

Features of the standard display

- Standard display - periodically displays actual values of measured or calculated quantities selected by the user
- Each quantity is displayed for 5 seconds, or for 15 seconds for volume at base conditions Vb
- Display without diacritical marks

Parameterization of the device with the service SW. enables individualized display of selected quantities to be set in addition to the standard display of actual values.

A1.2 Display using keypad keys

Keypad keys allow the various device parameters, system data, and device diagnostics, including the status of the internal modem, to be displayed along with the values of actual and calculated data. The data to be displayed are selected using the device menu (see A2.1). What items the menu displays depends on the parameters set in the device. The contents of some menu items can be user-configured.

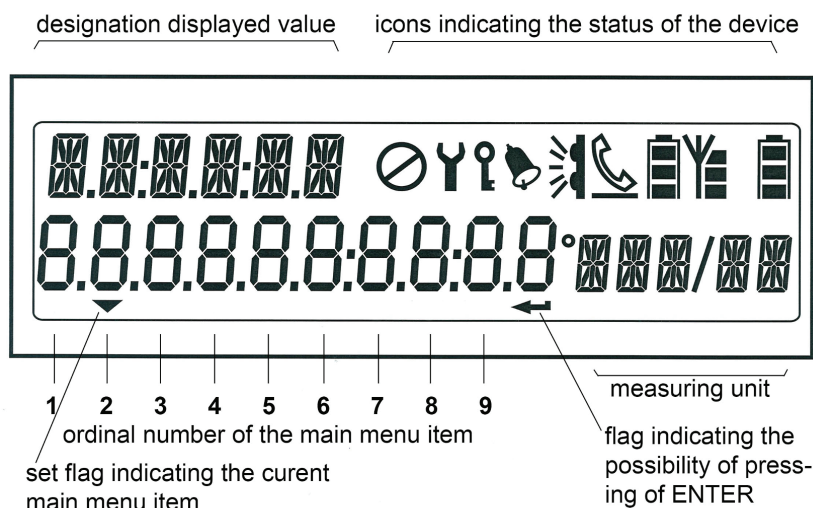
Display features

- The display switches to the default in compliance with standard EN 12405-1+A2, Section 6.3.1.5. The parameters can be used to select the time after which the device switches to the default display.
- For untrained users to operate the device easily, there is an option of displaying actual values sequentially, by pressing . First, exit to the top menu level by pressing the button  several times.

i

The device does not display the contents of archived data, which can only be done with the service SW [38], running on a PC connected to the device.

A1.3 Device display



	Indication of the operating state "Unconfigured"
	Indication of the operating state "Maintenance"
	Indication of the status of the metrological and service switch lighted: - The metrology or service switch is ON
	Indication of the status checksum not shown: - status OK lighted: - Warning or Error
	The communication channel of the device is switched to the optical interface. lighted: - infrared head is attached
	The GSM / GPRS modem is serviced by the communication channel of the device. The modem is being registered with the network and an IP address is being assigned.
	The GSM / GPRS modem is serviced by the communication channel of the device. Communication is established in the GPRS mode.
	Battery status of the GSM / GPRS modem. The number of black rectangles displayed indicates the battery capacity: number of rectangles: 3 2 1 0 capacity: >50 % 25÷50 % 10÷25 % <10 %

	Indicates the signal strength of the GSM network at the device location. The number of black displayed rectangles indicates the signal strength: number of rectangles: 3 2 1 0 signal strength: $\geq 75\%$ $50 \div 74\%$ $25 \div 49\%$ $< 25\%$
	Device battery charge condition. The number of black rectangles display indicates the state of the battery. number of rectangles: 3 2 1 0 capacity: $> 50\%$ $25 \div 50\%$ $10 \div 25\%$ $< 10\%$

Tab. 37 Meaning of display icons

A2 System menu

Data that appears on the device display are structured based on the menu. Main menu items are at the highest level and pressing the **Enter** key for them navigates to the lower menu (submenu). To return from the submenu back to a higher level, press **Esc**.

A2.1 Main menu

The menu depends on the parameters set in the device. The set of items below can be changed according to the device settings.

The main menu consists of eight items. The main menu can be displayed from the home screen (Vb) by pressing **Enter**. Use **▶** and **◀** to scroll through the items. If any of the main menu items contains a submenu (e.g. item PARAM, CONFIG or SYSTEM etc.), the submenu is entered with the **Enter** key.

	main menu	1st submenu	2nd submenu	3rd submenu	note
1	Vb				actual value of the volume counter at base conditions
2	ACTUAL				actual values display
		Vb			actual value of the volume counter at base conditions
		Vm			actual value of the primary volume counter
		E			actual value of energy
		P			actual value of gas pressure
		T			actual value of gas temperature
		Q			actual value of primary flow rate
		Qb			actual value of flow rate at base conditions
		C			conversion factor
		K			gas compressibility factor
		Z			gas compressibility factor at measurement conditions
		Zb			gas compressibility factor at base conditions
		Vbs			actual value of the spare value at base conditions
		Vs			actual value of the spare value at measurement conditions
		... etc.			other items depending on the device configuration

	main menu	1st submenu	2nd submenu	3rd submenu	note
3	MENU1				user-defined display of actual values
4	(reserve)				reserved
5	PARAM				display of device parameters
		COMMUN			communication parameters
			COM.GEN.		general
				ADDR	communication address 1
				ADDR2	communication address 2
			IR.HEAD		optical head
				SPEED	communication speed
				PROT.	communication protocol
			COM0		internal modem
				SPEED	communication speed
				PROT.	communication protocol
				COM.DEV.	communication device
			COM1		RS232/RS485 interface
				SPEED.	communication speed
				PROT.	communication protocol
		SERV			service parameters
			S.N. DEV		serial number of the device
			I.D. DEV		identification number
			VER.APP		application firmware - version no., CRC
			VER.MTR		metrological firmware - version no., CRC
			VER.LDR		loader - version no., CRC
			ST.NAME		station designation
		CONV			gas volume conversion parameters
			CONV.G		
				STAND.C	compressibility calculation method
				PB	pressure reference value
				TB	temperature reference value
				ZB	gas compressibility factor under reference conditions
				C1H4	Concentration of CH ₄
				CO2	Concentration of CO ₂
				H2	concentration of H ₂
				N2	concentration of N ₂
			C		

	main menu	1st submenu	2nd submenu	3rd submenu	note
				C.TYPE	
				P.SPARE	spare pressure value
				T.SPARE	spare temperature value
				K.SPARE	spare compressibility value
				STAND.C	
				P.RANGE	pressure measuring range
				T.RANGE	temperature measuring range
		INPUTS			inputs parameters
			Vm		operating volume
				GAS KP	gas meter constant [imp/m ³]
				SN.GAS	serial number of the gas meter
			P		pressure measurement
				P.RANGE	pressure range
				SN. P	serial number of the transducer
			T		temperature measurement
				T.RANGE	temperature range
				SN. T	serial number of the transducer
6	CONFIG				setting the device parameters from the keyboard
		SERV			setting service parameters
			ST.NAME		station designation
			GAS.H.		hour of the beginning of the gas day
		COMMUN			setting of communication parameters
			COM.GEN.		general parameters
				ADDR	communication address 1
				ADDR2	communication address 2
			IR.HEAD		optical head
				SPEED	communication speed
				PROT.	communication protocol
			COM0		internal modem
				SPEED	communication speed
				PROT.	communication protocol
			COM1		interface RS232/RS485
				SPEED	communication speed
				PROT.	communication protocol
		GAS.COM.			gas composition setting
			CO2		concentration of CO ₂

	main menu	1st submenu	2nd submenu	3rd submenu	note
			H2		concentration of H ₂
			N2		concentration of N ₂
			C.VALUE		calorific value
			DENS		relative density
		DAT:TIM			
			TIME		setting the system time of the device
			DATE		date setting
		VOL1			volume measurement settings
			GAS KP		gas meter constant setting
			Vm		operating volume setting
			Vb		setting the corrected volume
			Vs		setting the spare operating volume
			Vbs		setting the spare corrected volume
			E		energy setting
			Es		spare energy setting
			S.N. GAS		setting the serial number of the gas meter
			QMAX		setting of max. gas meter flow
		CLEAR.A.			deleting the contents of archives
			DATA.AR.		deleting a data archive
			DAY.AR.		deleting a daily archive
			MONTH.A.		deleting a monthly archive
			TARIFF		deleting a tariff archive
			BINARY		delete a binary archive
			LIMIT.A.		deleting limits archive
			SETUP.A.		delete a settings archive
			STATUS.		deleting a status archive
			GAS.AR.		deleting a gas composition archive
		WORK.M.			operating mode settings
		SAVE.PA.			writing the set parameters to the device
7	SYSTEM				display of system parameters
		TIME			system time display
		DATE			display of system data
		RESET			reset of device
		MODEM			modems parameters
			MODEM1		modem no.1 parameters
				GPRS.IP	the current IP address of the GPRS modem

	main menu	1st submenu	2nd submenu	3rd submenu	note
				MODERR	modem last error code and time of occurrence (format Err.xx hh:mm DD.MM.YY) „xx“ – modem error message code (see Tab. 25)
				SIGNAL	Measurement of signal strength triggered by a command from the keyboard. The measurement status is displayed: BTS:test After a successful signal strength measurement, the percentage value is displayed (SIG:xx [%], conversion on dBm – see Tab. 24). Automatic termination after 2 min or by the user.
				MOD ON	manual switching on of the modem power supply from the keyboard according to the set mode is switched on or switched on and connected to GPRS displays the time in seconds until the connection is automatically terminated and the modem is turned off automatic termination after 5 min or by the user
				CALL	manual initialization of GSM / GPRS calls from the device to the master system must be enabled in the parameters after activating the command, the text "working" will be displayed then you can exit the mode and the device will perform the action
		BAT.EVC			remaining battery capacity of the device [%]
		BAT.MOD			remaining modem battery capacity [%]
		Vcc			battery voltage
		LATCH			Displays and freezes the current values on the display. This function is used when checking the function of the device in the field (called abbreviated test). For Vb, Vbs, E, Es values, the decimal part of the value is displayed after pressing Enter.
8	DIAG				Device diagnostics
		ACT.ST.			The current status of the device is displayed (browsing with the ENTER key)
		SUM.ST.			The total status of the device is displayed (browsing with the ENTER key)
		SUM.CLR			resetting the total status
		TEST			start the device test
9	TARIFF	ID.CURR			
		ID.PREV			
		PREV.D			

Notes:

1. The number of characters (digits) that appear on the display at a time is limited to 10. If longer information needs to be displayed (such as item ST.NAME - Station Identification), the displayed information will be scrolled.
2. Some menu items may not be displayed unless they are used in the device (the device is not configured for such functions).

A2.1.1 ACTUAL menu – actual values display

(consecutive number 2 of the main menu)

Actual values of metrological quantities and set non-metrological quantities are displayed (non-metrological quantities are set in the parameters of the device using the utility software [38]). The default view (device idle) displays this data periodically (except as in A2.1.2).

Indication of exceeding the limit

If the value of the measured quantity is outside the measuring range of the device, the "E" flag appears before the displayed numerical value.

A2.1.2 MENU1 menu

(consecutive number 3 of the main menu)

This item is displayed only if it is set in the device. Settings can only be made with the utility SW [38]. These settings allow actual values to be displayed in the order defined by a user.



If the MENU1 menu is set in the device, the display of the actual values defined in the ACTUAL.V. item is suppressed and the actual values defined in the MENU1 item are displayed.

A2.1.3 PARAM menu

(consecutive number 5 of the main menu)

Select this menu to display the device's set parameters. The displayed parameters are divided into several groups: communication parameters, service parameters, gas quantity conversion parameters and input parameters.

A2.1.4 CONFIG menu

(consecutive number 6 of the main menu)

Use this menu to set the device parameters from the keypad. Service parameters, communication parameters, gas composition, system date and time, gas meter parameters and volume measurement parameters can be set. After changing the parameters, the changed values have to be saved to the device's memory using the last submenu option SAVE.PA.



The setting of the device parameters from the keyboard can be protected:

- service switch (for writing the switch must be in the ON position)
- password (for more details see paragraph 10.6.2)

If the service switch is in the OFF position, the message "not.possibl" will appear on the display.

Select CLEAR.A to delete the contents of the device archives.

A2.1.5 SYSTEM menu - system data

(consecutive number 7 of the main menu)

RESET - Device Reset

Device reset causes the program to jump to the starting address and re-initializes the entire metering system. Neither the contents of all archives, nor the values of gas volumes (Vm, Vs, Vb, Vbs) change during this operation. The same applies to all the other parameters that have been set. The command executes independently of the position of the service switch.

MODEM

This option finds out the device's assigned IP address for the configured GPRS modem and the mobile network's signal strength where the device is located. It is also possible to turn on the modem and possibly initiate a connection with the dispatch center if the device is configured to send alarms. These operations are especially useful when configuring the modem and putting the device into operation.

LATCH – Freezing Actual Values

Pressing the key freezes measured actual values on the device display. Frozen values of quantities (for example Vb, Vm, P, T) can be displayed in the standard way as in the display of actual values. The frozen values of quantities (like Vb, Vm, P, T) can be displayed in the standard way as when displaying the actual values. Press  to stop displaying the frozen quantities.

The LATCH function is suitable for manual copying of actual values of measured quantities when checking the device's accuracy.

A2.1.6 DIAG menu – device diagnostics

(consecutive number 8 of the main menu)

Information on the device's condition is stored in the DIAG menu.

ACT.ST. - Actual Status

This menu displays the device's current status. Pressing  displays all the current errors and warnings of the device in sequence.

SUM.ST. - Summary Status

The summary status monitors all active error states (individual device status bits) that have occurred since the last summary status reset. This means that the states of the device, which may have already disappeared, are also stored here.

Basic information about the summary status is also displayed as a "bell" icon on the device display.

SUM.CLR - Summary Status Reset

Selecting this option with the device keypad or the "Summary Status Reset" option from the "Setup-Diagnostics" menu in the PC service SW resets the summary status, i.e. current status is set according to actual status. The service switch must be ON to enable the reset. If it is switched to OFF, a message ("Not Possible") is displayed, indicating that the reset cannot be performed.

TEST - Device Test

After selecting this menu item, the device tests its internal state and displays a list of detected errors and warnings. The test runs for several seconds (the message "Working" appears on the display) and does not affect the actual measuring and archiving operation of the device. The command executes independently of the position of the service switch.

The notification is displayed during the test. Indicated errors are identified with the prefix "E" and the identification number; similarly, the prefix "W" is used for warnings ¹²⁾. Refer to Tab. 26, Tab. 27 for a complete list of error messages and warnings.

12) Due to the limited characters appearing on the customer display, the "W" is displayed as "U"

Dresser Utility Solutions GmbH

Hardeckstr. 2

76185 Karlsruhe

T: +49 (0)721 / 5981 - 0

info.karlsruhe@dresserutility.com



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