Corus Evo+

Gas Volume Converter

User Manual V2.2

Safety Measures

Only a person trained in accordance with the specification, safety regulations and EN standards may operate the metering device. In addition, other legal and safety regulations for special cases of use in potentially explosive atmospheres must be taken into account. A similar measure applies to the use of the accessories. Training for the operators must be in accordance with safety at the workplace (national standard).

The information in these instructions do not establish legal commitment by the manufacturer. The manufacturer reserves the right to change them. Changes in the instructions or of the product itself may be made at any time without prior notice in order to improve the device or to correct typographical or technical errors.

CONTENTS

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	
CLO	...	4-20mA current output module	
CRC	...	checksum - for data protection purposes	
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 Vb 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	…	substitute energy value	MJ
EDTxx		digital transducer of pressure EDT 96 or of temperature EDT 101	
Iflag Evo	…	Native communication protocol of Corus Evo+	
EMC	...	electromagnetic compatibility and resistivity	
EMI	...	electromagnetic radiation	
EVC		Electronic gas volume corrector	
firmware, FW	...	software in the device	
GOST 30319.2	…	method to calculate gas compressibility factor	
GOST 30319.3	…	method to calculate gas compressibility factor	
H_s	...	combustion heat	MJ/m^3
JB	...	intrinsically safe, intrinsic safety	
MID		Measuring Instrument Directive, 2014/32/EU Directive about measuring instruments supply to the market (NV 120/2016 Sb.)	
Modbus	...	Modicon communication protocol [15]	
MPE	…	maximum permissible error	
M900	...	RMG communication protocol	
SGERG-88	...	method to calculate gas compressibility factor, for more details refer to [18]	
SW	...	software – PC program	
C	...	conversion factor	-
K	...	gas compressibility factor (Z/Z_b)	-
k_p	...	gas meter constant (number of pulses per $1m^3$)	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
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}	...	substitute volume at base conditions (substitute converted volume)	m^3
V_s	...	substitute volume at measurement conditions (substitute primary volume)	m^3
V_d	...	primary volume difference	m^3
V_{bd}	...	volume difference at base conditions	m^3
HF	...	primary volume for the set tariff (tariff counter of primary volume)	m^3
V_{bf}	...	volume at base conditions for the set tariff (converted volume counter)	m^3
Z	...	gas compressibility factor at measurement conditions	-
Z_b	...	gas compressibility factor at base conditions	-

1 Introduction

1.1 Basic Description of the Device

The Corus Evo+ gas volume converter (hereinafter referred to as the device) is a measuring device designed to convert the volume of gas measured under operating conditions to volume under base conditions.

The gas volume information is scanned through the gas meter's pulse outputs or through the encoder data output. Gas temperature and gas pressure are measured with integrated transducers. The gas compressibility degree the instrument calculates according to common methods or a constant value is used.

The converter has been designed and approved according to the harmonized standard EN 12405-1:2018 as a Type 1 converter and can be used as a T, TZ, PT or PTZ converter.

The device can also be used without its sensors as a data logger (without performing volume conversion). In this case it doesn't perform any metrological activity.

From a safety point of view, the device has been designed to be intrinsically safe according to EN 60079-11 and IEC 60079-11 and approved for potentially explosive atmospheres.

The device is manufactured and delivered in accordance with the following directives of the European Parliament and of the Council:

2014/34/EU	(ATEX) Equipment and protective systems intended for use in potentially explosive atmospheres
2014/30/EU	Electromagnetic Compatibility
2014/32/EU	(MID) Measuring Instruments
2014/53/EU	(RED) Radio Equipment and Telecommunication Broadcasting Equipment
2011/65/EU	(RoHS)

The device is placed on the market and put into service according to the above-mentioned directives with the CE mark affixed.

The device is built in a housing made of durable plastic with IP66 rating. It is equipped with a graphic display or segment display and 6-key keypad.

The device is powered by a battery pack, with several packs available (1 D size battery pack or 2 D size battery pack, or an Alkaline battery pack). In the defined operating mode, the battery life is 18 years with the 2 D battery pack. It can also be powered from an external power supply.

For gas pressure measurement, the device is equipped with a digital pressure sensor positioned as standard in the bottom of the device housing. A digital temperature transducer located on the cable is used to measure the gas temperature. The gas meter information on gas consumption can be transferred to the corrector from the pulse output of the meter (LF or HF) or from the gas meter encoder data output.

In addition to the pulse inputs, the device also has binary inputs that can work for example as control inputs to check the connection to a gas meter or perform other functions such as monitoring the state of the safety quick closing valves, condition of the door etc. The device has also digital outputs that can be configured as pulse, binary, or data outputs for the CLO module. Analogue current output can be implemented using this module.

To store the values, the device uses several types of internal archives. The data archive stores the measured and calculated values, has an adjustable structure with an adjustable storing frequency.

In the daily and monthly archives, it is possible to program the storing of important quantities and the calculation and storage of some statistical values. The binary archive captures changes on binary inputs and occurrence of supervised events (limits, ...). Error states and diagnostics are stored in the status archive. In the settings archive, operations that affect the device parameters are recorded for service and metrology purposes when changing the settings. In addition, other archives are available; for more details, refer to Section 11.3.

The device is equipped with serial interface RS232/RS485 for communication with superior system. The various communication protocols installed in the device allow easier connection to SCADA systems. The device can be supplied with built-in modems of both modern fast communication networks and older 2G networks. In the event of an alarm condition, the device can initiate the connection itself. The device also works with standard telephone, radio, GSM and GPRS modems via the RS232/RS485 line.

The device allows wide-range user parametrization. The device can be configured using the keypad of the device or the supplied PC software (see [20]. This software also allows reading, displaying and archiving both actual measured values and the internal archives contents.

1.2 Main characteristics

Name	**CORUS Evo+**
Manufacturer	**Dresser Actaris™ Gas**
Type	**Gas volume conversion device - Type 1**
Model	**T, PT or PTZ**
Metrology	**Conform to EN12405-1A2:2010 (for MID approval)** **Accuracy conform to EN12405-2 class B (0,5%), optionally class A available (0,3%).** **Energy calculation conform to EN12405-2** **MID test certificate: TCM-134/20 - 5716 by CMI (module B)** **MID production approval by PTB (module D)**
	PTZ model: Z computed according: ➢ **S-GERG 88** ➢ **AGA NX-19** ➢ **AGA NX-19 mod** ➢ **GOST 30319.2-2015** ➢ **GOST 30319.3-2015** ➢ **AGA 8 – Gross method 2 (GM1 or GM2)** ➢ **AGA 8 – Detailed method (DM)**
Ambient temperature range	**-25°C to +70°C (optionally from -40°C with alphanumeric LCD)**
Gas temperature range	**[- 30°C; +70°C]**
Reference conditions	**Pb: 101.325 kPa, 100.000 kPa, 101.592 kPa, 101.560kPa, 101.0085 kPa, 102.3872 kPa, 103.5937 kPa (other units available)**

	Tb: 15°C, 0°C, 15.55555°C, 20°C, 25°C, 27°C (other units available)
Protection class	**IP66 according EN60529, covered outdoor installation**
Power Supply	• **Main Internal battery B-03 (17Ah) or B-03D (30Ah) battery or B-03A alkaline battery or external DC voltage (requires optional module to be added in to the product)** • **Internal back-up battery lithium** • **Additional internal batteries and power module forecasted for use with internal cellular modem**
Internal power supply	**Nominal voltage: 3.6V DC**
External power supply	**Limits: 6 V DC < Vext < 12 V DC** **Nominal voltage: 10V DC**
Pressure ranges MID	- **80 - 520 kPa** - **200 - 1000 kPa** - **400 - 2000 kPa** - **700 - 3500 kPa** - **1400 - 7000 kPa** - **2500 - 13000 kPa** - **80 - 1000 kPa** - **80 - 2000 kPa extended optional range** - **400 - 7000 kPa extended optional range**
Pressure ranges non MID	- **80 - 1000 kPa absolute pressure value** - **80 - 2000 kPa absolute pressure value** - **80 - 3500 kPa absolute pressure value** - **80 - 7000 kPa absolute pressure value** - **80 - 13000 kPa absolute pressure value** - **0 - 20 kPa relative pressure value** - **0 - 100 kPa relative pressure value** - **0 - 160 kPa relative pressure value** - **0 - 400 kPa relative pressure value** - **0 - 600 kPa relative pressure value** - **0 - 1000 kPa relative pressure value** - **0 - 2500 kPa relative pressure value** - **0 - 4000 kPa relative pressure value** - **0 - 7000 kPa relative pressure value**
Pressure sensor type	**External Piezo-resistive transducer with integrated coefficients for linearization**
Temperature probe	**Platinum probe - PT1000 class A according EN60751 with integrated coefficients for linearization**
Metering input (volume)	**Low frequency type (10Hz max.)** **High Frequency (5KHz max) with optional module** **Namur Encoder input with optional module**
Cables length	**Max 2.5 or 5m, approved with up to 30m**

'CE' marking	- **2014/34/EU (ATEX) Equipment and protective systems intended for use in potentially explosive atmospheres** - **2014/30/EU Electromagnetic Compatibility** a) - **2014/32/EU (MID) Measuring Instruments** b) - **2014/53/EU (RED) Radio Equipment and Telecommunication Broadcasting Equipment** c) - **2011/65/EU (RoHS)**		
Electromagnetic class	**E2**		
Mechanical class	**M2**		
Humidity	**Designed for condensing and non-condensing humidity environments.**		
ATEX and IECEx classification	**Version**	**IECEx**	**ATEX**
	- Basic version	**Ex ia IIB T4 Ga**	**II 1G Ex ia IIB T4 Ga**
	- With internal modem (battery-powered)	**Ex ia IIB T3 Ga**	**II 1G Ex ia IIB T3 Ga**
	- With internal modem powered from external source S4-PWR2	**Ex ib IIA T3 Gb**	**II 2G Ex ib IIA T3 Gb**
Enclosure material	**PC (polycarbonate)**		
Enclosure dimensions (mm)	**263 x 201 x 111 mm**		
Total weight (approx.)	**2 kg**		
Display	**LCD graphic display, 128 x 64 pixels, backlit, or** **Multi-segment display (for -40°C environment)**		
Keyboard	**6 keys – Capacitive type**		
Communication ports	**Standard: Optical port** **Option: 2 RS232/RS485 boards max, 1 internal cellular modem**		
Nature of measured gas	**Fuel gases of the first and second family according EN437**		
Units of main data	**Pressure (absolute): bar, Psi, kPa, kgm/cm2** **Temperature: °C, °F, °R** **Volume: m^3, Cft** **Energy: MJ, kWh, Btu**		

Main features

- the latest technology used to ensure the high performance of the device and its high resistance to use and handling
- robust cabinet designed for covered outdoor use, the cover is equipped with a closing mechanism that keeps the lid closed without securing the screws
- high immunity to electromagnetic interference (EMC), withstand up to twice the interference values required by the industry standard
- modular architecture for easy customization
- digital inputs and outputs widely configurable by the end user
- resistant capacitive keyboard for easy operation of the device
- display of actual and archival values - a graphic display option
- device variant suitable for temperatures up to -40°C with always ON multisegment display
- new generation of pressure and temperature digital transducers with high precision and long-term stability
- linearization coefficients of sensors (pressure and temperature), stored on sensors, facilitating field maintenance
- high capacity FLASH memory for internal archives for storing measured and calculated data for several years
- communication with the device via several independent communication channels. It can run locally or remotely via an internal modem in the latest generation networks with different communication protocols
- each communication channel can communicate with different protocol
- communication is completely independent and does not affect the measurement, computation and data archiving system
- possibility of remote download of the FW according to Welmec 7-2 Extension D
- several degrees of protection against device abuse have been implemented
- changing the device settings locally or remotely
- open architecture to satisfy new requirements and projects
- allows battery operation up to 18 years without battery replacement
- battery capacity is stored in the battery pack, device measures capacity loss continuously and updates the figure stored in the battery pack.
- connecting gas meters with LF (reed, Wiegand), HF (NAMUR) pulse outputs, or various types of encoders (NAMUR, SCR +)
- use as a single-channel or two-channel gas volume corrector with the possibility of adding a non-metrological channel
- modular architecture allows to create different configurations (up to 6 pressure or temperature transducers, 12 digital inputs, 4 digital outputs, 6 analog inputs and 4 analog outputs)
- battery power supplied devices with an option of external power supply
- reading of NAMUR encoder (like Cyble SC) in battery mode (without external power supply)
- 4 independent communication channels with high communication speed (up to 115kBd)
- possibility to connect two modems (internal / external + external)
- optional meter error curve correction, when using HF input for volume

1.3 Securing the Device

The device is equipped with the following mechanisms against abuse:

Sealing the device

- sealing of the closed device with the seal of the user and the possibility of locking the device by a lock (par. 5.2 and 5.5.1.2)
- sealing the connection of the pressure transducer to the pipeline (par. 5.4.1)
- sealing the connection of the temperature transducer to the pipeline (par. 5.4.2)

Sealing of the internal parts (par. 5.2)

- protection of metrological parts by an official MID seal
- protection of selected non-metrological parts by the manufacturer's identification seal or by the user's identification seal

Tampering device detection

- detection of the opening of the device with the possibility of sending an alarm (**Fig. 37**)
- detection of removing metrological covers with the possibility of sending an alarm

Device configuration and data protection (11.6)

- metrological switch - secured by the official MID seal, blocks the execution of operations that directly modify the metrological characteristics of the instrument (e.g. measuring accuracy, calibration of transducers, exchange of transducers, setting of converted volume counters, etc.)
- service switch - is used to block parameter settings that do not directly affect the device's metrological properties.
- password security - optionally, you can use 50 passwords in 5 groups with different hierarchy of authority to modify the device settings.
- unique encryption keys for each device
- encryption - protection of transmitted data by encryption (symmetric AES encryption with 128-bit encryption key length) This option is optional and can be used for data transmission by Iflag Evo protocol, or CTR protocol. (par. 10.4)

All changes to device parameter settings, along with the worker's identification mark, are stored in a non-resettable setting archive.

1.3.1 Features

Corus Evo+ can be supplied in a single channel or dual channel design. Its features can be largely customized by additional modules. The device can be operated either as battery-powered or with external power supply. In devices equipped with an internal modem, the modem is powered by a separate battery; alternately, it can be powered from an independent external power supply. Extension modules are inserted into slots (SLOT 0 to SLOT 5) on the input board.

a) Basic (minimum) configuration of the device:

- Single channel (dual channel) battery corrector
- Six-key keypad
- Graphic or multisegment display
- 1 x (2 pcs) digital pressure transducer EDT 96
- 1 x (2 pcs) digital temperature transducer EDT 101
- 1 x (2 x) pulse input for connecting the gas meter with the LF pulse output
- 2 x (2 x) digital input
- 4 x digital output (binary, or pulse, or analog)
- Optical head communication
- 1 x corrector battery

b) The basic version can be extended by one of the following modules:

- 1 x interface module for gas meter with encoder (SLOT 0 position):
  - NAMUR interface module for NAMUR encoder like Cyble SC; or
  - SCR interface module for SCR encoder; or
  - Module for connection of HF pulse output of gas meter (module EXT1)
  - module for connection of HF pulse output of gas meter and extension of digital and analogue inputs (EXT1 module with auxiliary terminal board EXT1-T)
- 1 x communication interface or analogue input/output module (SLOT 1 position):
  - Communication module RS232/RS485 for communication with the master system; or
  - Analogue input module 4 - 20 mA (2 inputs); or
  - Analogue output module 4 - 20 mA (2 outputs)
- 1 x communication interface or analogue input/output module (SLOT 2 position):
  - Communication module RS232/RS485 for communication with the master system; or
  - Analogue input module 4 - 20 mA (2 inputs); or
  - Analogue output module 4 - 20 mA (2 outputs)
- 1 x PWR1 module for connecting an external IS power supply for the device (SLOT 3)
- 1 x modem external power supply module or communication interface for external modem (SLOT 4 position):
  - PWR2 module to connect an external IS power supply to the modem, or
  - RS232 communication module for connecting an external modem
- 1 x internal modem module (SLOT 5[1] position) /including battery for internal modem/:
  - 2G modem (i.e. GSM, dial-up CSD and GPRS connection); or
  - LTE modem

The designations and features of the modules are specified in Section 3.11.

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[1]) If the modem is not powered externally, the internal modem must be installed in SLOT 4 position.

2 Safety

2.1 General

The device has been approved according to Directive 2014/34/EU and the following certificates has been issued for it:

FTZÚ 19 ATEX 0035X	EU type-examination certificate (ATEX) for use in potentially explosive atmospheres.
IECEx FTZU 20.0001X	IECEx Certificate of Conformity

Important Notices:

ATTENTION!

The device has been designed in accordance with safety rules for use in potentially explosive atmospheres. It has been approved as an intrinsically safe device in accordance with EN 60079-11.

DANGER!

The device must be installed and used in accordance with this documentation and the conditions stated in the ATEX certificate.

WARNING!

Only batteries listed in the technical parameters table (see Sections 3.4 and 3.11.3) may be used to power the device.

The battery replacement procedure should be performed in accordance with this documentation (see Sections 7.4.2 and 7.4.4).

WARNING!

The IP66 rating is valid only if correctly tightened cables of the appropriate diameter are used in the cable glands of the device. Unused cable glands must be blinded.

2.2 Using the Device in Potentially Explosive Atmospheres

Based on the EU type-examination certificate FTZÚ 19 ATEX 0035X, the device in the basic battery powered version may be operated in potentially explosive atmospheres designated as ZONE 0 (environment, where explosive atmosphere may occur under normal operation). If the internal modem is powered externally, or when using an SCR encoder, the device is designed for ZONE1 environment.

The marking of the device in terms of explosion safety depends on the extension modules fitted:

Corus Evo+ marking

European Union marking (ATEX)

Designation of explosion safety	Device and its internal equipment	Environment
II 1G Ex ia IIB T4 Ga	Basic design including module extensions: - S0-NAM interface for NAMUR gas meter encoder - S0-EXT1 extension module - S1-COM1 RS232/RS485 communication module - S1-2AI Analog inputs module - S1-2AO Analog outputs module - S3-PWR1 EVC external power supply module - S4-COM0 – RS232 communication module	**ZONE 0**
II 1G Ex ia IIB T3 Ga	**- when installed by the module:/*** M2G internal 2G modem, or M4G internal LTE-Cat1 modem internal LTE-Cat M1 modem	**ZONE 0**
II 1G Ex ia IIA T4 Ga	**Powered by an alkaline battery B-03A /***	**ZONE 0**
II 2G Ex ib IIA T3 Gb	**- when installed by the module:/*** S4-PWR2 external power supply of the internal modem module	**ZONE 1**
II 2G Ex ib IIB T4 Gb	**- when installed by the module:** S0-SCR interface for SCR gas meter encoder	**ZONE 1**

/* You cannot use an internal modem when using a B-03A alkaline battery

North America marking

Designation of explosion safety	Device and its internal equipment	Environment
Ex ia IIA T3 Ga **Class I, Zone 0, AEx ia IIA T3 Ga** **Class I, Division 1, Group D, T3** **Ta -40C to +70C**	Basic design including module extensions: - S0-NAM interface for NAMUR gas meter encoder - S0-EXT1 extension module - S1-COM1 RS232/RS485 communication module - S1-2AI Analog inputs module - S1-2AO Analog outputs module - S3-PWR1 EVC external power supply module - S4-COM0 – RS232 communication module - M2G internal 2G modem, or M4G internal LTE-Cat1 modem	**ZONE 0** **Division 1**

	internal LTE-Cat M1 modem	
Ex ib IIA T3 Gb **Class I, Zone 1, AEx ib IIA T3 Gb** **Class I, Division 2, Group D, T3** **Ta -40C to +70C**	Basic design including module extensions: - S0-NAM interface for NAMUR gas meter encoder - S0-SCR interface for SCR gas meter encoder - S0-EXT1 extension module - S1-COM1 RS232/RS485 communication module - S1-2AI Analog inputs module - S1-2AO Analog outputs module - S3-PWR1 EVC external power supply module - S4-PWR2 external power supply of the internal modem module - S4-COM0 – RS232 communication module - M2G internal 2G modem, or M4G internal LTE-Cat1 modem internal LTE-Cat M1 modem	**ZONE 1** **Division 2**

ATTENTION!

The device has been designed and approved as intrinsically safe. This means that only approved devices (intrinsically safe devices, connection devices) or "Simple Devices" meeting the EN 60079-11 standard and complying with intrinsically safe parameters listed in the EU type-examination certificate [14] may be connected to all terminals of the device.

When connecting the device, the relevant safety standards must be observed.

When connecting the device, the electrical characteristics of the connecting cables must be considered and the requirements of the relevant safety standards met. Additionally, the Special conditions for Use must be observed, if listed in these Certificates. The explosion safety parameters of the device are specified in Section 4.

2.3 Special Conditions for Use

ATTENTION!

Under certain extreme circumstances, an electrostatic charge capable of explosion initiation can form on the plastic box. The device must not be installed in places where external conditions could result in electrostatic charge. The device may be wiped only with a damp cloth.

2.4 Risks of Use

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

To avoid the risk of ignition due to electrostatic charge, we recommend observing the following procedure:

2.4.1 If the device is used in potentially explosive atmospheres, it must not be installed in a location where external conditions can cause electrostatic charge generation.

2.4.2 The device may be cleaned only with a damp cloth.

2.5 Connecting External Devices

Intrinsically safe signals run to all the connection terminals of the device. When connecting external devices to these terminals, the intrinsic safety principles must be followed. The equipment must be connected in accordance with applicable standards, in particular:

EN 60079-25 ed.2: VI.2011 - Explosive atmospheres - Part 25: Intrinsically safe electrical systems;

EN 60079-14 ed.4: IX.2014 - Explosive atmospheres - Part 14: electrical installations design, selection and erection;

EN 60079-0 ed.4 (33 2320): III.2013 - Explosive gas atmospheres, Part 0: Equipment - General requirements;

EN 60079-11 ed.2 (33 2320): VII.2012 - Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i".

The intrinsic safety parameters of the connection terminals are specified in Section 4. The recommended cable types are listed in Section 5.5.

3 Technical Parameters

3.1 Mechanical Parameters

Mechanical dimensions (W x H x D)	263 x 201 x 111mm
Weight	2.2 kg
Cabinet material	PC+GF (polycarbonate + fiberglass)
Connecting Terminals - Conductor cross section	0.5 mm^2÷2.0 mm^2
Mechanical Environment Class	M2
Electromagnetic Environment Class	E2

3.2 Environment

IP Rating	IP66, according to EN 60529
Operating temperature	-25 °C ÷ +70 °C -40 °C ÷ +70 °C [2]) -30 °C ÷ +65 °C [3])
Storage temperature	-40 °C ÷ +85 °C
Recommended working position	vertical
Working environment	according to EN 60721-3-4, class 4K3
Measurement of the device internal temperature	
- Location	integrated sensor in CPU module
- Measurement error	±3 °C
System time of the device	
- Long-term stability	± 5 min/year at 25 °C
Keypad	Capacitive, 6-key
Displaying	LCD graphic display, 128 x 64 pixels, backlit, or segment customer display

[2]) Device design with segment display. Extended temperature range at extra charge.

[3]) When the alkaline battery B-03A is used.

3.3 Safety, Explosion Protection

	Corus Evo+
Explosion Safety Level [4]	
- Basic version	II 1G Ex ia IIB T4 Ga
- With internal modem (battery-powered)	II 1G Ex ia IIB T3 Ga
- With internal modem powered from external source S4-PWR2	II 2G Ex ib IIA T3 Gb
- With SCR encoder interface	II 2G Ex ib IIB T4 Gb
Ambient temperature Tamb	-40°C ≤ Ta ≤ +70°C
Type of explosion protection	"I" – intrinsic safety
EU Type-Examination Certificate	FTZÚ 19 ATEX 0035X
IECEx Certificate of Conformity	IECEx FTZU 20.0001X
Protection against dangerous contact of live and dead parts	by low voltage SELV

3.4 Corrector Power Supply

	Corus EVO+
- Type of battery	B-03, B-03U Lithium battery with capacity 17 Ah, or B-03D, B-03DU Lithium battery with capacity 30 Ah, or B-03A alkaline battery
- Battery life - B-03, B-03U B-03D, B-03DU	11 years [5] 18 years [5]
- Battery voltage	3.6 V
- Battery operating temperature range	-40°C ÷ +70°C for B-03, B-03D -25°C ÷ +70°C for B-03U, B-03DU -30°C ÷ +65°C for B-03A
- The prescribed type and number of cells for batteries with replaceable cells	B-03U: 1 x SAFT LS33600 (size D, 3.6V/17Ah) B-03DU: 2 x SAFT LS33600 (size D, 3.6V/17Ah)
- Battery life indication	Yes, alert when the capacity drops to 10%
- Battery voltage limit for switching on the backup battery	2.7 V
- Battery voltage for switch from backup to battery power supply	3.3 V
- Optional external power supply of the corrector	Yes
- Module for the connection of EVC external power supply from IS source	S3-PWR1
- External power supply parameters	See the technical parameters of the S3- PWR1 module

Back-up Battery of the Corus Evo+	
- Back-up battery	yes (part of the CPU module)
- Back-up battery life	16 years (EVO+ indexer – 15 years) [5)]

[4]) Depending on the configuration of the device, see Section 2

[5]) The lifetime of the battery depends on the mode set, the lifetime of the back-up battery depends on the way the device is used without the battery (see Section 7.4.1).

3.5 Device Accuracy

Relative error (in operational temperature range)	
- Max. total error of the corrector	< 0.5 % of the measured value < 0.3 % of the range [6] – option according EN12405-2, not covered by MID certification
- Typical total error of the corrector	0.15 % of the measured value 0.10 % of the range [6] - option according EN12405-2, not covered by MID certification
- Operating volume measurement error	No error
- Compressibility factor calculation error	< 0.05 %

3.6 Measurement Parameters

3.6.1 General

Measurement principle	PTZ converter [7]
Type-approval marking	TCM 143/20 – 5716, EU-Type Examination Certificate (MID certification)
Measurement Period	30 s (adjustable, range 1s ÷ 1h)
Reference conditions	
- Reference temperature Tb	15° C, or 0 °C, 15.55555 °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)
Compressibility calculation	SGERG-88, AGA NX-19 mod, AGA 8-G1, AGA 8-G2, AGA 8-DETAIL, GOST 30319,2-2015, GOST 30319.3-2015
Period of official metrology check	- vary from country to country. In general, the validation period of a specified meter is determined by a country's decree.

[6]) For the device version without MID certification, measurement errors are specified in % of the range according to US common practice.

[7]) Simpler conversion options can also be configured. Supported variants are PTZ, PT, TZ, and T.

3.6.2 Pressure Measurement

Number of pressure transducers, single channel	1
Number of pressure transducers, dual channel	2
Designation of the pressure transducer	EDT 96 pressure transducer
Transducer version	internal - built-in in the device, or external - cable length 2.5 m as a standard (max. 100m in total for the connected EDTxx transducers)
Sensor	silicon piezoresistive sensor
Pressure connection	∅ 6 mm tube, ¼‘‘ BSP cylendric male or ERMETO M12 x 1.5 threaded joint (option ½‘‘ NPT male)
Measurement of gas pressure within temperature range of	-25 ÷ +70 °C -40 ÷ +70 °C [2)]
Measurement ranges - MID certified	
(absolute pressure values)	80 ÷ 520 kPa
	200 ÷ 1000 kPa
	400 ÷ 2000 kPa
	700 ÷ 3500 kPa
	1400 ÷ 7000 kPa
	2500 ÷ 13000 kPa
	80 ÷ 1000 kPa [8)]
	80 ÷ 2000 kPa [8)]
	400 ÷ 7000 kPa [8)]
- Measurement error	< 0.25 % of the measured value
- Long-term stability	< 0.1 % per year of the measured value
Overload capacity without changing metrological parameters	standardly: 1.25 x upper limit (UL) on request: 1,5 x UL for the range 80 ÷ 2000 kPa 3 x UL for the range 80 ÷ 1000 kPa 5 x UL for the range 80 ÷ 520 kPa
Mechanical resistance (without leakage)	2 times upper limit of the measurement range or 17MPa [9)] (whichever is lower)

[8)] Extended pressure range at extra charge.

[9)] Pressure transducer is destroyed, gas-tightness remains.

Measurement ranges - without MID certification	
(absolute pressure values)	
	80 ÷ 1000 kPa
	80 ÷ 2000 kPa
	80 ÷ 3500 kPa
	80 ÷ 7000 kPa
	80 ÷ 13000 kPa
- Measurement error	< 0.20 % of the range [10])
- Long-term stability	standardly: < 0.2 % per year of the range [10] on request: < 0.1 % per year of the scale [10]
Overload capacity without changing metrological parameters	standardly: 1.25 x upper limit (UL) on request: 1,5 x UL for the range 80 ÷ 2000 kPa 3 x UL for the range 80 ÷ 1000 kPa 5 x UL for the range 80 ÷ 520 kPa
Mechanical resistance (without leakage)	2 x upper limit of the measurement range or 17Mpa [11]) (whichever is lower)
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
	0 ÷ 7000 kPa
- Measurement error	< 0,20 % of the range (ranges 100 kPa and higher) [12]) < 0,40 % of the range (ranges lower than 100 kPa) [12])
- Long-term stability	< 0,20 % of the range (ranges 100 kPa and higher) [12]) < 0,40 % of the range (ranges lower than 100 kPa) [12])
Overload capacity without changing metrological parameters	2 x upper limit (UL)
Mechanical resistance (without leakage)	2 x upper limit of the measurement range or 17 MPa [11]) (whichever is lower)

[10]) For the device version without MID certification, measurement errors are specified in % of the range according to US common practice.

[11]) Pressure transducer is destroyed, gas-tightness remains.

[12]) For the device version without MID certification, measurement errors are specified in % of the range according to US common practice.

3.6.3 Temperature measurement

Number of temperature transducers, single channel	1
Number of temperature transducers, dual channel	2
Designation of the pressure transducer	EDT 101 temperature transducer
Temperature sensor	Pt 1000 platinum resistance sensor
Transducer measurement range	-25 ÷ +70 °C -40 ÷ +70 °C [2])
- Measurement error	±0.2 °C (i.e. ± 0.09 % of the measured value in K)
- Long-term stability	< 0.02 % per year (relative error in K)
Sensor design	∅ 5.7 mm tube, measuring shank 50 mm long, integrated cable with electronics
Length of the sensor cable	2.5 m as a standard, (max. 100 m in total for the connected EDTxx transducers)

3.7 Digital inputs

A. Metrology	
- Number	2
- Terminals marking (DIN terminal blocks)	DI1, DI4
- Input options (SW configuration)	1 LF pulse input, 1 binary input/intrusion contact/ LF pulse input to determine the direction of rotation of the meter
- Backup function in case of power supply failure	Yes, the signal monitoring function at the specified DI inputs is backed up by the backup battery of the device
- Cable length for each input	max. 30 m
- LF pulse input	Terminals DI1, DI4 (DI4 – for gas meters with the option of detecting the rotation direction)
- Maximum frequency - Maximum operating flow rate Qm	10 Hz 36 000 m^3/h
- Input type	Reed contact or potential-free output connection, WIEGAND, or Cyble Sensor Atex
- Min. pulse/delay time	40 ms
- No-load voltage	2.5 V ÷ 3.6 V
- Short-circuit current	ca 3 μA

- "ON" level	R < 100 kΩ or U < 0.2 V
- "OFF" level	R > 2 MΩ or U > 2.5 V
- Binary input, tamper contact	Terminals DI4 (Terminals DI1 [13])
- Input type	Low-power input, reed contact or potential-free output connection
- Min. duration of the condition	100 ms
- No-load voltage	2.5 V ÷ 3.6 V
- Short-circuit current	ca 3 μA
- "ON" level	R < 100 kΩ or U < 0.2 V
- "OFF" level	R > 2 MΩ or U > 2.5 V
B. Non-Metrology	
- Number	2
- Marking of the terminals (DIN terminal block)	DI2, DI3
- Input options (SW configuration)	2 LF pulse inputs, or 2 binary inputs, or 1 LF pulse input + 1 binary input
- Backup function in case of power supply failure	No
- Cable length for each input	30 m max.
- LF pulse input	
- Maximum frequency	10 Hz
- Input type	Reed contact or potential-free output connection, WIEGAND
- Min. pulse/delay time	40 ms
- No-load voltage	2.5 V ÷ 3.6 V
- Short-circuit current	ca 3 μA
- "ON"	R < 100 kΩ or U < 0.2 V
- "OFF"	R > 2 MΩ or U > 2,5 V
- Binary input	
- Input type	Low-power input, reed contact or potential-free output connection
- Min. duration of the condition	100 ms

[13]) Only when input DI1 is not used for gas meter connection (e.g. with the datalogger).

- No-load voltage	2.5 V ÷ 3.6 V
- Short-circuit current	ca 3 μA
- "ON"	R < 100 kΩ or U < 0.2 V
- "OFF"	R > 2 MΩ or U > 2.5 V

3.8 Digital Outputs

- Number	4
- Marking of the terminals (DOUT terminal block)	DO1, DO2, DO3, DO4
- Output options (SW configuration)	Pulse output, binary output, analogue output (via CLO)
- Output type	Open collector
- Cable length for each output	30 m max.
- Galvanic separation	Yes (output circuit requires power to U0 +) *)
- Supply voltage range (terminal U0 +)	3.6 V – 15 V
- Max. output voltage (DO1-4)	15 V**)
- Max. output current	10 mA
- Max. resistance in closed state	5 Ω
- Pulse output	
- On time	Programmable 5 ms ÷ 25 s
- Off time	Programmable 0.1 s ÷ 25 s or adaptive
- Analogue output	
- Output realization	via external module CLO
- Type of output	4-20 mA current output, passive transmitter
- supply voltage range of current loop	5 V ÷ 40 V
- accuracy	0.25 % of the range (at 25 °C)

*) DO1 and DO2 outputs can be operated in pulse output mode even without power supply at U0+ terminal with defined limitation: it requires a shorting jumper JP1 (the operating values drop - for more details refer to Section 7.5)

**) JP1shorting jumper must not be fitted, otherwise reduced voltage values apply for DO1, DO2 (see Section 7.5)

3.9 Communication Inputs/Outputs

Communication interface for optical head	
- Interface type	Interface IEC-1107
- Communication speed	9600 Bd to 115200 Bd, adjustable

- Communication protocol	Selectable, depending on the firmware version (see Section 10)
The Corus Evo+ has no integrated interfaces RS232/RS485 communication interface solution uses plug-in modules in SLOT 1, SLOT 2 or SLOT 4	

3.10 Quantities Archiving

Data archive	
- Archiving frequency t_{arch}	1 hour as standard (adjustable from 1 s to 1 h)
- Capacity	ca 112 000 records (i.e. ca 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 + adjustable depending on the configuration
Daily archive	
- Capacity	ca 4 200 records (ca 11.5 years)
- Stored quantities	Vm, Vb, Vs, Vbs, E, Es, Status, t, p, Q, C + adjustable depending on the configuration
Monthly archive	
- Capacity	ca 960 records (approx. 80 years)
- Stored quantities	Vm, Vb, Vs, Vbs, E, Es, Status + adjustable depending on the configuration
Other archives (capacities)	
- Binary archive	ca 4 600 records
- Status archive	ca 5 000 records
- Gas composition archive	ca 1 870 records (ca 5 years at 1 change per day)
- Settings archive	More than 1000 records (depending on the type of setting)
- Limit archive	1 record for each monitored quantity
- Billing archive	ca 1 260 records

3.11 Optional Extension

3.11.1 Interface modules for connecting the gas meter encoders

S0-NAM Interface module for ENCODER – NAMUR	
- Max. number of modules in device	1
- Installation in the device	SLOT 0
- Number of inputs	1
- Connection	Two-conductor
- Type	NAMUR (DIN 19234)

- terminals marking	SLOT0 Terminals NAM- (1), NAM+ (2)
- Cable length	30 m max.
Note: The module installation is protected by a MID security mark.	
S0-SCR Interface module for ENCODER – SCR	
- Max. number of modules in device	1
- Installation in the device	SLOT 0
- Number of inputs	1
- Connection	Two-wire
- Type	SCR+
- Communication protocol supported	OBIS 2005 (IEC 62056-21 Mode A) (EDIS (IEC1107 Mode A))
- Terminals marking	SLOT0 Terminals A (1), B (2)
- Cable length	30 m max.
Note: The module installation is protected by a MID security mark.	

3.11.2 Communication Modules

S1-COM1 Communication module RS232/RS485	
- Max. number of modules in device	2
- Installation in the device	SLOT1, SLOT2
- Galvanic separation	Yes
- Serial communication interface	RS485 or RS232 (cannot be used simultaneously)
- Communication protocol	Selectable, depending on the firmware version (see Section 10)
- Communication speed	2 400 Bd to 115 200 Bd, adjustable
- Byte format	8 bits, 1 stop, no parity
- RS232 communication output	
- Marking of the terminals	SLOT1,2 terminals GND (3), CTS (4), RxD (5), TxD (6)
- Connection via IS separator	B-RS module, or MTL5051
- Cable length	30 m max.
- RS485 communication output	
- Marking of the terminals	SLOT1,2 terminals D+ (1), D- (2), GND (3), U+ (4)
- Connection via JB separator	B-RS module
- Max. cable length	100 m max.

S4-COM0 RS232 communication module	
- Max. number of modules in device	1
- Device installation	SLOT 4
- Galvanic separation	yes
- Serial communication interface	RS232
- Communication protocol	Selectable, depending on the firmware version (see Section 10)
- Communication speed	2 400 Bd to 115 200 Bd, adjustable
- Byte format	8 bits, 1 stop, no parity
- RS232 communication output	
- Marking of the terminals	RS232 terminals (GND, CTS, TxD, RxD)
- Connection via IS separator	B-RS module, or MTL5051
- Cable length	30 m max.

M2G internal2G modem	
- Max. number of modules in device	1
- Device installation	SLOT 4 (battery powered) SLOT 5 (external power supply)
- Type of connection	2G modem, GSM/GPRS
- Frequency	Quad band 850/900/1800/1900 MHz
- Output power	Class 4 (2 W) for GSM 850 MHz, 900 MHz Class 1 (1 W) for GSM 1800 MHz, 1900 MHz
- Communication protocol	Selectable, depending on the firmware version (see Section 10)
- Required SIM card size	miniSIM
Power supply of the modem module:	
- Battery type	HB-03 (12 Ah) or HB-03D (20 Ah) battery
- Battery life - HB-03 HB-03D	6 years [14]) 11 years [14])
- Battery voltage	3,0 V
- External power supply option	Yes
- Type of module for external power supply connection	S4-PWR2

[14]) The life of the battery depends on the set mode of the modem connection

M4G internal modem LTE	
- Max. number of modules in device	1
- Device installation	SLOT 4 (battery powered) SLOT 5 (external power supply)
- Required SIM card size	miniSIM
Versions of LTE modem	
Designation	**M4G, LTE-Cat1E**
- Type of connection	LTE cat. 1, European design
- Frequency	800/900/1800/2100 MHz
- Output power	Class 4 (2 W) for GSM 900 MHz Class 1 (1 W) for GSM 1800 MHz Class 3 (23 dBm) for LTE 800, 900, 1800, 2100 MHz
Designation	**M4G, LTE-Cat1US**
- Type of connection	LTE cat. 1, American design
- Frequency	700/850/1700/1900 MHz
- Output power	Class 3 (+24 dBm) for UMTS 850, 1700, 1900 MHz Class 3 (+23 dBm) for LTE 700, 850, 1700, 1900 MHz
Designation	**M4G, LTE-CatM1US**
- Type of connection	LTE-M1, American design
- Frequency	700/1700/1900 MHz
- Output power	Class 3 (+23 dBm) for LTE 700, 1700, 1900 MHz
- Communication protocol	Selectable, depending on the firmware version (see Section 10)
Power supply of the modem module:	
- Battery type	HB-04 (12Ah) battery
- Battery life	6 years [14])
- Battery voltage	6V
- External power supply option	Yes
- Type of module for external power supply connection	S4-PWR2

3.11.3 Modules for Connecting External Power Supply

S3-PWR1 module of EVC power supply	
- Installation in the device	SLOT3

- Module function	External power supply of the corrector circuits from an intrinsically safe PS-E source (does not power to M2G, M4G modems)
Galvanic separation	yes
Supply voltage	4,5 V ÷ 6,5 V
Max. consumption	70 mA
Terminals marking	PWR1+, PWR1-
Cable length	30 m max. (min. conductor cross section 0.75 mm^2 see paragraph 5.5.6)
S4-PWR2 module of external power supply of the internal modem	
Max. number of modules in the device	1
- Installation in the device	SLOT4
- Module function	External power supply of the of the M2G or M4G internal modem module from an intrinsically safe PS-M source
Galvanic separation	yes
Supply voltage	4,5 V ÷ 6,2 V
Max. consumption	1 A
Terminals marking	PWR2+, PWR2-
Cable length	see chapter 5.5.6 (depends on used cable cross section)

3.11.4 Analogue Inputs/Outputs Modules

S1-2AI Module of 4 – 20mA analogue inputs	
- Max. number of modules in device	2
- Installation in the device	SLOT 1, SLOT 2
- Number of module inputs	2
- Marking of the terminals	SLOT1,2 terminals GND (2), AI1 (3), GND (5), AI2 (6)
- Input options	4 ÷ 20 mA current input
- Galvanic separation	No
- Cable length for each output	30 m max.
S1-2AO Module of 4 – 20mA analogue output	
- Max. number of modules in device	2
- Installation in the device	SLOT 1, SLOT 2
- Number of module inputs	2

- Marking of the terminals	SLOT1,2 terminals AO1- (2), AO1+ (3), AO2- (5), AO2+ (6)
- Output options	4 ÷ 20 mA current output
- Galvanic separation	Yes (separation from the instrument and mutual separation both outputs apart)
- Power supply voltage	5 V ÷ 28 V
- Cable length for each output	30 m max.

3.11.5 Other Modules

S0-EXT1 extension module	
- Max. number of modules in device	1
- Installation in the device	SLOT 0
DIN-NAMUR digital inputs	
- Number of digital inputs	2
- Input options DI1, DI2	HF NAMUR: 2 HF pulse inputs, or 1 HF pulse input of the gas meter with the option of detecting the rotation direction, or 2 binary inputs (NAMUR), or 2 NAMUR encoders
- Terminals marking	SLOT0 terminals DI1- (1), DI1+ (2), DI2- (5), DI2+ (6)
DIN digital inputs	
- Number of digital inputs	6
- Input options DI3 to DI8	LF inputs: 6 LF pulse inputs, or 3 LF pulse input of the gas meter with the option of detecting the rotation direction), or 6 binary inputs
- Terminals marking (DIN terminals)	GND, DI3, DI4, DI5, DI6, DI7, DI8 [16])
- Cable length for each input	30 m max.
AIN analogue inputs	
- Number of analogue inputs	2
- Terminals marking (AIN terminal blocks)	AI1, AI2, GND [16])

[16]) The terminals are mounted on a special EXT1-T terminal board (KP100 160), which is connected with an extension module S0-EXT1 via cable (see Section).

- Input options AI1, AI2	4 ÷ 20 mA current input
- Cable length for each input	30m max.
Inputs for digital transducers	
- Number of inputs	2
- Terminals marking (IB1 terminal blocks)	GND, U+, D-, D+ [16])
- Type of transducer	EDT 96, EDT 101
- Max. cable length (total length of both transducers)	100m max.
BARP Barometric pressure sensor	
- Max. number of modules in device	1
- installation	optional *) – during production
***) Warning:** The requirement to install the BARP module must be specified when ordering the device. The module will be installed during manufacturing of the device. The module cannot be installed by end user.	
- Barometric pressure measurement ranges	30 ÷110 kPa
- accuracy	± 0,25 kPa
*)Remark: The barometric pressure measurement module BARP is connected directly to the device's internal bus and does not reduce the number of connectable EDT xxx transducers to the device.	

4 Explosion Safety Parameters

DIN digital inputs: *(terminals DI1, GND, DI2, GND, DI3, GND, DI4, GND)*

Uo = 6.5V

Io = 2mA

Po = 3mW

	IIB	IIA
Co	20μF	100μF
Lo	10mH	100mH

Ui = 5,5V
Ii = 1mA
Pi = 1mW
Ci = 0, Li = 0

DOUT digital outputs: *(terminals U0+, GND0, DO1, DO2, DO3, DO4)*

Ui = 15V

Ii = 0.3A

ΣPi = 0.5W

Ci = 3.3uF

Li = 0

IB0 and IB1 internal buses: *(terminals GND, U+, D-, D+)*

Uo = 6.5V

Io = 2.2A

Po = 1.1W

	IIB	IIA
ΣCo	24μF	50μF
ΣLo [1/]	1uH	1uH

[1/] *inductive concentration, max. 100m cable can be connected*

KP 100 060 - Indexer interface: *(SLOT 0 TERMINALS: GND, U+, TXD, RXD, UB)*[√]

Uo = 6.5V

Io = 2.2A

Po = 1.1W

	IIB	IIA
ΣCo	45μF	45μF
ΣLo	1uH	1uH

KP 100 061 - SCR interface: *(SLOT 0 TERMINALS: A, B)* [2/]

Uo = 8.0V

Io = 20mA

Po = 160mW

	IIB	IIA
Co	14uF	100uF
Lo [3/]	8uH	10uH

[3/] *Inductive concentration, max. 30m cable can be connected.*

[2/] *The module has an impact on the basic type of protection - see the instructions.*

KP 100 062 - NAMUR interface: *(SLOT 0 TERMINALS: NAMUR+, NAMUR-)*

Uo = 10.0V

Io = 11mA

Po = 27mW

	IIB	IIA
Co	20uF	100uF
Lo	1mH	1mH

Ui = 5,5V
Ii = 1mA
Pi = 1mW
Ci = 0, Li = 0

KP 100 110 - RS485 interface: *(SLOT 1,2 TERMINALS: D+, D-, GND, U+)*

Ui = 10V

Ii = 0.15A

ΣPi = 0.33W

Ci = 4uF

Li = 0

KP 100 110 - RS232 interface: *(SLOT 1,2 TERMINALS: GND, CTS, RXD, TXD)*

Ui = 20V

Ii = 0.15A

ΣPi = 0.46W

Ci = 1uF

Li = 0

KP 100 121 - PWR1 external power supply:*(SLOT 3, terminals PWR1+, PWR1 -)*

Ui = 6.5V

Ii = 0.2A

Pi = 0.41W

Ci = 40uF

Li = 1.1mH

KP 100 140 – PWR2 external power supply: *(SLOT 4, terminals PWR2+, PWR2 -)* [4/]

Ui = 6.2V

Ii = 1A

Pi = 6.2W

Ci = 13.5mF

Li = 55uH

[4/] *The module has an impact on the basic type of protection - see the instructions.*

KP 100 112 - AIN analogue inputs: *(SLOT 1,2 TERMINALS: GND, AI1, GND, AI2)*

Ui = 28V

Ii = 93mA

Pi = 0,66W

Ci = 40nF

Li = 0

KP 100 113 - AO analogue outputs: *(SLOT 1,2 TERMINALS: AO1+, AO1-, AO2+, AO2-)*

Ui = 28V

Ii = 0.1A

Pi = 0.66W

Ci = 0.46uF

Li = 0

EXT1 board (KP 100 130) – DI1, DI2 (NAMUR): *(SLOT 0 TERMINALS: DI1-,DI1+,DI2-,DI2+)*

Uo = 10,0V

Io = 11mA

Po = 27mW

	IIB	IIA
Co	20uF	100uF
Lo	1mH	1mH

Ui = 5,5V
Ii = 1mA
Pi = 1mW
Ci = 0, Li = 0

EXT1 board (KP 100 130) – DI3 to DI8: *(terminals: GND, DI3,DI4, DI5, DI6, DI7, DI8)*

Uo = 6.5V

Io = 2mA

Po = 3mW

	IIB	IIA
Co	20μF	100μF
Lo	10mH	100mH

Ui = 5,5V
Ii = 1mA
Pi = 1mW
Ci = 0, Li = 0

EXT1 board (KP 100 130) - AIN analogue inputs: *(terminals: GND, AI1, GND, AI2)*

Ui = 28V

Ii = 93mA

Pi = 0.66W

Ci = 40nF

Li = 0

EXT1 board (KP 100 130) – Internal Bus IB1: (terminals EXT1-T: GND, U+, D+, D-)

Same as Internal Bus IB0 and IB1.

5 Installation and Commissioning

The corrector (logger) is a compact device built into a tough plastic enclosure with IP66 protection rating. The device is intended for installation in potentially explosive atmospheres. It has been approved for either ZONE 0 or ZONE 1 environment, depending on the specific modules installed in the device, as specified in Section 2.

In addition to completely enclosed electronics, the enclosure contains power supply batteries and a digital pressure transducer with M12x1.5 threaded joint according to DIN W 3861 for connecting a pressure pipe.

At the bottom of the cabinet are metal cable glands for connecting the input and output signal cables with the possibility to connect the cable shielding conductively.

5.1 Dimensions of the Device

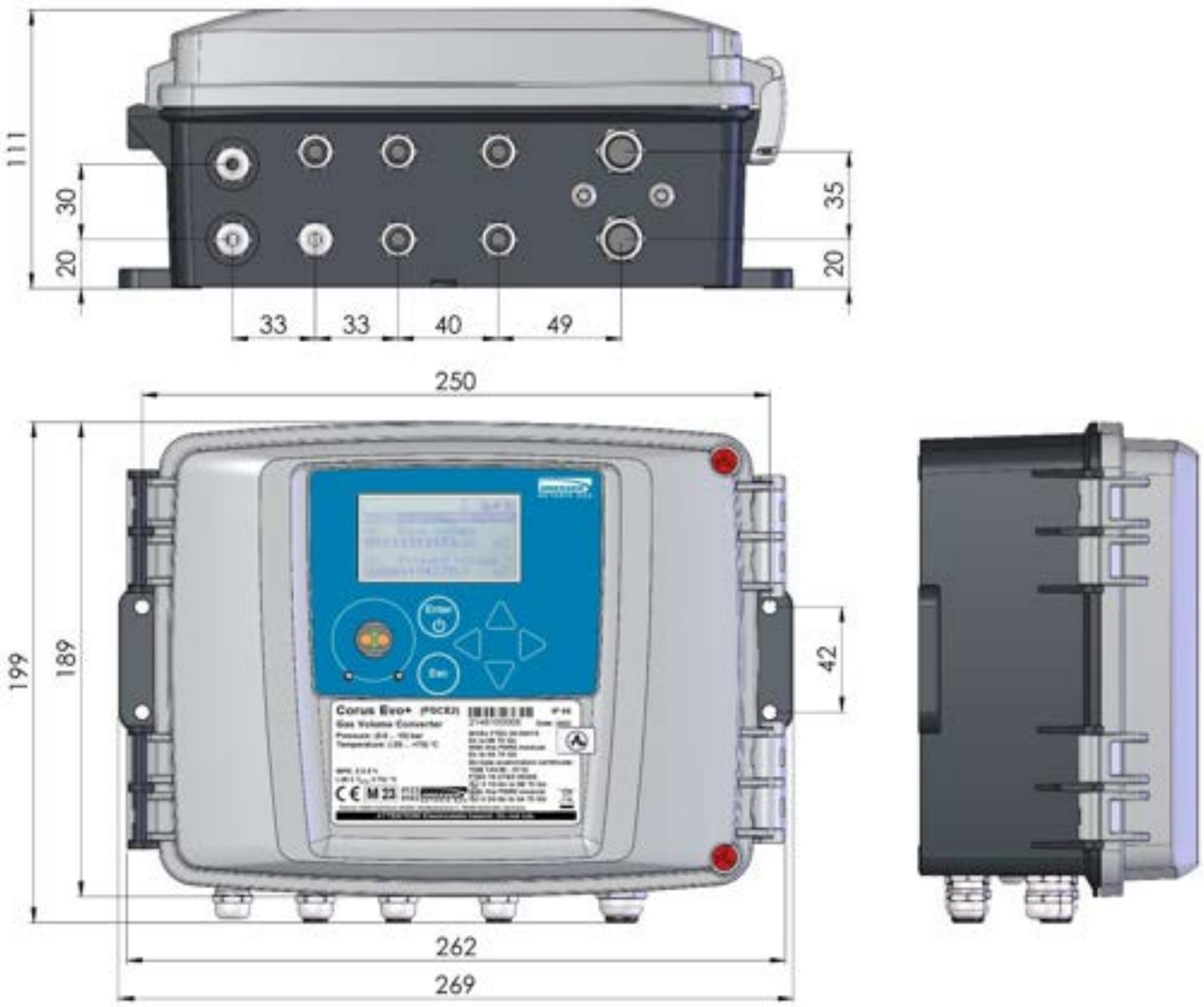


Fig. 1 Corus Evo+ device dimensions

5.2 Security Marks of the Device

Security marks on the device indicate the technical condition of the device from the point of view of unauthorized manipulation.

Security Mark MID (Metrological Seal)

- Its form is prescribed by the certificate for Quality Management System for Production, Output Control and Testing according to Annex No 2, Procedure D, NV 120/2016 Coll., issued by Notified Body No 0102. This security mark together with the CE conformity marking and the supplementary metrology marking M21, have of the same significance as the Official Mark of initial verification according to the Metrology Act (§9 Par. 3).

When this mark is breached, the manufacturer cannot guarantee that the device features are in compliance with the EU type-examination certificate.

Manufacturer's Seal

- Inspection mark of the manufacturer according to the manufacturer's needs.

User Mark

- Inspection mark (seal) of the user according to the user's needs.

M Metrology seal

F Manufacturer seal

U User seal

Fig. 2 Internal security seal

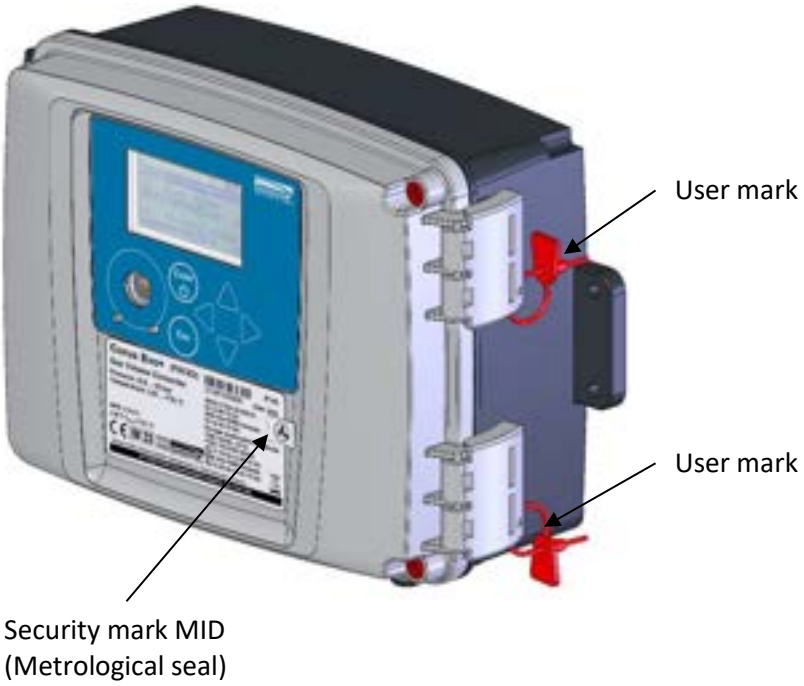


Fig. 3 External user seals of the device

5.3 Name plate

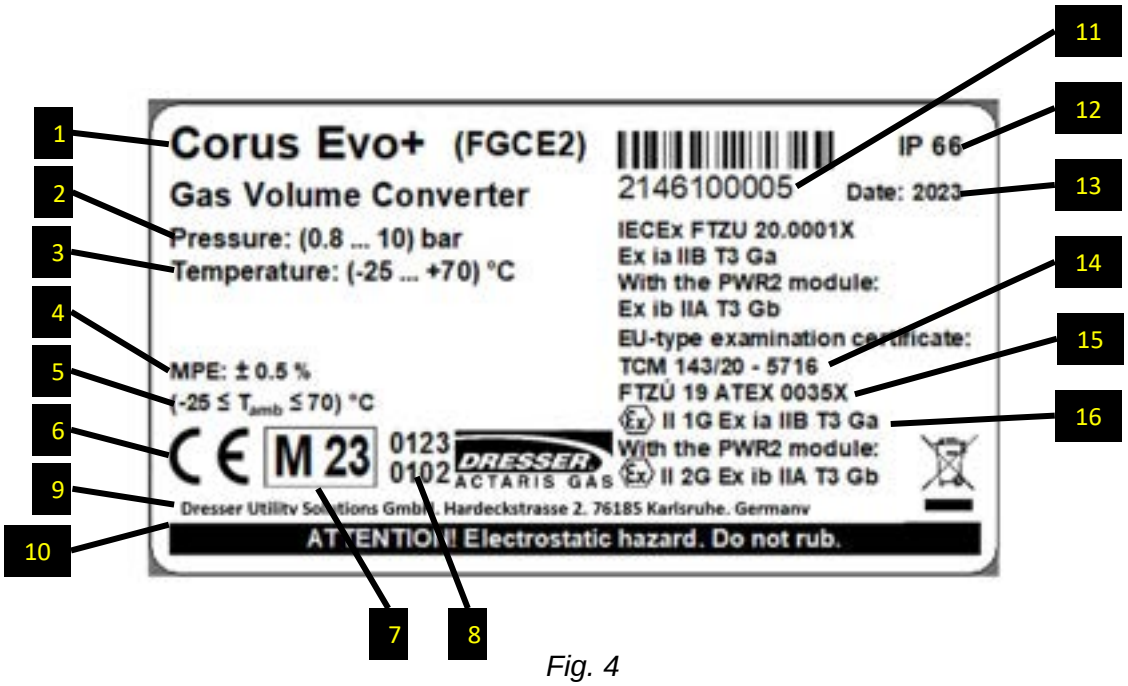


Fig. 4

Example of name plate

Legend:

1	Device designation	**9**	Manufacturer's address
2	Pressure measurement range	**10**	Warning to operators
3	Temperature measurement range	**11**	Serial number of the device
4	Max. permitted error of the device	**12**	IP rating
5	Ambient temperature range	**13**	Year of manufacture
6	CE conformity mark	**14**	EU Type examination certificate (metrological)
7	Year of conformity assessment	**15**	EU Type examination certificate (ATEX)
8	Notified body designation	**16**	Explosion protection designation

5.4 Mechanical Installation

The device is intended for mounting on a wall or on a pipe by means of a mounting plate. In the case of pipe mounting, special holders can also be used instead of the standard mounting plate.

The device is mounted on the mounting plate first. If a device pressure transducer is required to be connected via a 3-way ball valve, the 3-way ball valve can also be placed on this mounting plate. The mounting plate has been designed to be fitted with three-way valves supplied by Dresser Actaris™ Gas. The equipped mounting plate can be attached by means of screws and dowels to the wall, or by means of two clamps with locking devices on horizontal or vertical piping.

ATTENTION!

The gas volume corrector is a legally controlled technical equipment that is subject to government professional supervision.

The device may be installed by only a qualified person holding a certificate of professional competence issued by a government body of labor safety supervision.

A person meeting the above conditions must also hold a "Certificate of completion of professional training" for the installation and operation of the given type of equipment. Such certificate is usually issued by the device manufacturer or an authorized partner on the basis of the training provided.

Failure to comply with these requirements gives rise to a risk of breach of warranty conditions.

ATTENTION!

The Corus Evo+ gas volume corrector is classified under the Metrology Act as being in the category of approved measuring instruments. Entities intending to carry out the installation of approved measuring instruments must have the necessary accreditations according local metrology rules.

ATTENTION!

The device is available in various models to be used in ZONE 1 or ZONE 0 environment. The model designated for ZONE 1 must not be used in ZONE 0 environment.

The device may be operated in ZONE 0 only on condition that the "II 1G" category is indicated on name plate of the device in the ATEX label in reference to the assembly variant.

Before installing the device to ZONE 0, make sure that the "II 1G" category is indicated in the ATEX label.

The device display and the visor for the optical head are protected from scratching by a transparent protective foil. Remove the protective foils after installation (they may impair the readability of the display and the functionality of the optical head).

5.4.1 Connecting the Pressure Transducer

The pressure transducer is provided in standard version with a 2.5m cable to faciliate installation on gas meter. The available threads are:

- ¼“ BSP cylendric male
- Ermeto 6
- ½“ NPT male (with an adaptor)

It’s highly recommended to use a free nut fitting for installing the transducer on the meter directly or through a 3 way valve, to avoid damaging the wires of the cable.

There are other length of cable available (5m, 10m) and the possibility to have the transducer internal (no cable).

5.4.2 Connecting the Temperature Transducer

Connecting the temperature transducer by means of a thermowell fitted on the gas meter is the preferred method of connection. If no thermowell is fitted on the gas meter, a weld-on fitting for mounting the thermowell is welded according to the gas meter manufacturer’s instructions, typically at a distance of 1x DN to 2x DN after the gas meter in the media flow direction.

The weld-on fitting must be welded in such a way that the thermowell is in the vertical position, or inclined under 45° angle from the vertical axis with the cavity up (Fig.). Into the weld-on fitting, a thermowell of the appropriate length for the used pipe diameter is screwed over a copper gasket (see Table 1). The metal shank of the temperature transducer is inserted thoroughly into the thermowell and secured by a locknut. The maximum axial load of the temperature transducer cable is 50N.

Before inserting the sensor shank into the thermowell, it is recommended that the space around the shank inside the thermowell is filled with silicone oil or that the shank is 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

Table 1 Weld-on fittings and thermowells appropriate for the pipe diameters

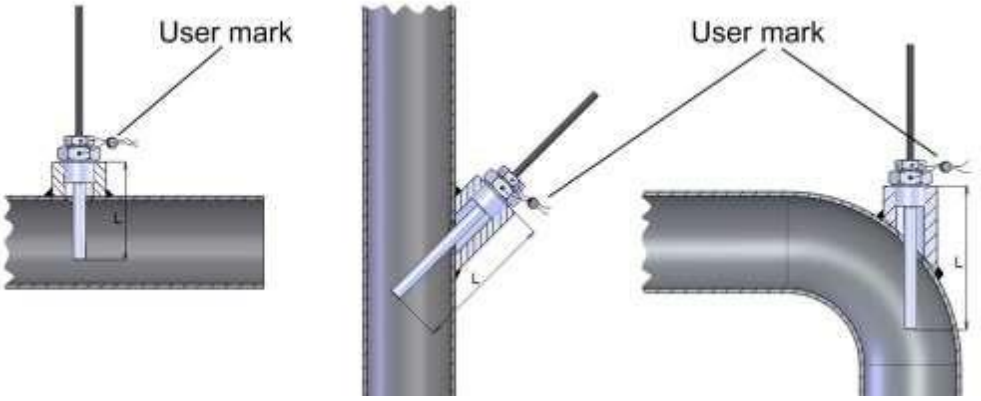
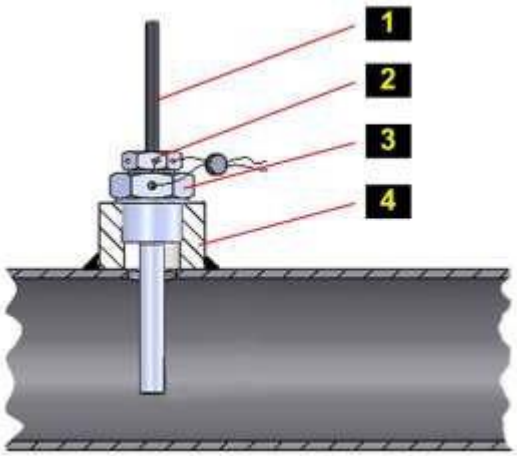


Fig. 5 Mounting the temperature sensor on the pipe



1 Temperature transducer
2 Locknut
3 Thermowell
4 Straight weld-on fitting

Fig. 6 Mounting the temperature sensor using a straight weld-on fitting

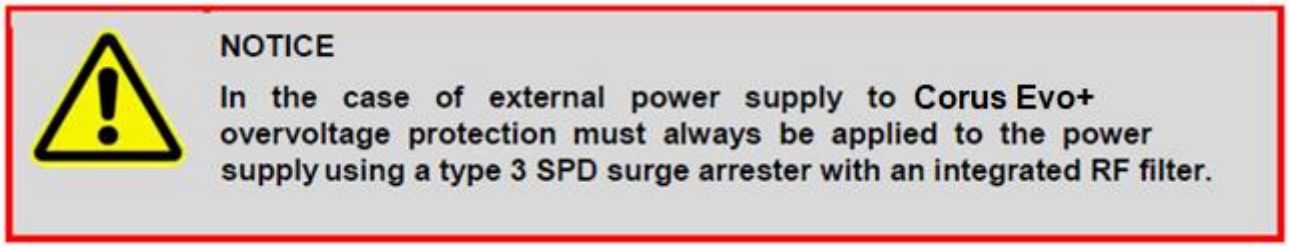
5.5 Electric installation

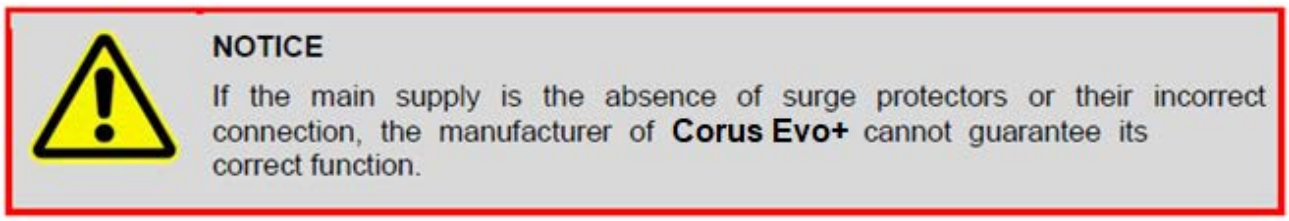
5.5.1 Basic installation requirements in terms of interference and EMC

Electronic devices must work correctly at the place of use. This must be applied even if the device is affected by electromagnetic interference (up to a certain size). The most important effects of electromagnetic interference, which may affect the device are:

- overvoltage - mainly impulse overvoltage and HF interference induced by atmospheric disturbances (storms, discharges) and interference from industrial equipment (frequency converters, compressors, pumps, etc.)
- transients during switching of inductive loads in the network (motors, valves, pumps, elevators, etc.)
- the difference in voltage potentials between the individual parts of the equipment, the flow of unwanted balancing currents
- electrostatic discharge

Limitation of the effect of these effects can be achieved by suitable installation, shielding of electrical and magnetic induction, use of filters in the supply wires to the device, and interconnection and grounding of metal parts of the installation.
Devices manufactured by Dresser Actaris™ Gas are designed to have very high immunity to interference. They are tested according to valid standards (set of standards EN 61000 4) for radiation (EMI) and resistance (EMC) to electromagnetic interference in an industrial environment. However, improper installation of the device may reduce the resistance, especially if the device is connected to other devices (communication, external power supply, etc.). Therefore, certain principles must be observed when installing the unit in order not to reduce the immunity to interference.





5.6 Electrical Connection

The text below describes electrical connection of the corrector with other devices. For the described connections to work properly, the device should also be set correctly up. The device can be set up either using the service software [20], or from the device keypad (see Section 6).

5.6.1 Connecting Cables

Always use shielded cables complying with the standard [5] to connect the device to other devices.

On the device side, the shields of all the connected cables must be connected to the metal body of the cable gland according to Fig. **.**

When installing the device and connecting the cable shields, make sure that ground loops are not created.

All the cable glands in the device are electrically interconnected, the shields of all the cables entering the device are therefore connected at this point. This ensures high resistance to electromagnetic interference.

The following applies:

- **For the digital pressure transducer (i.e. built into body of the device housing), the metal housing of the transducer is conductively connected with the metal cable glands of the device, i.e. with the shielding 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 with a shielded cable whose shield is connected to the metal body of the cable gland.**
- **The metal shank of the temperature transducer is insulated from the shield of the cable and all other parts of the device.**
- **The metal body of the external pressure transducer is connected to the cable shield.**

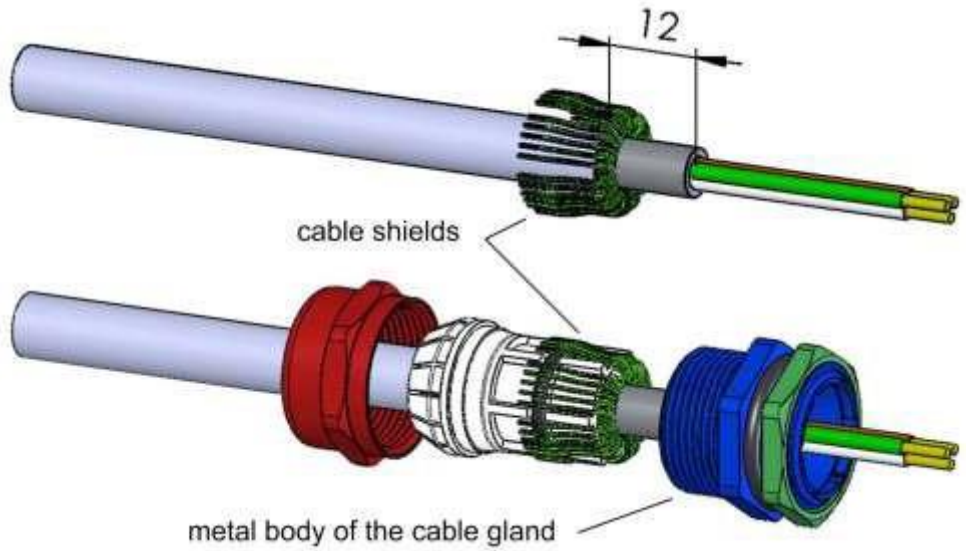


Fig. 7 Connecting the cable shields in the cable glands

The device is equipped with metal cable glands size PG7 and PG9. These glands are designed for cables of the following diameters:

PG7	**3.0 ÷ 6.5 mm**
PG9	**4.0 ÷ 8.0 mm**

The cable glands are arranged as shown in Fig. 8 .

The minimum cross section is specified for the recommended shielded cables listed below. When using larger cross sections, it is necessary to check that the cable diameter matches the used cable gland.

ATTENTION!
Unused cable glands must be sealed with a stopper plug.

When supplied, stopper plugs are mounted in all unused cable entries

Terminals for connecting cables allow to connect conductors with a cross section of 0.5 mm2 ÷ 2.0 mm2 (20 AWG ÷ 14 AWG).

Before connecting the cables, it is necessary to attach a cable sleeve to each insulated end of a cable and press the sleeves with pliers recommended by the sleeve manufacturer.

Cables terminated with sleeves can be inserted into the terminals without any tool, while taking the cable out requires a slight push on the clamp pin and slightly pulling the cable out.

Temperature ranges for recommended UNITRONIC LiYCY cables according to the manufacturer:

- Fixed mounting: -40°C ÷ + 80°C
- Occasional mobile use: -5°C - + 70°C

Fig. 8 Cable glands arrangement

No.	Cable	Size	No.	Cable	Size
1	Pressure (1st channel)	PG7	6	Temperature (2nd channel)	PG7
2	Temperature (1st channel)	PG7	7	Communication	PG7
3	Gas meter (1st channel)	PG7	8	External pressure (2nd channel)	PG7
4	HF gas meter, encoder	PG7	9	Digital output (DOUT), communication	PG9
5	Gas meter (2nd channel), digital inputs (DIN)	PG7	10	External power supply for the device and the modem	PG9

Table 2 Cable entries - recommended use

5.6.1.1 Opening and Closing the Device

To open the device:

- Loosen the screws **1**
- Open the catch **2**

Fig. 9 Enclosure catches

To close the device:

- Close the catch **2**
- Tighten the screws **1**

Specified tightening torque

the cover bolts are 0.5 to 0.7 Nm.

5.6.1.2 Locking and Sealing the Device

The clamp of the device cover can be secured with plastic or wire seal **1**

Fig. 10 Enclosure seals

5.6.2 Connecting Gas Meters

Gas meters with LF pulse output

DIN terminal block is the standard for a LF gas meter connection. The Corus Evo+ device can be either single channel or dual channel. The DIN terminal block is hidden under a plastic cap that the users can secure with their mark.

Corus Evo+ – LF gas meter	
1st channel	
Terminal	Connection
DI1	Pulse output of the gas meter
DI4	- Contact for the gas meter connection monitoring (tamper contact), or - Pulse output of the gas meter for detecting the rotation direction
2nd channel	
Terminal	Connection
DI2	Pulse output of the gas meter
DI3	- Contact for the gas meter connection monitoring (tamper contact), or - Pulse output of the gas meter for detecting the rotation direction

Gas Meters with HF Pulse Output

To connect the device, the EXT1 module must be installed in the SLOT 0 position. The EXT1 module allows for connecting either one HF gas meter with the detection of rotation direction or two HF gas meters. The meter is connected by means of terminals 1 and 2; to terminals 5 and 6, either auxiliary gas meter sensor with the detection of rotation direction or another HF gas meter can be connected.

WARNING

When using a HF meter, the corrector must be powered from an external intrinsically safe power supply (e.g. PS-E, PS-E/A).

Gas Meter with NAMUR or SCR Encoder

The module of the interface of the encoder must be fitted in the SLOT 0 position. The gas meter is connected to terminals 1 and 2. The external power supply of the corrector is not necessary.

Connection	**Cable**	**Entry**	**Recommended type of cable**	**Cable Ø**
Pulse input (both LF and HV gas meter), encoder	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 the detection of rotation detection	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.25 Lappkabel	5.0 mm

Table 3 Cables recommended to connect the gas meter

5.6.2.1 LF Gas Meter, Single Channel corrector

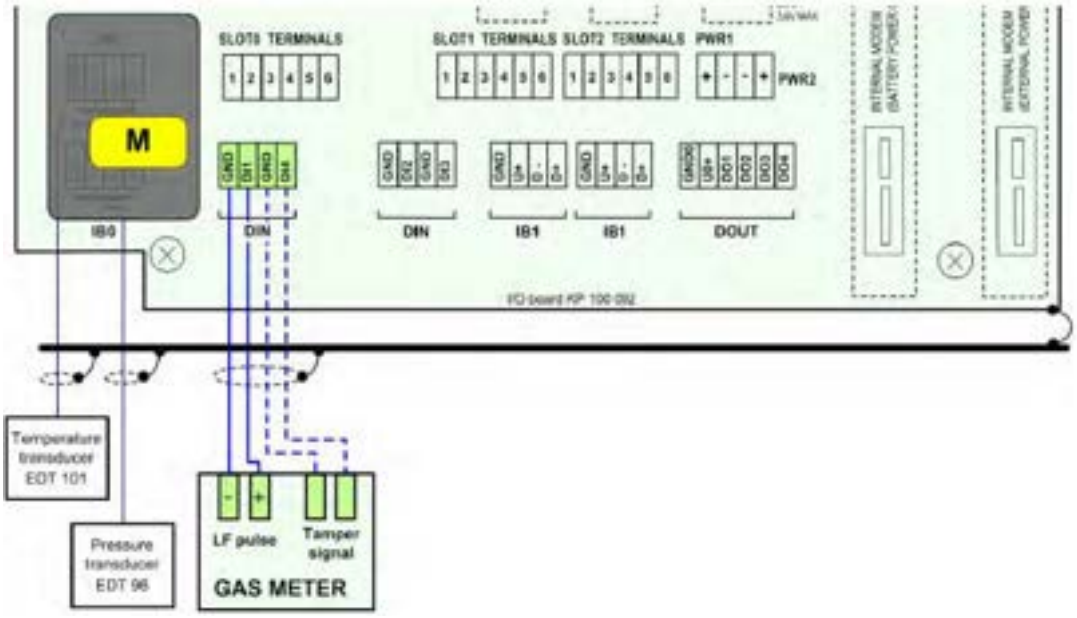


Fig. 11 Connecting LF gas meter to Corus Evo+ (single channel)

5.6.2.2 LF Gas Meter with the Detection of Rotation Direction

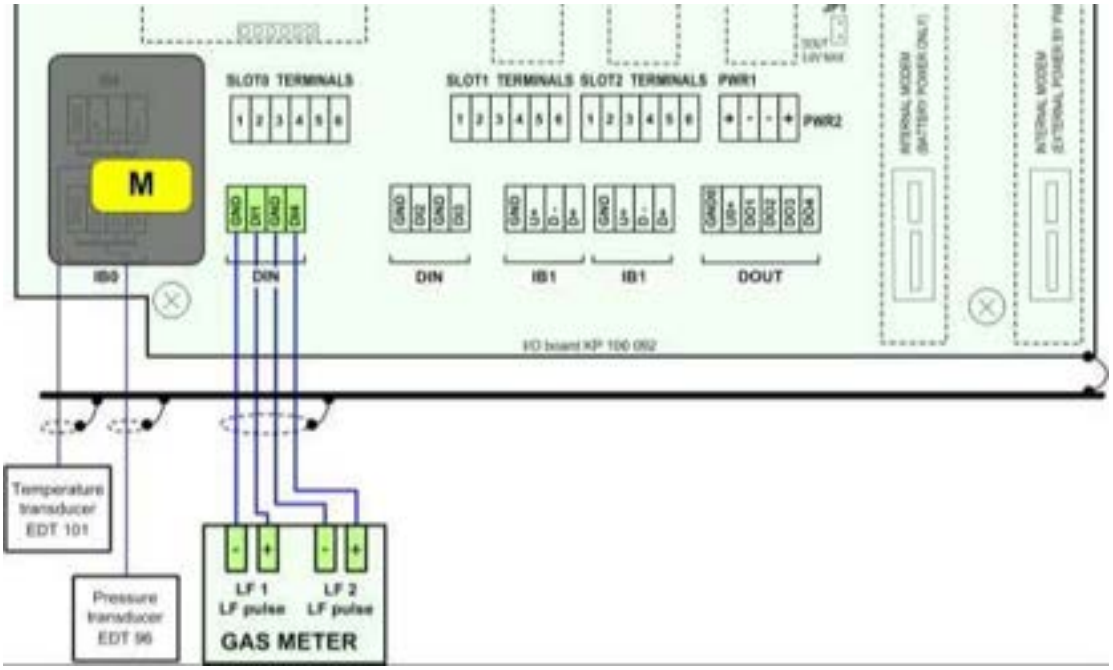


Fig.12 Connecting LF gas meter with the detection of rotation direction to Corus Evo+

5.6.2.3 LF Gas Meter, Dual Channel

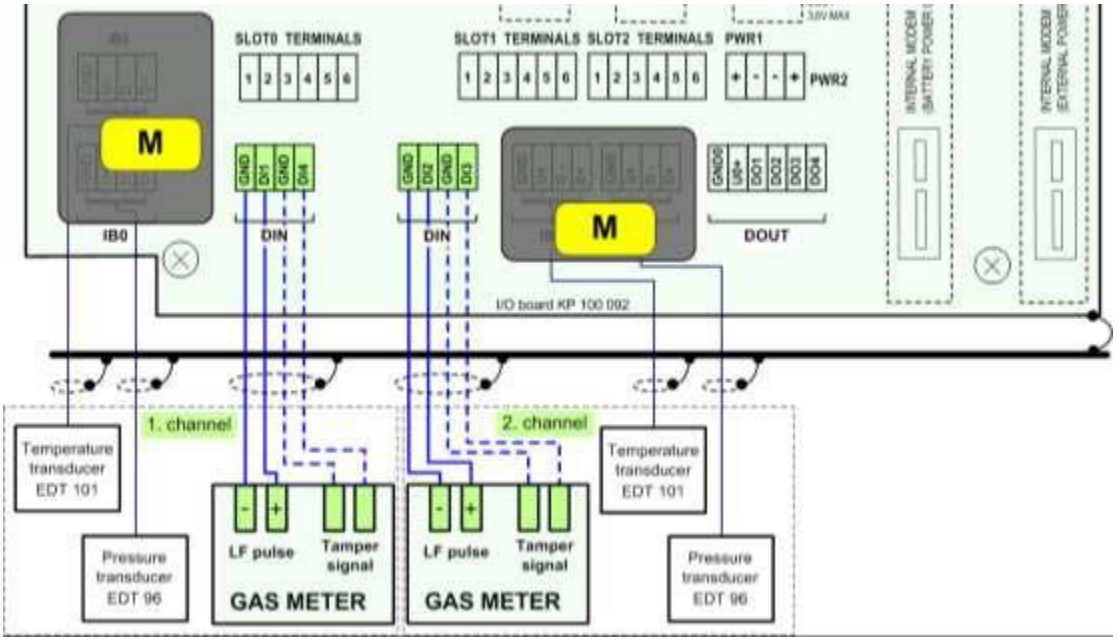


Fig. 13 Connecting LF gas meters to Corus Evo+ (dual channel)

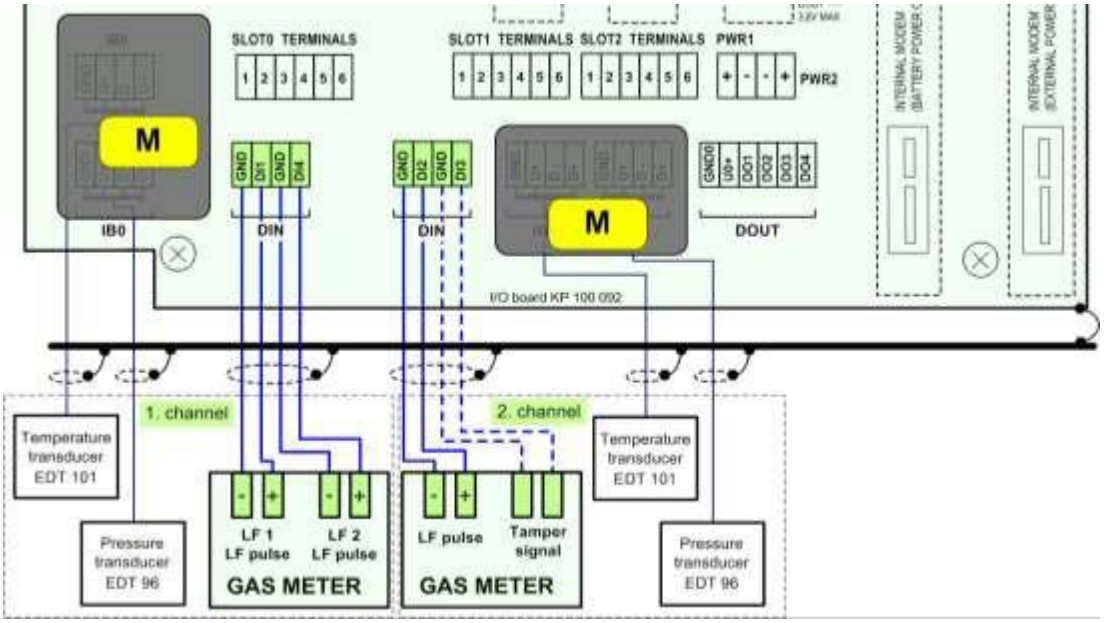


Fig. 14 Connecting LF gas meters to Corus Evo+ (dual channel, gas meter with the detection of rotation direction)

5.6.2.4 HF Gas Meter

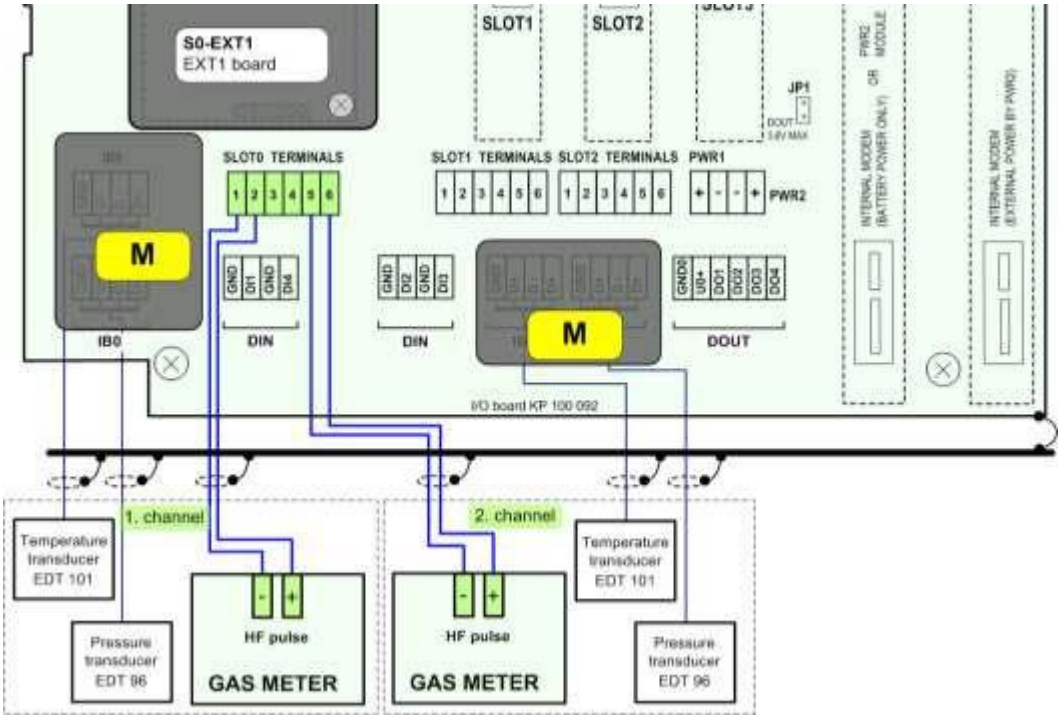


Fig. 15 Connecting HF gas meters to Corus Evo+ (dual channel)

5.6.2.5 Gas Meter with Encoder

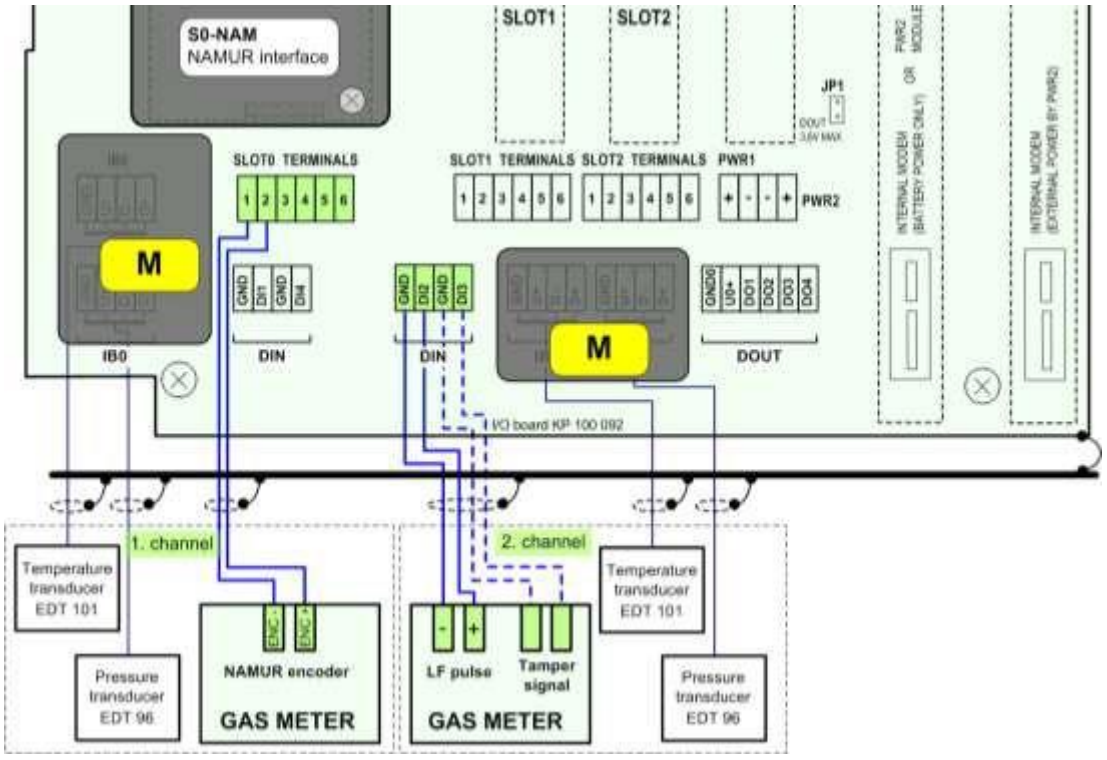


Fig. 16 Connecting gas meter with NAMUR encoder to Corus Evo+

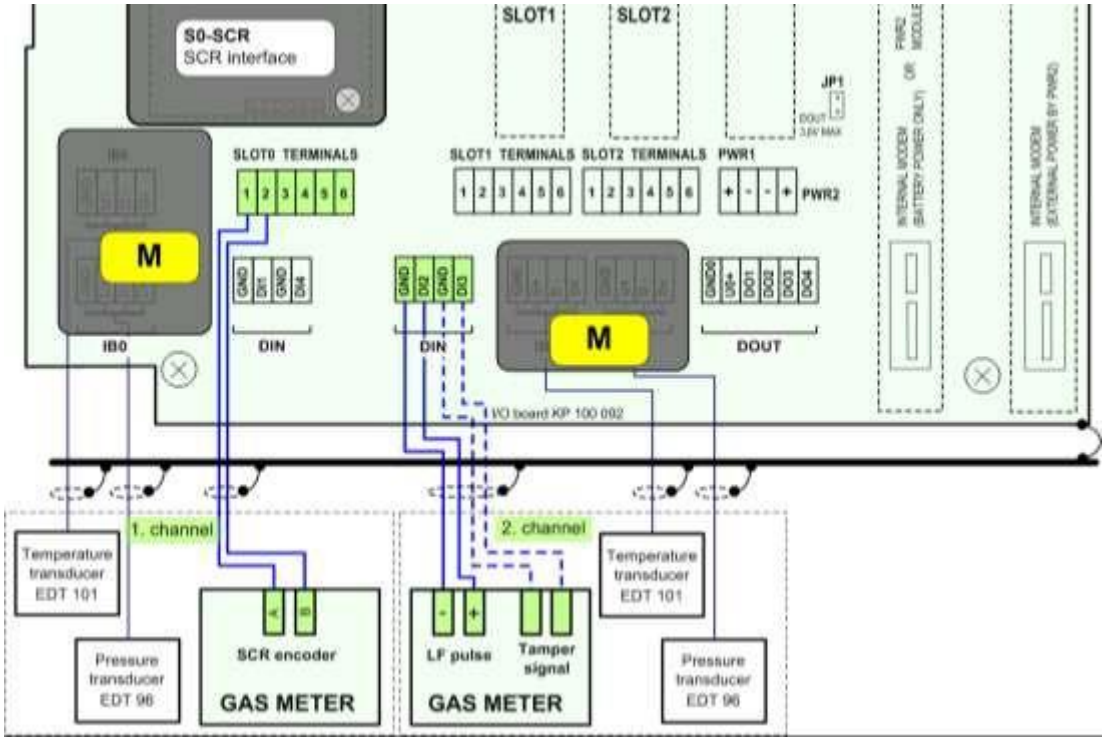


Fig. 17 Connecting gas meter with SCR encoder to Corus Evo+

5.6.3 Connecting Binary Inputs

One of the free terminals DI1 to DI4 can be used to connect binary inputs, if they have not been used to connect the gas meter.

ATTENTION!

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

- **Either intrinsically safe with the corresponding IS parameters,**
- **Or they must fall under the "Simple Device" category according to [2],**
- **Or they must be connected via a safety barrier.**

Connection	Cable	Entry	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 (double)	3-wire shielded	PG7	Unitronic LiYCY 3 x 0.25 Lappkabel	4.7 mm
Binary input (triple)	4-wire shielded	PG7	Unitronic LiYCY 4 x 0.25 Lappkabel	5.0 mm
Binary input (four times)	5-wire shielded	PG 7	Unitronic LiYCY 5 x 0.25 Lappkabel	5.6 mm

Table 4 Cables recommended to connect binary inputs

5.6.4 Connecting Binary Outputs

With 4 digital outputs available, DO1 to DO4 terminals on the DOUT terminal block.

ATTENTION!

The signals of the DOUT terminal block are intrinsically safe, which is why common devices must be connected via a separation safety barrier (B-DO module).

Connection	Cable	Entry	Recommended type of cable	Cable Ø
Digital output (single)	3-wire shielded	PG7	Unitronic LiYCY 3 x 0.25 Lappkabel	4.7 mm
Digital output (four times)	6-wire shielded	PG7	Unitronic LiYCY 6 x 0.25 Lappkabel	6.0 mm

Table 5 Cables recommended to connect binary outputs to the B-DO module

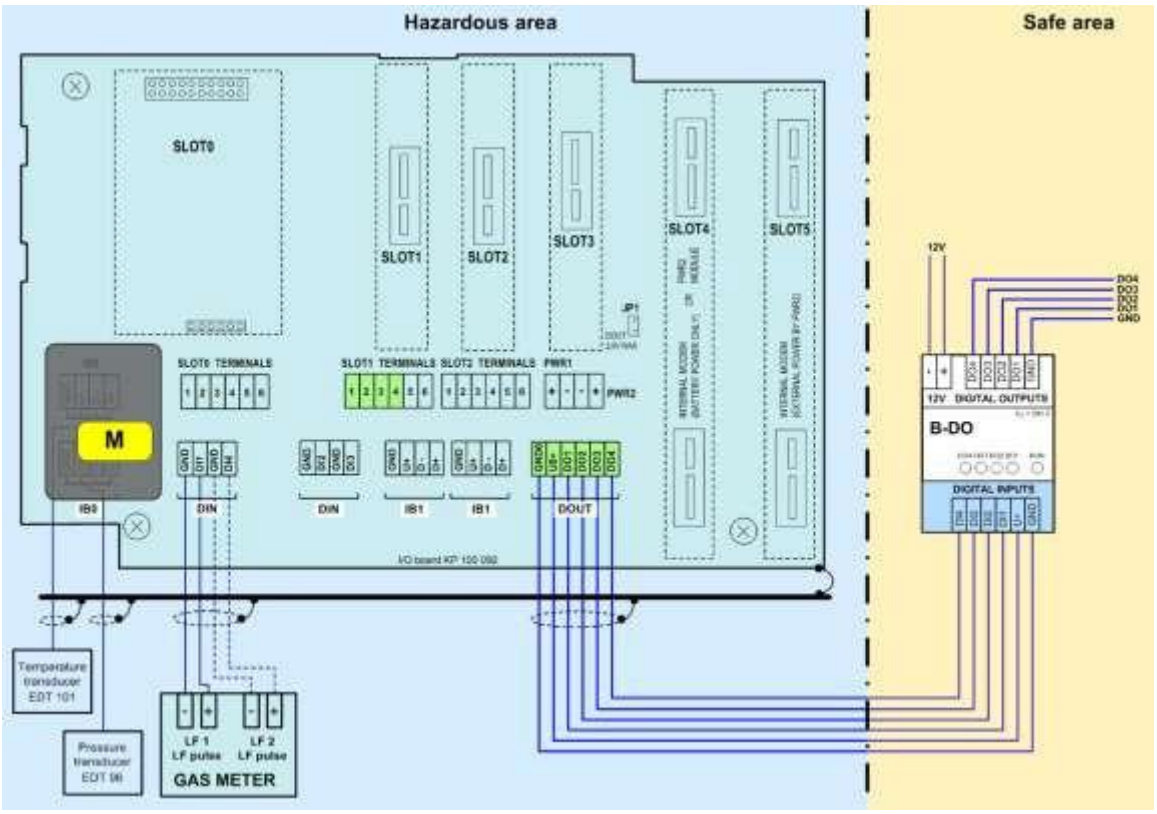


Fig. 18 Connecting digital outputs via B-DO separation barrier (Corus EVO+)

5.6.5 Connection of pressure and temperature transducers

These transducers are connected to the I / O board in the IB0 terminal block, respectively terminal block IB1. Furthermore, they can be connected to the IB1 terminal block of the EXT1-T terminal board of the EXT1 module. In the case of the metrology channel, the connection is covered and secured with the MID security mark.

ATTENTION!
The intrinsically safe internal communication bus is connected to terminals IB0 and IB1. In case of any manipulation on terminals IB0 and IB1 it is necessary to disconnect the device power supply (i.e. external power supply and battery).

IB0, IB1	EDT 96 EDT 101	EDT 101 Temperature transducer	EDT 96 Pressure transducer internal (var. A)	 external (var. C)
terminal	signal	wire	wire	wire
GND	GND	green	green	green
U+	PWR	brown	brown	brown
D-	DATA-	yellow	yellow	yellow
D+	DATA+	white	white	white

Table 6 EDT 96 and EDT 101 transducers wire colors

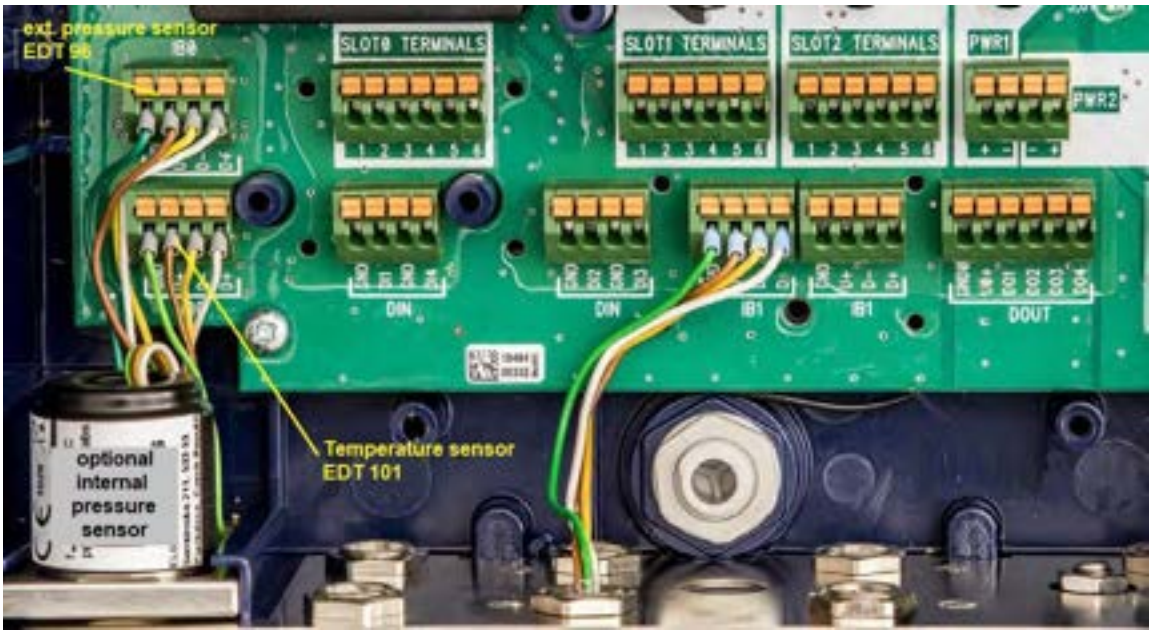


Fig. 19 EDT 96 and EDT 101 transducers connection

The EDT 96 pressure transmitter and the EDT 101 temperature transmitter are supplied by the manufacturer calibrated in whole measurement range. The calibration and correction data are stored in the transducer´s internal memory when the transmitter is calibrated and the resulting measured data already included with the corrections is passed to the instrument control unit.

Nevertheless, the device is equipped with the option of **one-point or two-point adjustment** of the transducer using the supplied SW [20]. This option is protected by the metrology switch provided by the metrology mark. In the case of a corrector without MID metrological verification or an electronic data logger, the adjustment is accessible to the user. A description of the corrector settings via user SW is given in [17].

For more information on EDT 101 and EDT 96 transducers, see [18] and [19].

5.6.6 Connecting External Power Supply

A cable with a minimum cross section of 0.75 mm^2 is required for the external power supply from the PS-E (PS-E/A) intrinsically safe power supply.

To connect the external power supply to internal modem from the PS-M (PS-M/A) intrinsically safe power supply, cable with the conductor cross section of at least 1 mm^2 is required. The table below shows the maximum length of this cable. The PG9 cable gland is designed for the cable. If both the corrector and the internal modem are powered from external power supply, the only one 4-core cable can be used for the power supply.

Connection	Cable	Cable gland	Recommended type of cable	Max. length	Cable Ø
External power supply of the corrector (separate)	2-wire shielded	PG9 (PG7)	Unitronic LiYCY 2 x 0.75 Lappkabel	30 m	6.0 mm
External power supply of the modem (separate)	2-wire shielded	PG9	Unitronic LiYCY 2 x 1.5 Lappkabel, or	20 m	7.1 mm
			Unitronic LiYCY 2 x 1.0	13 m	6.3 mm

			Lappkabel		
External power supply of the convertor and the modem	4-wire shielded	PG9	Unitronic LiYCY 4 x 1,0 Lappkabel	13 m	7.3 mm

Table 7 Cables recommended for external power supply for the corrector and the modem

5.6.6.1 External Power Supply for the Converter (Measurement Part)

External power supply can be used with Corus Evo+. If external power supply is used for the corrector (i.e. its measurement part), the S3-PWR1 module must be installed in SLOT 3. Power from an external intrinsically safe PS-E source is fed to the PWR1 terminals. In the event of a power failure, the corrector battery (B-03) performs the power backup function.

WARNING

If the corrector is powered from an external power supply, it is necessary for the device to operate correctly that the batteries (B-03) of the corrector are inserted and connected in the device.

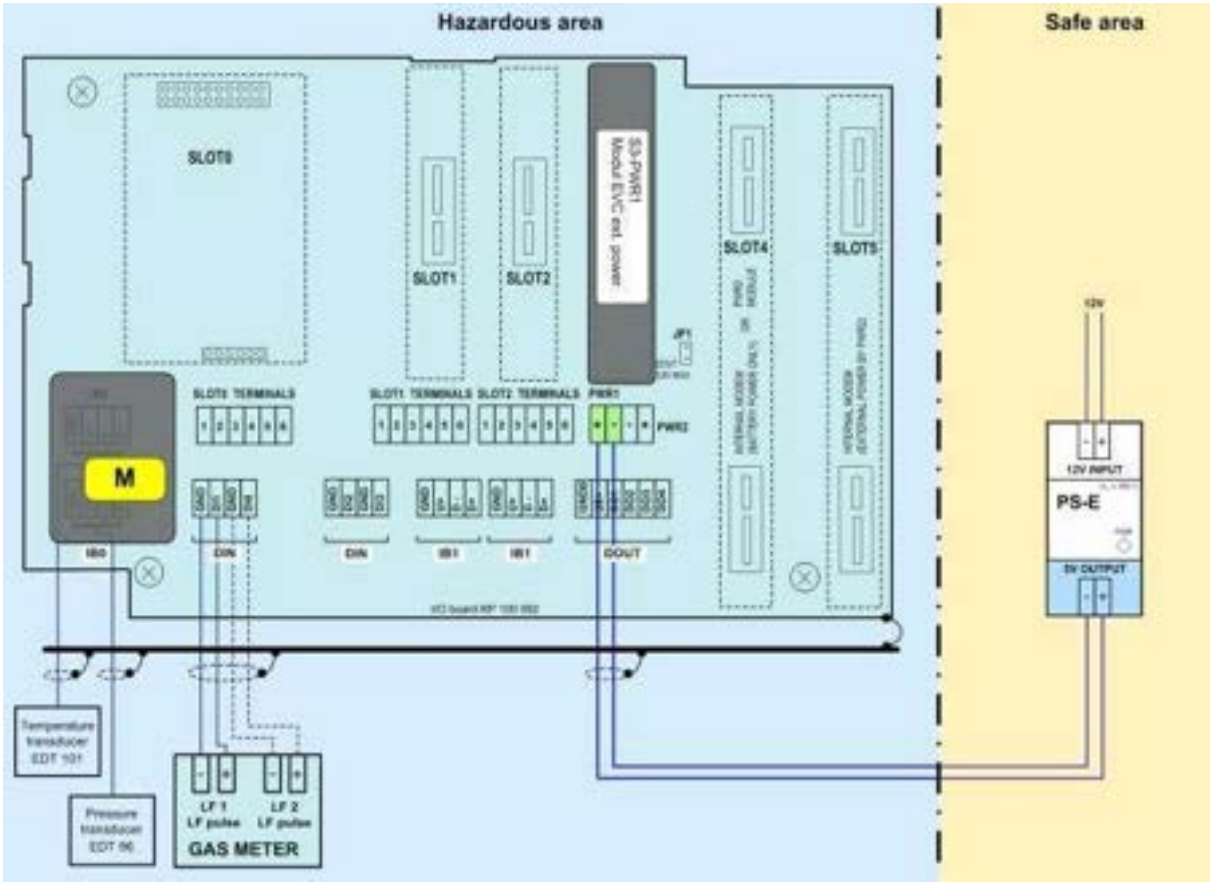


Fig. 20 Connecting the external power supply of Corus Evo+

5.6.6.2 External Power Supply for the Internal Modem

The external power supply for the modem is ensured by the S4-PWR2 module in conjunction with the PS-M external intrinsically safe source. The S4-PWR2 module must be installed in SLOT 4. Power from an external intrinsically safe PS-M source is fed to the PWR2 terminals.

In the event of a power failure, the modem battery (HB-03, HB-04, etc.) performs the power backup function.

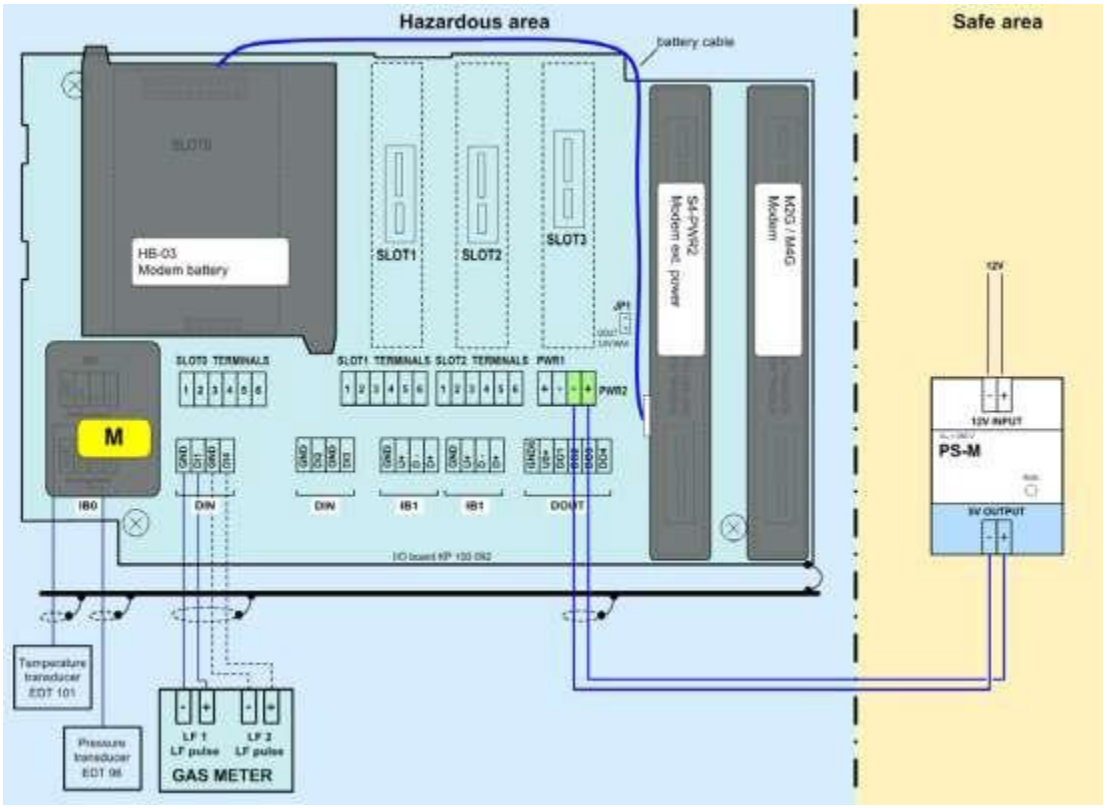


Fig. 21 PS-M External power supply for the internal modem from PS-M source

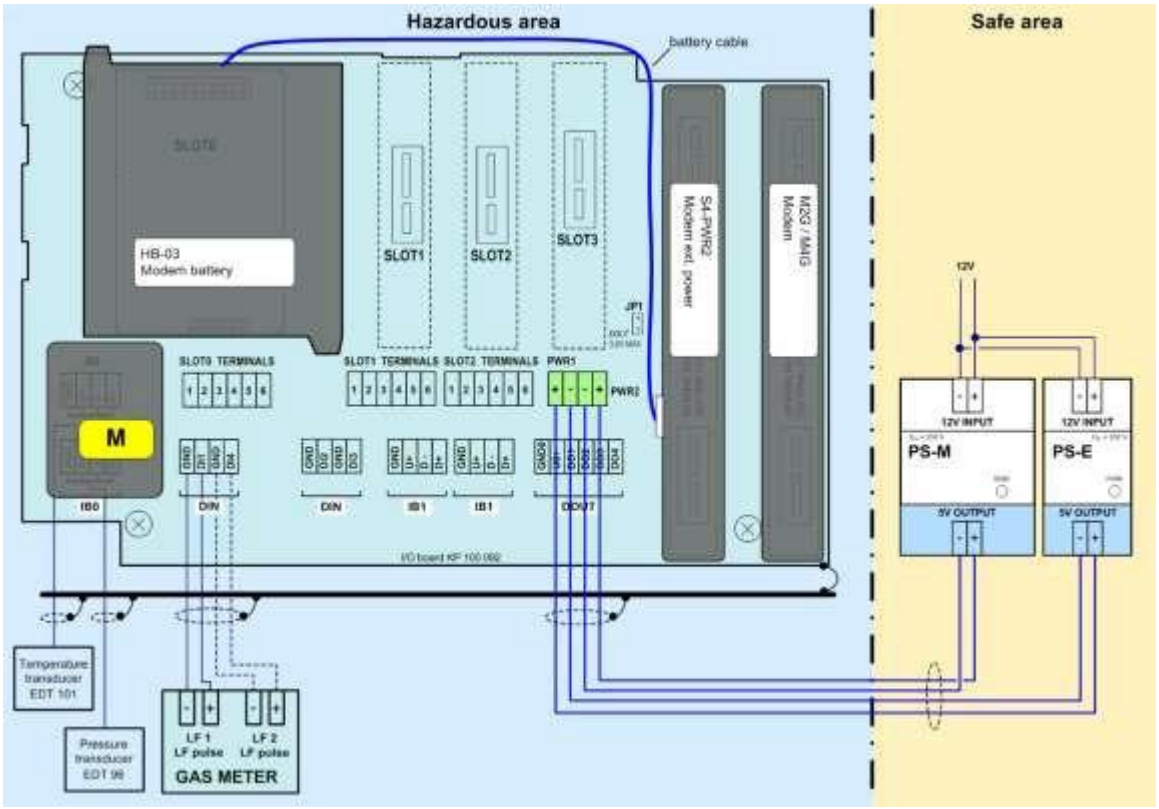


Fig.22 External power supply to Corus Evo+ and the internal modem

5.6.7 Connection of RS232/RS485 Communication

The device must be fitted with the S1-COM1 communication module. The module must be fitted in SLOT 1 or SLOT 2. The module offers RS232 or RS485 communication interface. Two S1-COM communication modules can be installed in the device. In this case, communication on two completely independent communication lines is possible. The cable is connected to SLOT 1 or SLOT2 terminal.

SLOT 1, SLOT 2	RS232	RS485
Terminal	Signal	Signal
1	---	D1+
2	---	D1-
3	GND	GND
4	CTS	U1+
5	RxD	---
6	TxD	---

Table 8 Assigning the terminals of the terminal block SLOT 1 and SLOT 2 when S1-COM module is installed

Communication interface	Cable	Cable gland	Recommended type of cable	Max. length	Cable Ø
RS232	4-wire shielded	PG7	Unitronic LiYCY 4 x 0,34 Lappkabel	30 m	5,7 mm
RS485	4-wire shielded	PG7	Unitronic LiYCY 4 x 0,34 Lappkabel	100 m *)	5,7 mm

Table 9 Recommended cables for RS232 and RS485 of the corrector

*) cable length may be reduced at higher communication speeds

If there is no internal modem in the device, the communication can be extended by one additional independent RS232 communivation interface using the S4-COM0 module in SLOT 4. Up to three independent communication lines are available.

ATTENTION!

The signals of the DOUT terminal block are intrinsically safe. Common devices must be connected via a suitable communication barrier (B-RS).

Recommendation:

If an external communication modem is connected to the device, an RS232 communication interface is required to connect the device with the B-RS barrier to ensure full duplex communication.

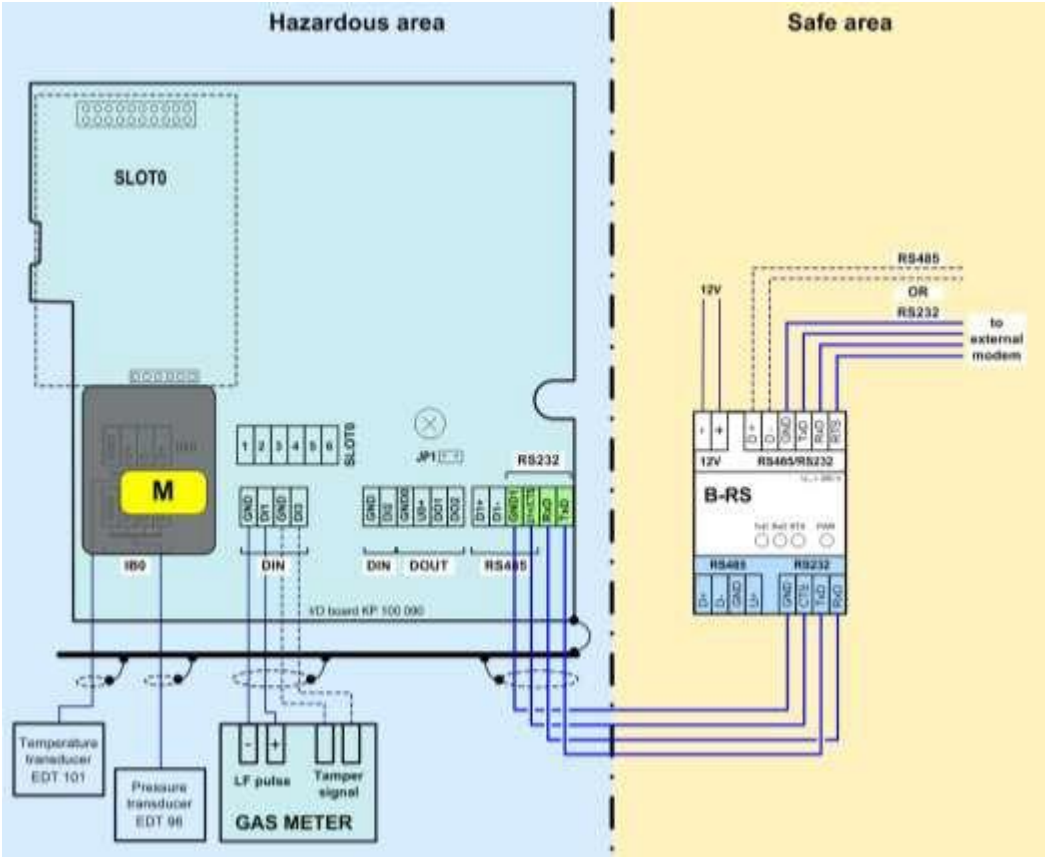


Fig. 23 Connecting B-RS when external modem is connected

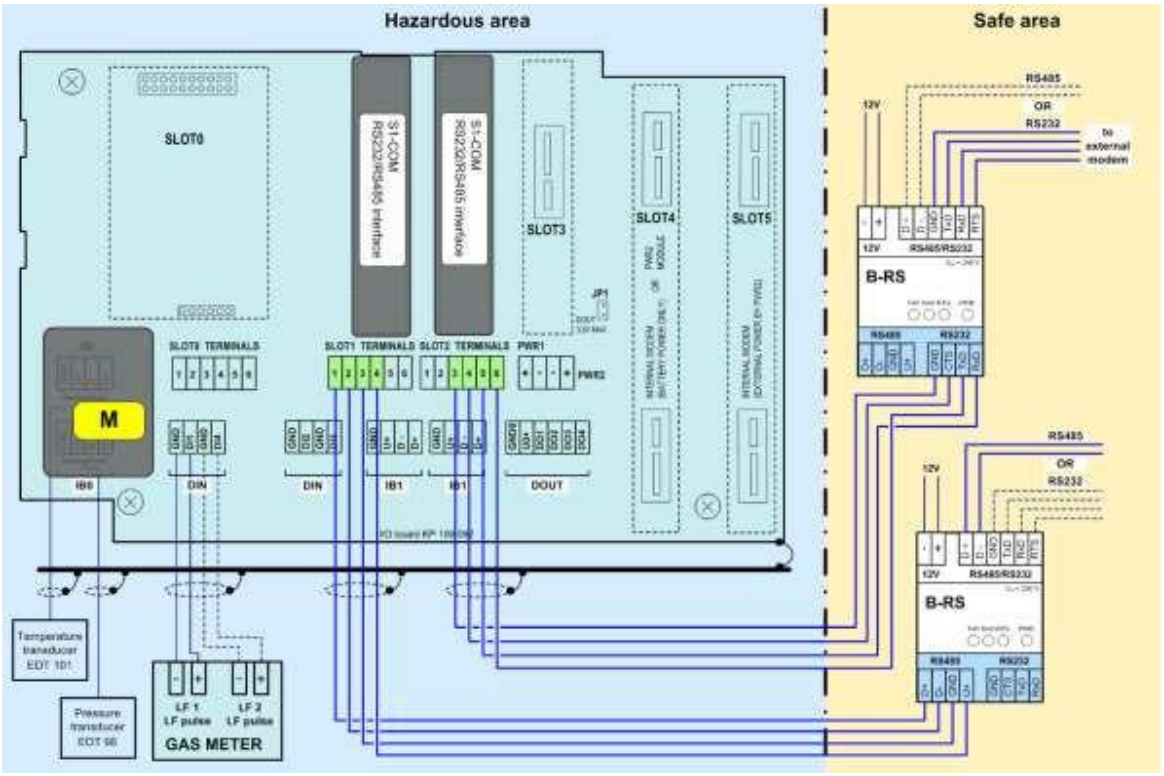


Fig 24. Communication via two independent interfaces RS232/RS485

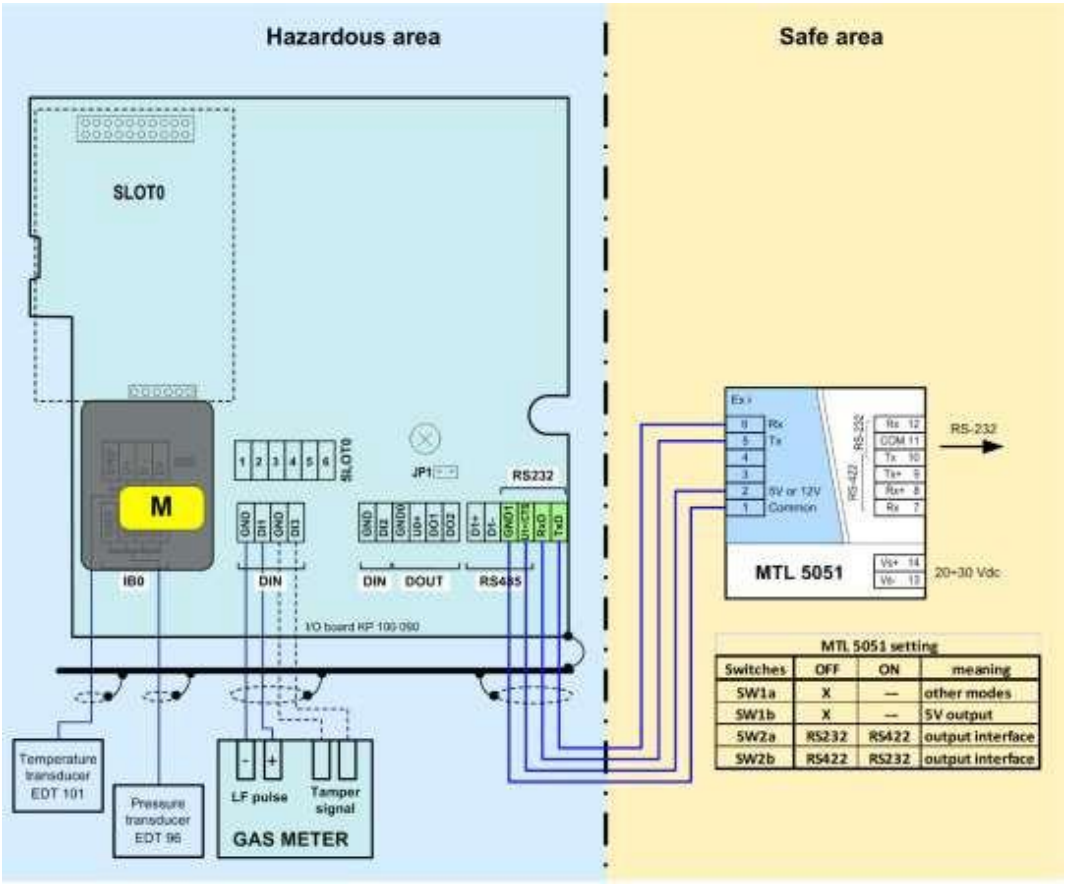


Fig.25 Communication using the barrier MTL 5051

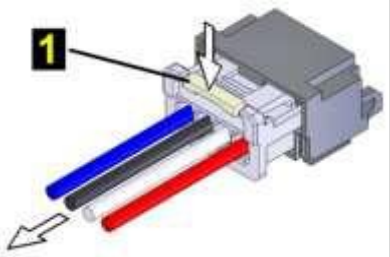
5.7 Commissioning

The device is delivered either in the operating state with the battery connected or in the off mode with the battery disconnected. Both the battery of the device (B-03 etc.) and the modem battery (HB-03, HB-04, etc.) are equipped with a cable with a connector by which they are connected to the device.

WARNING!

All the connectors in the device contain a mechanical safety lock 1 against accidental disconnection.

To disconnect the connector, first press the lock to release the connector, then pull the connector gently out of the socket. Never apply force grasping and pulling the cable, it can be damaged.



To re-connect the cable to the device, plug the connector slightly so that the lock snaps into place, then check for the proper connection by a slight pull on the cable.

The device comes with pre-set configuration parameters. After the mechanical assembly of the device, however, some parameters have to be set to ensure proper operation of the gas meter.

The basic operations to put the device in operation are as follows:

- **5.7.1 Connecting the batteries**
- **5.7.2 Checking (or adjusting) the system time of the device**
- **5.7.3 Setting the offtake point identification**
- **5.7.4 Setting the temperature and pressure substitute values**
- **5.7.5 Setting the method to calculate the gas compressibility**
- **5.7.6 Setting the gas composition**
- **5.7.7 Checking the diagnostics, removing device errors, if any, initiating cumulative status**
- **5.7.8 Resetting the device archive**

These basic operations can be performed either from the device keypad (Section 6), or from the PC with a utility program . When using a PC, you must connect the device to a computer, preferably using HIE 04 infrared head. If necessary, additional parameters can be set using the utility program (setting the pulse outputs, setpoints, etc.).

5.7.1 Connecting the Battery

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

If the device is delivered in the off mode (nothing is displayed after pressing Enter for more than 2 seconds), the B-03 battery pack is disconnected from the unit. The battery cable with connector 1 must be plugged into connector 2 of the processor board (CPU module) to put the device into operation. This operation is also possible in potentially explosive environments.

When the battery is connected, the device is automatically in the operating mode.

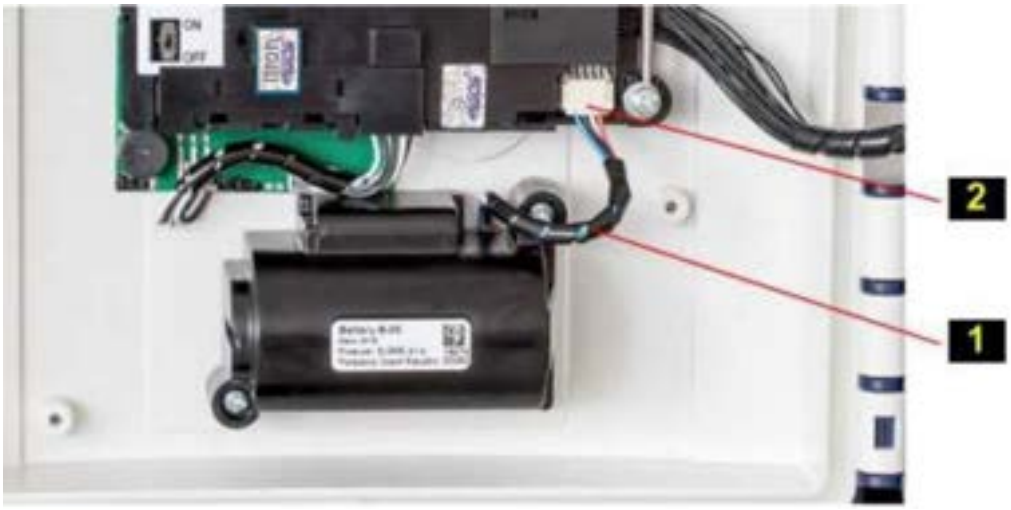


Fig. 26 Connecting the device battery

5.7.2 Connecting the Modem Battery

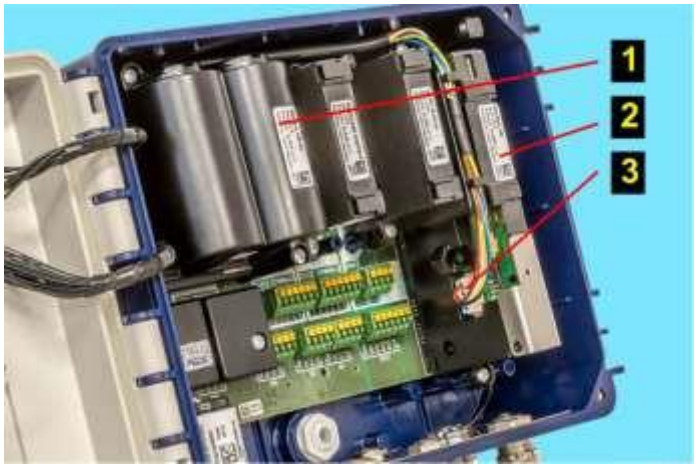
The version of the device with internal GSM/GPRS modem can be delivered with a disconnected modem battery.

When commissioning, the modem power supply battery pack (HB-03, HB-04, etc.) with the connector must be plugged into the connector of the module that is installed in the SLOT 4 position.

ATTENTION!

<u>The internal modem battery must always be connected to the module in SLOT 4:</u>

- **If the external power supply of the modem is not used, the modem module is installed in SLOT 4. In this case, the modem battery is connected directly to the modem.**
- If the external power supply of the modem is used, the modem is installed in SLOT 5, while the module of the external power supply of the modem S4-PWR2 is in SLOT 4. The battery is then connected to the S4-PWR2 connector.



1 Modem battery

2 PWR2 in SLOT 4 position

3 Connector of the modem battery

Fig. 27 Connecting the modem battery

Note:

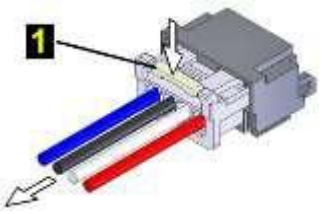
For longer time storing, it is recommended to remove the batteries from the device or, if necessary, at least disconnect them by pulling out the battery connector.

5.7.3 Installing SIM Card in the Modem

The device is delivered without the modem SIM card. Before using the modem, the SIM card received from the operator must be inserted into the modem. The SIM card holder is designed for miniSIM size of the SIM card.

To insert/remove the SIM card:

- If the external power supply of the modem is used, disconnect the power supply from the PWR2 terminals.
- Press lock **1** and pull gently the cable out to disconnect the connector of the battery modem.
- Push slightly in the direction of arrow **3** on the SIM card cover **4** and tip it to the vertical position.
- Insert SIM card **5** into the holder and push it until you hear a click.



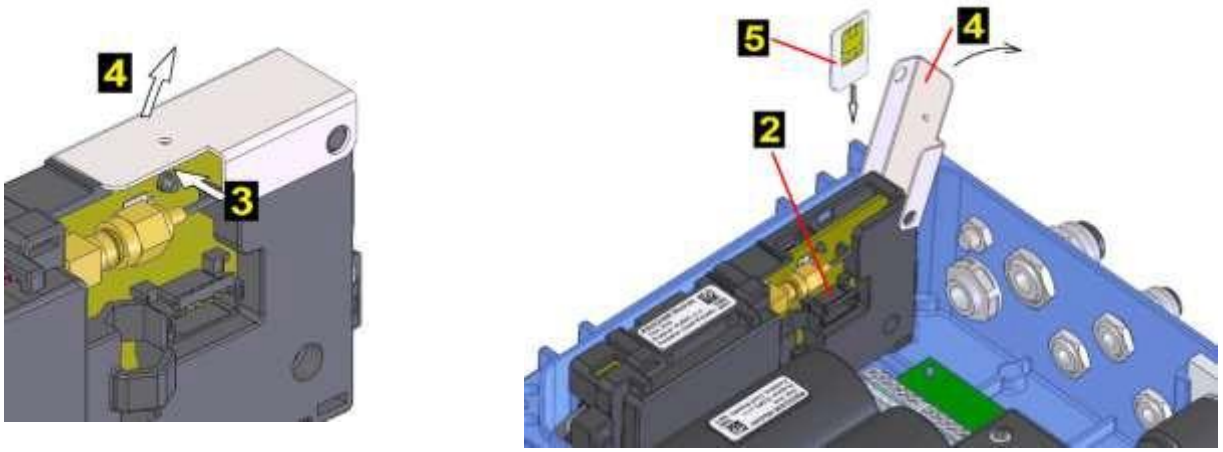


Fig. 28 Connecting the modem SIM

- To remove the SIM card, press the card until you hear a click, release the pressure, and the card moves several millimeters out. Grasp the card and remove it from the holder.
- After inserting the SIM card, close cover **4** and push it slightly in the direction of arrow 3 for easier insertion.
- Connect the connector of the battery of modem **2** For a device without external power supply of the modem, connect the connector to the modem. For a device with the external power supply of the modem, connect the connector to the S4-PWR2 module and then connect the wires to the PWR2 terminals of the external power supply of the modem.

6 Operating the Device

The device is not equipped with a power switch. The device turns automatically into the operation mode when the battery is inserted in the device. The device registers the LF pulses even with the main battery removed.

A 6-button keypad is used to operate the device and to display the measured and other values. The values are displayed on a 128 x 64-pixel graphic display, or on a segment display.

For battery operation, the graphical display is switched off after 30 seconds since the last press of any key. **The display lights up when the enter key** 

has been pressed for 2 seconds. If the device is powered by an external power supply source, the display is permanently on.

With the segment display, the display is permanently on and backlit even when the device is battery operated.

The keypad is the same for the version of the device with the graphical display and with the segment display.

The display and operating features of the device with the segment display are described in the "Segment Display Version" appendix.

The data to be displayed are selected in the device menu. The menu items are displayed depending on set parameters of the device. The contents of some menu items are user- configurable.

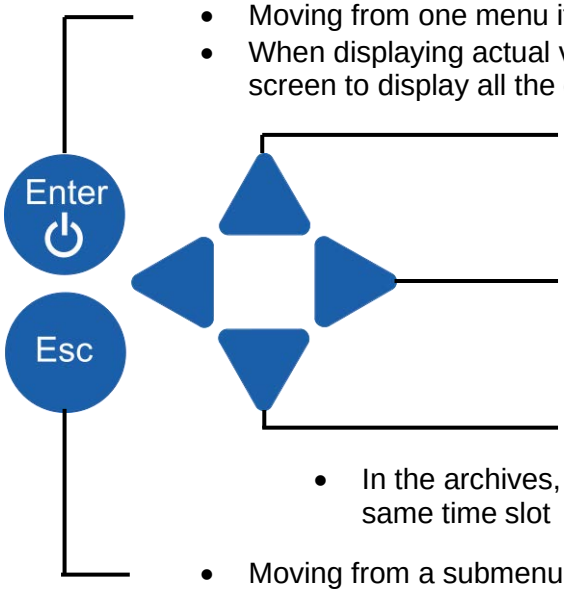
Display Features (Graphical Display)

- Automatic display update for changing data with 1 sec period
- Autorepeat - when holding a key, the keystroke is automatically generated; this feature can be useful for example when viewing archives
- Display without diacritic
- In compliance with the standard EN 12405-1:2018, Section 6.3.1.5, the display switches to the basic settings after a certain idle time. The time after which the display switches to basic can be set in the parameters.
- In order to simplify the operation by an untrained user, the option to display actual values one after another by pressing the 

key is included. Before this, it is necessary to exit by pressing the 

key several times to the top menu level.
- For energy saving purposes, the device's graphic display goes out after 30 seconds when in battery operation mode, and lights up only when any key is pressed...

6.1 Keypad



- Pressing the Enter key for 2 seconds **turns the display on**
- Moving from one menu item into lower level menu (submenu)
- When displaying actual values, Enter will scroll through the screen to display all the quantities one after another

- Menu navigation
- Moving in time in the archives towards older records

- In the archive view, moving to the next quantity in the same time slot

- Menu navigation
- Moving in time in the archives towards newer records

- In the archives, moving to the previous item in the same time slot

- Moving from a submenu item back to higher level menu

Fig. 29 Function of the keys

6.2 System Menu

The device is operated based on selecting items from the menu. For the purposes of further interpretation, we call the basic menu items the highest items. By entering those items, navigate to the lower menu levels (submenus).

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

Home Screen (Initial Display)

Fig. 30 Home menu

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

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

Table 10 Status icons of the display

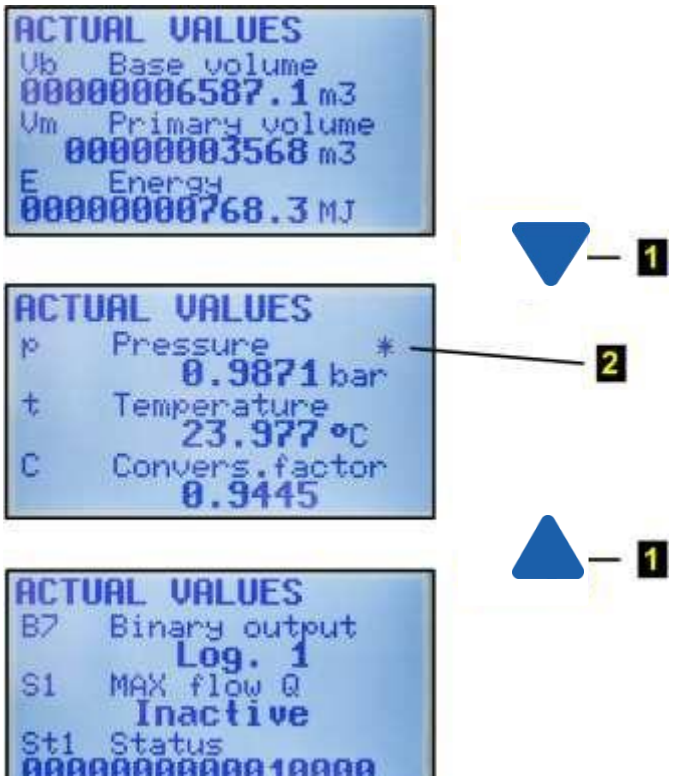
6.3 Main Menu

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.

6.4 Actual Values Menu

By pressing the key Enter the actual value are displayed. To scoll through the displayed data, use the arrow up and down keys



1 Scrolling through the displayed values

2 The asterisk flag indicating exceeding the measuring range of the analogue quantity

Fig.31 Example of actual values display

6.5 Data Menu

For data, daily, monthly, and binary archives, the way the data is displayed is identical and can be seen in the figure below.

Fig.32 Navigation in the archives (in this case, with archiving frequency 1 h)

The binary archive is displayed in the same way, only the records are not stored in the archive with the archiving frequency, but at times when the status of some of the stored quantities has changed.

To end archive viewing, press the key Esc.

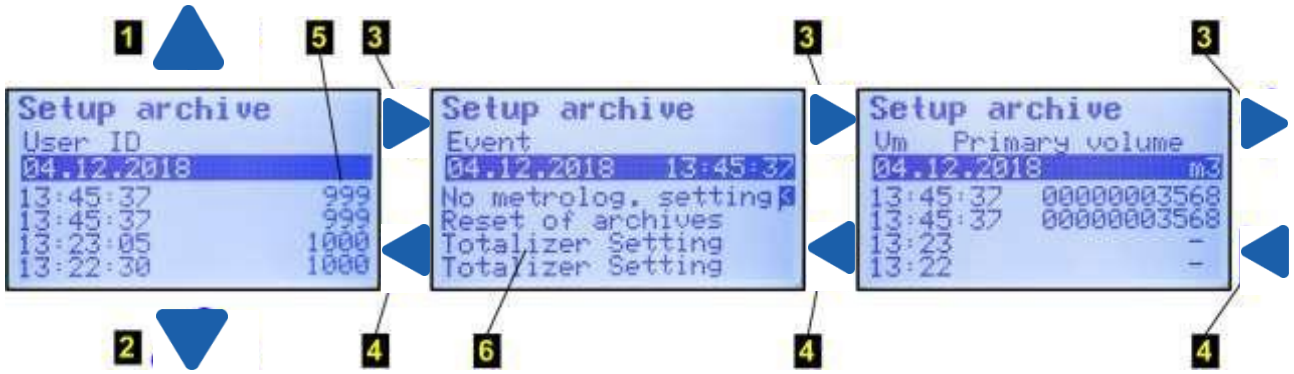
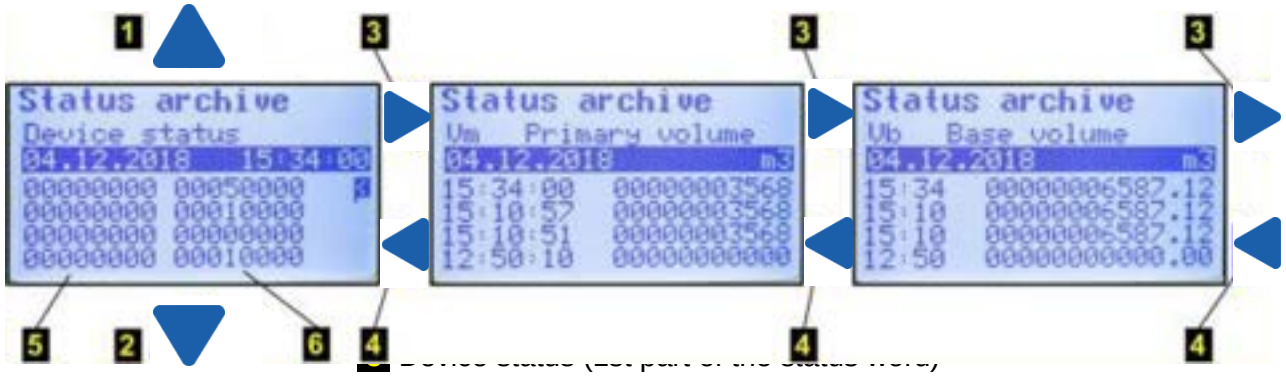


Fig.33 Display of the settings archive



6 Device status (2nd part of the status word)

Fig. 34 Display of the status archive

6.6 Conf Menu

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

6.6.1 General parameters (network address1, network address2)
6.6.2 IR head (baud rate, communication protocol)
6.6.3 Internal modem (baud rate, communication protocol, communication device)
6.6.4 Serial COM1 (baud rate, communication protocol, communication device)
6.6.5 Serial COM2 (baud rate, communication protocol, communication device)

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

6.6.6 Serial number of the device
6.6.7 Application FW, version and checksum (CRC)
6.6.8 Metrological FW, version and Checksum (CRC)
6.6.9 FW Loader, version and checksum (CRC)
6.6.10 Memory size [byte]
6.6.11 Station Identification

Scroll through the display using the ▼ and ▲ keys. The end of the data is marked with "<" on the display.

In the **Conversion** menu, the following data is displayed:

6.6.12 Conversion

6.6.12.1 Conversion according to the standard
6.6.12.2 Reference pressure pb
6.6.12.3 Reference temperature tb
6.6.12.4 Compressibility Zb
6.6.12.5 Gas composition items (displayed depending on the selected conversion standard)

6.6.13 C Conversion Factor

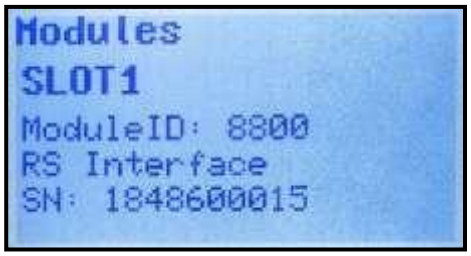
6.6.13.1 Recalculation type
6.6.13.2 Substitute temperature
6.6.13.3 Substitute pressure
6.6.13.4 Compressibility
6.6.13.5 Standard
6.6.13.6 Pressure range
6.6.13.7 Temperature range

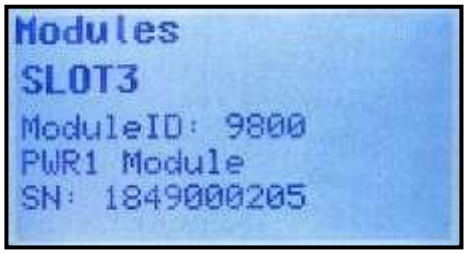
In the **Input Parameters** menu, the following data are displayed:

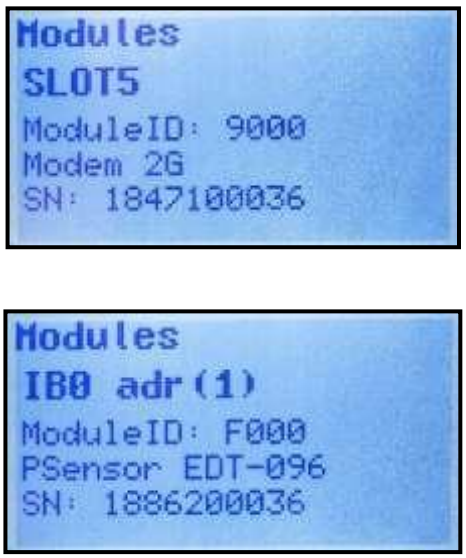
Vm (gas meter)	- Marking of input terminals - Gas meter constant kp [imp/m3] - Serial number of the meter
t EDT 101 (temperature measurement)	- Transducer communication address - Measuring range - Serial number of the temperature sensor
p EDT 96 (pressure measurement)	- Transducer communication address - Pressure range - Serial number of the pressure transducer

plus e.g. parameters of the 2nd channel and additional transducers (non-metrological)

In the **Modules** menu, you can view the basic data of the modules, transducers, batteries, and other system components. Use the ▲ and ▼ keys to scroll through the data.







1 Module identification number
2 Module designation
3 Serial number of the module
4 Number of the slot in which the module is installed or the identification of the internal communication bus to which the module (transducer) is connected

Fig. 35 Example of the displayed information on device components

In this menu, the device parameters can be set directly from the device keypad.

Setting device parameters from the keypad can be protected:

- By the service switch (the switch must be set to ON)
- By a password (for more details, refer to Section 11.6.2)

If the service switch is set to OFF, the message "Parameters cannot be set" appears in the display.

The following parameters can be set:

Service parameters	- Station Identification - Gas hour
Communication	- General parameters - IR head - Communication protocol - Internal modem - Serial COM1 - Serial COM2 ... (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)	- kp1, kp2 Gas meter constant [imp/m3] - Vm1, Vm2 Primary volume (-Vb1, Vb2 Volume at base conditions) - Vs1, Vs2 Substitute primary volume (- Vbs1, Vbs2 Substitute volume at base conditions) (- E Energy) (- Es Substitute Energy) - Serial numbers of the gas meters - Qmax1, Qmax2 Max. gas flow rate
Archive reset	Data archive Daily archive Monthly archive Billing archive Binary archive Limit archive (Settings Archive) (Status Archive) (Gas composition archive)
Work mode	normal (standard)
Saving parameters	Entering the changed parameters in the device

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

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

	Selecting the edited position in the row
	Selecting and entering an alphanumeric character (space, 0 to 9, A to Z, a to z)
	End of editing the parameter

Saving the Parameters

After you finish editing the parameters, you need to enter the changes in your device. To do this, choose "Save Parameters". Successful saving the parameters in the device is confirmed by the message "Valid Data".

Totalizer values and Current time are saved immediately after entering the value. A confirmation dialog is displayed before the value is saved, and on confirmation, the value is stored in the appropriate register.

6.7 System data Menu

6.7.1 About Device

The basic system parameters are displayed here, In addition, you can use the ▲ and ▼ keys to display additional data (digital inputs and outputs, etc.).

6.7.2 Device Reset

The command is non-destructive. After selecting the device reset, the program jumps to the start address and re-initializes the entire metering system. Neither the contents of all archives, nor the values of all V and V_b gas volumes change during this operation. The same applies to all the other set parameters. The command execution is independent of the position of the service switch.

6.7.3 Communication

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 the connection** to the master communication point (modem) of the dispatch center (regardless of the timer setting and calls of the internal timers of the device).

For modem communication, also some diagnostic data is displayed.

In the first step, the modem is selected (the device allows for connecting no more than 2 modems, one internal and one external). The following options can be selected for each of selected modems.

6.7.3.1 Modem Status

The current status of the modem is displayed on the 2nd row of the display. The following rows 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 connecting	the modem was connected to power (by software- the internal control signal connected the modem power supply)
modem init	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 [16])

2 Signal strength [17])
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 Table 11
3 IP Address
For GPRS communication, the IP address of the device is displayed.
4 Modem Error[17])
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 Table 12.
5 ERROR Date and Time[17])
For modem error, the date and time of the last error is displayed.

6.7.3.2 Signal Testing

After selecting this option (the modem must be set in the device parameters, it can be turned off), the device turns on the modem power supply, initializes the modem and measures the signal

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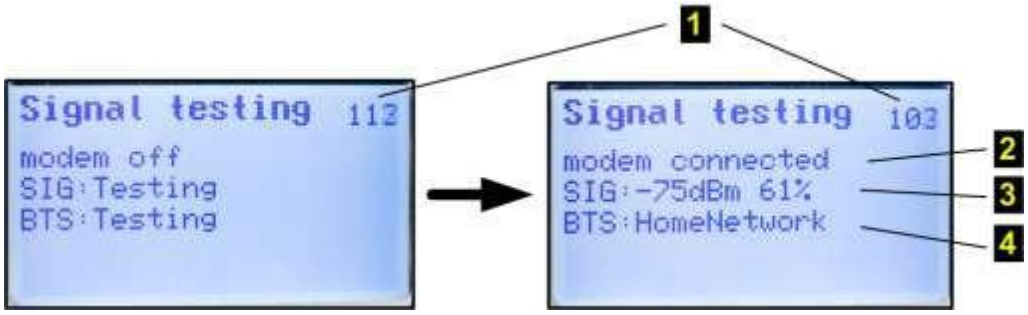
[16]) If modem communication is in progress, the modem is turned off only after the communication has been completed.

[17]) After resetting the device (see Section 6.7.2), or after changing some important modem parameters, this value is reset.

strength after connecting to the mobile network. (The sequence **2** modem off, modem on, modem init, modem connected is run). 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%). Under this value, the device displays error number 10 (see Table 12). In addition, low GSM/GPRS signal levels significantly reduce the reported battery life of the modem.



Note:

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

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

Table 11 RSSI signal strength conversion table between dBm, %, 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 (Initialization or Special Initialization field in the service software
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

Table 12 Error Codes of the Modem

6.7.3.3 Power on Modem

This option will turn the modem on for 5 minutes (i.e. 300 seconds; the remaining time in seconds to turning off the modem **1** shows in the top right corner of the display). This command is useful, for example, to test the communication when setting up the device (basically simulates the function of the internal parameter "Timer - Service Window" described in the TELVES program parameterization).

6.7.3.4 Call to Dispatch

If the device is configured to call the dispatch center, this command can verify that the device call to the master system is correct (applies to both dial-up connection and GPRS mode). This option basically simulates the function of the internal parameter "Timer - Call Window". On the first row of the display, the modem states (switching on, initializing, connections ...) are displayed sequentially through which the modem goes through when the connection is terminated. When the connection is established, the device sends the calling data frame to the master station, which must accept it when the settings are correct. After that, the modem terminates the connection and is turned off.

6.7.3.5 Modem Battery

It displays the battery charge status of the modem in % and the current battery voltage. If the battery is disconnected, the message "Communication Error"/"Comm.error" appears.

6.7.4 Frozen Values

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

6.8 Diagnostics

In the "Diagnostics" menu, the status of the corrector is displayed. The errors are indicated by the prefix "E" and the identification number; similarly, the prefix "W" is used for warnings. For a complete list of error and warning messages see paragraph 6.8.5.

Technical assistance in troubleshooting

If there are any problems with the operation of the device for any reason, technical support personnel may be contacted. Contacts are available at https://www.itron.com/na/contact/support-request.

To help you find a solution to the problem, we recommend providing as much as possible information about your device and connections to related devices nearby. Diagnostic and solving the problem would be easier, if you send us a * .dt_all diagnostic file obtained from the device via a service.

6.8.1 Current Status

This menu displays the current status of the device. Press the "*right arrow*" key to display all current errors and warnings of the corrector one after another.

6.8.2 Summary Status

The summary status is used to monitor the occurrence of active error states (individual device status bits) **since the last summary status reset**. This means also the statuses of the device that have been removed by the operator, or have disappeared over time (typically, for example, exceeding the pressure limit, etc.) are recorded in memory.

Fig. 36 Example of a summary status display

Basic status information is also displayed in the form of an icon (see Section 6.2) of the home screen.

6.8.3 Summary Status Reset

After this option has been selected using the device keypad or via the "Summary Status Reset" option from the "Setup-Diagnostics" menu of the PC utility SW, the summary status is initialized, i.e. the current status is set according to the actual status. To enable initialization, the service switch must be ON. If switched to OFF, a message is displayed that the initialization cannot be performed.

6.8.4 Device Test

After selecting this menu item, the device tests its internal state and displays a list of detected errors and warnings. The test of the device runs for several seconds and does not affect the measuring and archiving operation of the device. The execution of the command is independent of the position of the service switch.

The notification is displayed during the test.

6.8.5 Device Errors Display

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

The shortened form of summary diagnostics is displayed in the right corner of the top-level menu in the form of OK, Err or Wrn (see Section 6.2). This shortened form is the sum of the individual states, and in each case, the abbreviation with the highest priority is displayed. The priority order is Err, Wrn, OK, starting with the highest one. More detailed diagnostic information can be displayed using the utility SW [20]. An overview of the indicated Err messages is included in Table 13*, and the Wrn report is provided in* Table 14*.*

Displayed Message	bit	Description
E0 program CRC	0	Firmware checksum error.
E1 loader CRC	1	Checker loader 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
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 of compressibility table calculation
E31 FRAM error	26	FRAM memory error
E32 FLASH error	27	FLASH memory error
E33 bar sensor error	46	Integrated barometric transducer error

Table 13 List of events - error messages (Err indication)

Displayed Message	**bit**	**Description**
W0 transd. warning	11	Warning alert on one of connected transducers (internal modules SCR, NAMUR, EXT1, SRM or other). Details can be found by reading the parameters of the corrector.
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
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 dif.	47	Volume limit has been exceeded when comparing volume counters
W37 metrology. cover	60	Cover of metrological part of the device was opened
W38 RTC setting	58	The system time has been set
W39 Primary volume setting	59	The primary volume has been set
M0 no configuration	30	The device is in Not configured state
M1 maintenance	31	The device is switched to Maintenance state

Table 14 List of events - error messages (Wrnr indication)

6.8.6 Status Word of the Device

The current status of the device is stored in the 64-bit status word of the device. Each of the monitored status (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 changed, the entire status word is stored in the status archive with a time stamp.

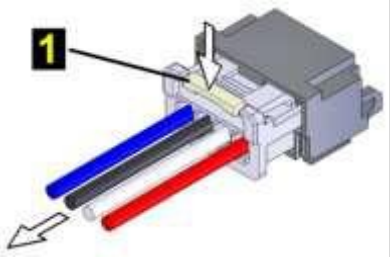
The status word of the device is also stored in the data, daily and monthly archives. These records store information about whether the bit has reached the active state during the archiving interval. Assignment of a specific status word bit to each monitored event is shown in Table 13 and Table 14. When viewing the status in the device archives by the utility. The status word is already displayed in decoded readable form.

7 Technical Description of the Device

WARNING!

All the connectors in the device contain a mechanical safety lock 1 against accidental disconnection.

To disconnect the connector, first press the lock to release the connector, then pull the connector gently out of the socket. Never apply force grasping and pulling the cable, it can be damaged.



To re-connect the cable to the device, plug the connector slightly so that the lock snaps into place, then check for the proper connection by a slight pulling on the cable.

7.1 Architecture of the Device

The device is of compact design with a temperature and pressure transducers solidly attached. In the standard version of the corrector, the pressure transducer is built into the bottom wall of the enclosure. The device architecture is based on interchangeable modules that are mounted in the slots of the I/O board (see below) located on the bottom of the enclosure.

The CPU Module (processor board) with the display, keypad, and battery for the device (powering the device except the modem) is located in the top cover of the device. The CPU module is protected by the cover and marked with an official mark. In the cover of the board is an opening to access the service switch. Use the service switch to enable/disable the device parameter settings.

At the bottom of the cabinet there is the I/O board of inputs and outputs with terminal blocks for connecting external devices and with slot connectors for connecting of exchange modules used to extend the features of the device.

Connections related to the metrological function of the corrector are protected by covers that are marked with the official mark.

The device is equipped with autodetection of the installed modules.

Modules located in SLOT 0, SLOT 1, SLOT 2 and SLOT 3 are always detected (without any other conditions).

To the detection of SLOT 4 and SLOT 5 modules, the following applies:

- Modems requiring a modem battery (S4-PWR2 module or M2G, M4G modem) can only be detected in these slots with the modem battery connected.
- Other modules are always detected.

7.2 Main parts of the device

The below figure shows the main parts of the Corus Evo+.

The Corus Evo+ is equipped with SLOT 0 to SLOT 5 extension connectors.

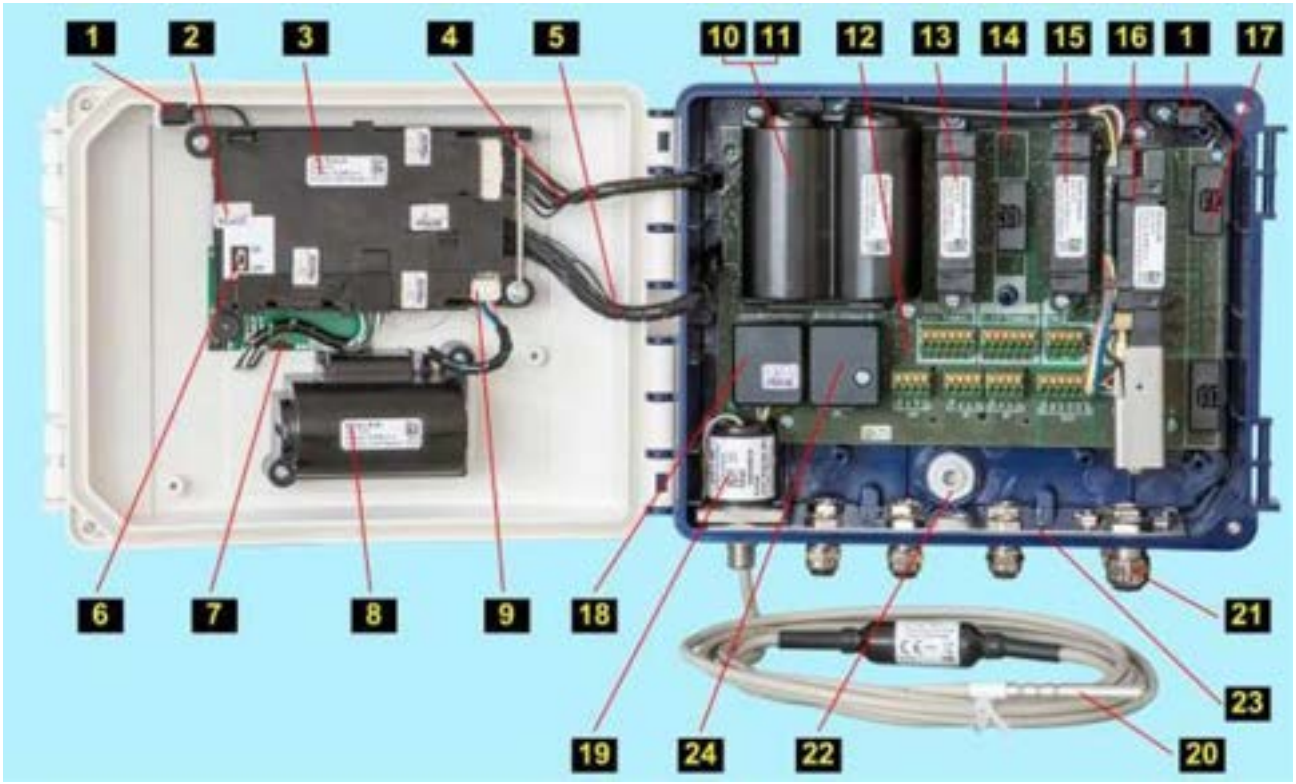


Fig. 37 Main parts of the Corus Evo+ device

Legend:

1	device opening sensor	14	empty SLOT 2
2	metrological seal of metrological switch cover	15	module installed in SLOT 3
3	CPU mode	16	module installed in SLOT 4
4	modem cable	17	module installed in SLOT 5
5	I/O board cable	18	cover or temperature and pressure transducer
6	service switch	19	EDT 96 pressure transmitter
7	keypad board	20	EDT 101 temperature transmitter cable
8	device battery	21	cable glands
9	device battery connector	22	ventilation grommet with IP68 rating
10	modem battery	23	conductive strip connecting the metal cable glands, cable shields
11	module fitted in SLOT 0 (placed under modem battery	24	terminal cover for gas meter connection
12	I/O board	25	cable adapter for external modem antenna connection
13	module installed in SLOT 1	26	Internal modem (Corus Evo+)

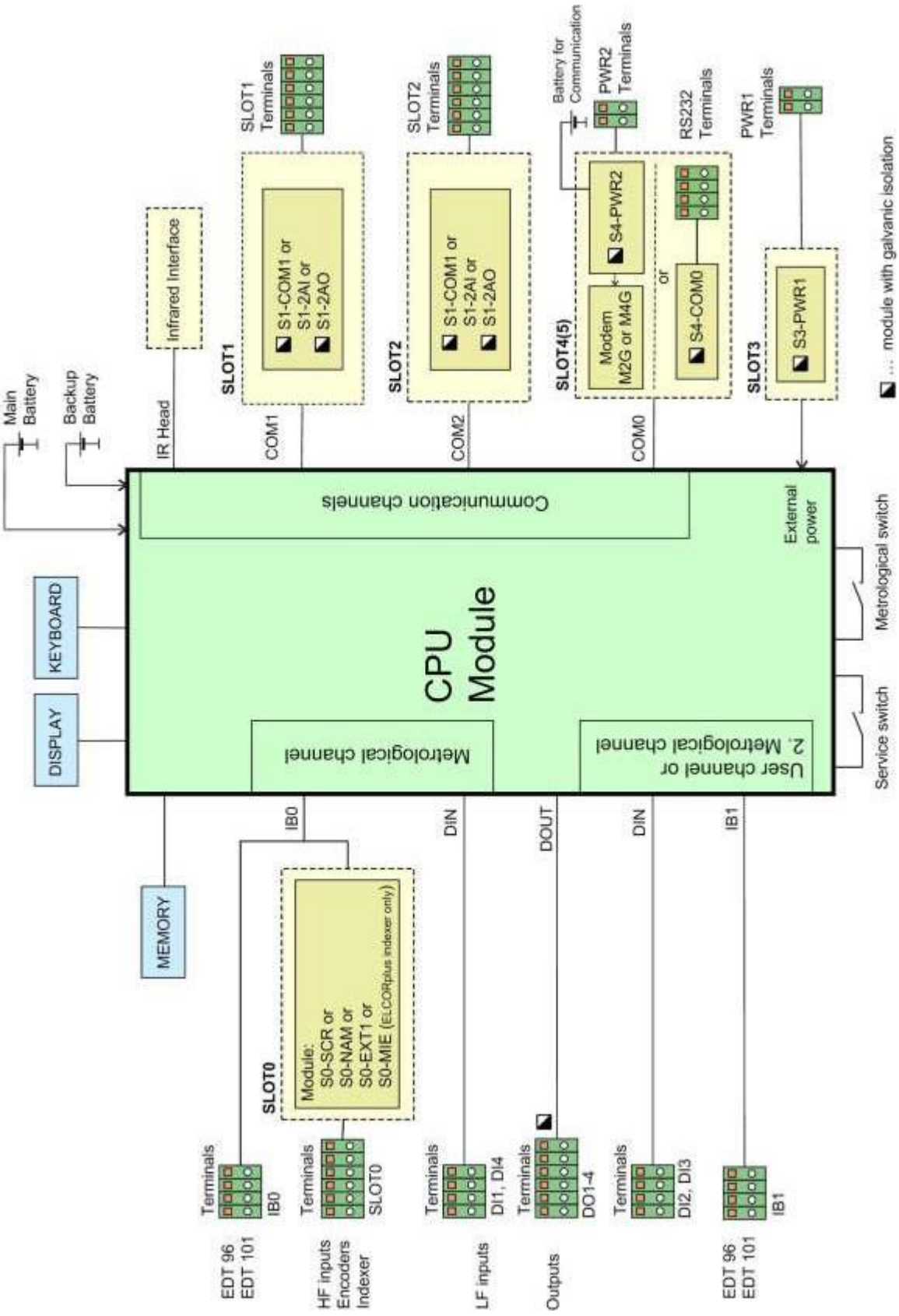


Fig.38 Functional diagram of Corus Evo+

7.3 Modules, Principles of Use

The supplied expansion modules are designed for installation into the slots located on the I/O board. For each module, the manufacturer determines into which slot it can be fitted. Each slot is fitted with a connector into which the module is inserted. The inserted module is fixed in the device by two secure screws.

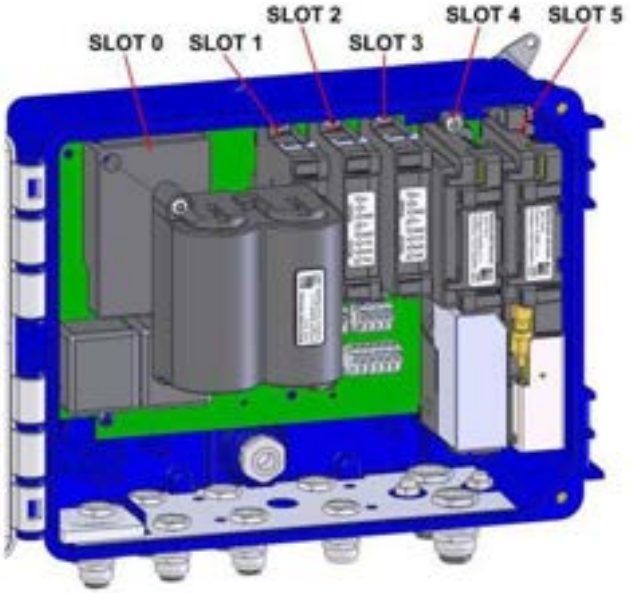


Fig.39 Arrangement of Corus Evo+

ATTENTION!

A trained person may install or replace modules that are not protected by a metrological seal (i.e. outside of SLOT 0) even in potentially explosive environments, provided that the warnings and procedures described in this document are observed and that all safety standards applicable to products and explosive environments are complied with.

ATTENTION!

When handling the modules in the device, first disconnect the device and modem power supply. If external power supply is used, disconnect it first, then disconnect the battery.

Following this procedure, the module replacements may be carried out even in potentially explosive environments. When handling removed modules, be careful so as not to damage them. Put plastic protective caps to the connectors to the empty slots of the I/O board.

ATTENTION!

The device and modules are equipped with CMOS components that are sensitive to static charges. Do not touch the outlets of the components and connectors.

When working, do not use synthetic fabrics (including clothing) from which a static electricity spark could arc to the circuit.

7.3.1 Installing the Modules

The device design allows additional extension or alteration of the input/output modules (SLOT 1, SLOT 2) and external power supply of the whole device (SLOT 3) and the communication module (SLOT 4).

ATTENTION!

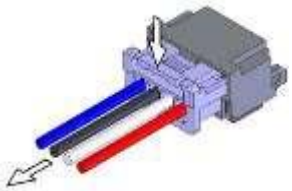
If the device classification from the point of view of explosion safety has been changed after retrofitting of certain modules (see paragraph 2), the classification must be corrected on the device name plate.

The prescribed tightening torque of the module mounting screws to the I / O board is 0.7 Nm.

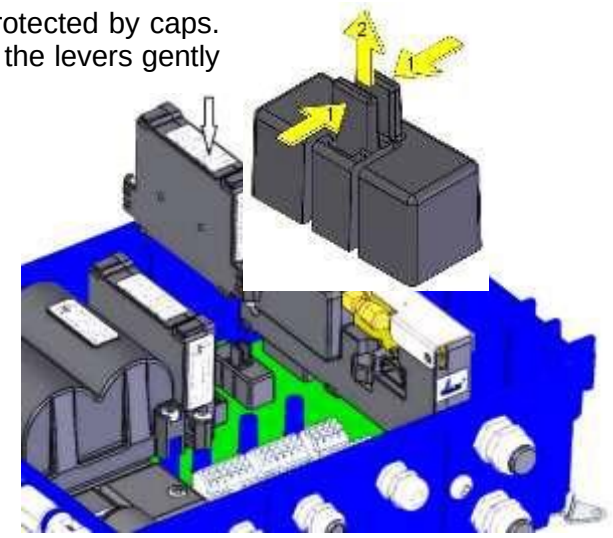
Procedure:

Always disconnect the power supply from the measurement part (processor board) before handling the modules.

- If external power supply is used, disconnect the power supply from the PWR1 terminals.

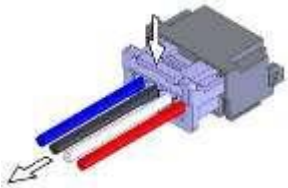


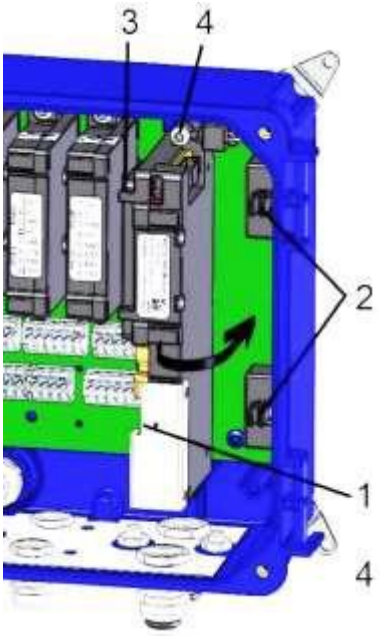
- Disconnect the battery. Press the lock and gently pull the wires to disconnect the connector.
- Unused connectors on the system board are protected by caps. To retrofit a module, first remove the cap. Push the levers gently with pliers to release the latch and remove the cap easily.
- Attach the module to the posts and press it gently into the connector on the system board. Tighten the screws. The module is impossible to be installed in a wrong slot. If the module is difficult to plug in, do not use greater force, but check the correct position and orientation of the module.
- Connect the battery or external source terminals.



7.3.2 Installing the External Power Supply of the Modem

- Press the lock and gently pull the cables to disconnect the connector of the modem battery (1).
- <u>The battery-powered modem is located in SLOT 4. To connect an external power supply source, you need to move the modem to SLOT 5 and place the external power module in SLOT 4.</u>
- Remove the caps of the connector (2) in SLOT 5. Using pliers, press gently the levers to loosen the catch and release the cap.
- Loosen the battery cables from the bracket (3)
- Loosen the fixing screws (4).
- Remove the modem by pulling it perpendicular to the base plate, do NOT tilt the module to the side! An antenna is installed inside the module, which moves together with the module.
- Place the module on the posts of Slot 5 and press it gently into the connector on the system board. Tighten the screws (4).
- Install the external power supply module to SLOT 4 in the same way.
- Connect the external source cables to the PWR2 terminals.
- Insert the battery into the PWR2 external power module.





7.3.3 Replacement of the Modem

- If external power supply sources are used, unplug the power supply from the PWR1 and PWR2 terminals.
- Press the lock and gently pull the cables to disconnect the connectors of both batteries.
- Loosen the battery cables from the bracket (3)
- Loosen the fixing screws (4).
- Remove the modem (1) by pulling it perpendicular to the base plate, do NOT tilt the module to the side! An antenna is installed inside the module, which moves together with the module. If external antenna is used, disconnect its connector from the communication module before removing the module.
- Place the module on the posts and press it gently into the connector on the system board. Tighten the screws (4). Pay attention to the correct orientation and position of the module, see Section 5.6.2
- Connect the battery connectors (2) and (3).
- Connect the cables to the PWR1 and PWR2 terminals of the external power supply.
- Make sure that the battery is connected to the correct connector, see Section 5.6.2.

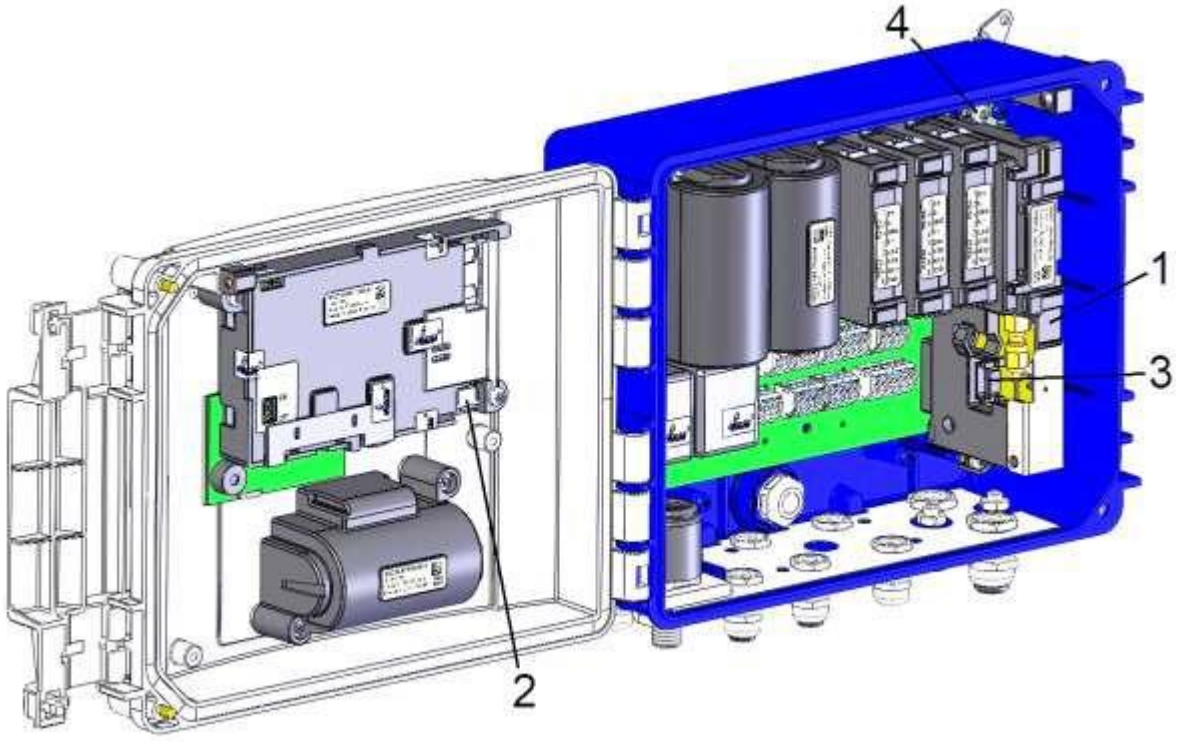


Fig. 40 Modem replacement

7.4 Power Supply of the Device

ATTENTION!

Only batteries prescribed by the manufacturer (see paragraphs 3.4 and 3.11.3) approved by the laboratory for this device and complying with the parameters for explosive environment may be used in the device.

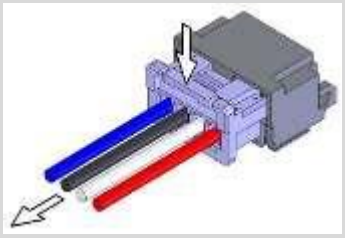
Batteries are sealed by the manufacturer and must not be disassembled for safety reasons.

Both the device battery and the modem battery can be replaced in a potentially explosive environment.

Only the prescribed type of battery may be used

WARNING!

All used connectors in the device contain a fuse against accidental disconnection. When disconnecting, it is necessary to press down first to release the pull-out catch, then pull it slightly.



Never pull by force on the cable, it can be damaged. When reinserting, simply insert it slightly so that the lock is visible. Then, make sure to pull it lightly by the cable.

Discharged batteries fall under hazardous waste category. According to the WEEE Directive (2002/96/EC) and under national regulations, batteries may not be disposed of together with household waste. Discharged batteries are subject to a take-back obligation. Therefore, it is necessary to dispose of the discharged batteries at the point of take-back or at authorized points for the recycling of electrical and electronic waste.

7.4.1 Batteries to Power the Device

The device is powered by a **B-03** (B-03U) battery (battery pack, BP) with a nominal voltage of 3.6 V and a capacity of 17 Ah. Instead of this battery, the device Corus Evo+ can be equipped with a **B-03D (B-03DU** battery that has a higher capacity (30 Ah). The B-03U and B-03DU have replaceable battery cells, unlike the B-03 and B-03D.

In special cases, the **B-03A** alkaline battery can be used to power Corus Evo+. When using this battery, an internal modem cannot be used in the device.

The modem module is not powered from this battery in the device variant with the modem. Its power supply is provided by its own battery.

During operation, the consumed capacity is measured and calculated. The remaining battery capacity is stored directly in the internal battery memory.

If the battery capacity drops to 10% before the expected discharge, the device will alert you of the need to replace the battery (error message **E9**, see Table 13).

The battery life depends mainly on the device configuration, the frequency of communication, the time of display illumination and weather conditions.

Defined conditions for declared battery life:

- 30 s measurement period (not applicable to encoders)
- archive period of data archive 1 hour
- period of input pulses from the gas meter ≤10 Hz
- generating output pulses with frequency f ≤ 1 Hz
- operating communication (local or remote) with the device for 2 min per day
- service communication (local or remote) with the device for 5 min per week
- firmware update (locally or remotely) once a year
- ambient temperature [18]): -25 °C to +70 °C or -40 °C to +70 °C
- ambient temperature [19]): -30 °C to +65 °C

Under these conditions, the lifetime of the batteries supplied for typical Corus Evo+ configurations are shown below:

7.4.5.1 Basic Variant

a) Basic configuration

Battery life	With the display OFF (graphic or segment)	Display ON all the time (segment only)
Lithium battery B-03, B-03U	11 years	9 years
Lithium battery B-03D, B-03DU	18 years	16 years

Backup battery lifetime: *16 years backup time (including use without main battery for 3years)*

b) Basic configuration with online communication

Communication via RS232 or RS485 interface, transfer rate 115 kBd:

Battery life	With the display OFF (graphic or segment)	
Actual values reading period	5 s	15 s
Lithium battery B-03, B-03U	---	5 let
Lithium battery B-03D, B-03DU	5 let	10 let

Declared battery life applies to the HW device configurations:

HW Configuration:

- IB0: 1x EDT 96, 1x EDT 101 (metrological transducers)
- IB1: not fitted
- SLOT0: not fitted
- SLOT1: S1-COM1 - RS232/RS485 interface
- SLOT2: not fitted
- SLOT3: S3-PWR1
- SLOT4: S4-PWR2 or modem
- SLOT5: Modem or not fitted

7.4.5.1 Corus Evo+ variant with connected NAMUR or SCR+ encoder

a) Encoder reading period 1 hour

Battery life	With the display OFF (graphic or segment)	Display ON all the time (segment only)
Lithium battery B-03, B-03U	10 years	8 years
Lithium battery B-03D, B-03DU	17 years	15 years

Backup battery lifetime:16 years backup time (including use without main battery for 15 months)

b) Encoder reading period 30 s

Battery life	With the display OFF (graphic or segment)	
Encoder type	NAMUR	SCR+
Lithium battery B-03, B-03U	---	5 years
Lithium battery B-03D, B-03DU	5 years	9 years

Comment:

1) In this mode, the battery life depends mainly on the power consumption of the connected encoder. The consumption of the encoder of different manufacturers may be different. Theabove lifetimes apply to encoders manufactured by Elster, RMG and FMG.

2) The encoder reading period is limited, see section 9.4.

HW Configuration:

- IB0: 1x EDT 96, 1x EDT 101 (metrological transducers)
- IB1: not fitted
- SLOT0: S0-NAM or S0-SCR module with encoder connected
- SLOT1: S1-COM1 - RS232 / RS485 interface
- SLOT2: not fitted
- SLOT3: S3-PWR1
- SLOT4: S4-PWR2 or modem
- SLOT5: Modem or not mounted

7.4.5.1 Dual channel variant

Battery life	With the display OFF (graphic or segment)	Display ON all the time (segment only)
Lithium battery B-03, B-03U	9 years	7 years
Lithium battery B-03D, B-03DU	15 years	13 years

Backup battery lifetime:16 years backup time (including use without main battery for 15 months)

HW Configuration:

- IB0: 1x EDT 96, 1x EDT 101 (metrological transducers - 1st channel)
- IB1: 1x EDT 96, 1x EDT 101 (metrological transducers - 2nd channel)
- SLOT0: not fitted
- SLOT1: S1-COM1 - RS232/RS485 interface
- SLOT2: not fitted
- SLOT3: S3-PWR1
- SLOT4: S4-PWR2 or modem
- SLOT5: Modem or not fitted

7.4.5.1 Other variants

Contact Dresser Actaris™ Gas to determine the battery life of a different HW/SW configuration of the device that is not stated here (see section 6.8).

Note:

If the device needs to be operated with a higher consumption than in the defined mode, it is necessary to take into account the more frequent replacement of the battery or, to use the external power supply.

7.4.2 Replacing the Battery

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

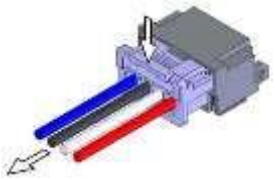
The device indicates discharged battery by E9 error message in the device diagnostics (see Section 6.8.5).

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

During the battery replacement, the device does not measure pressure or temperature, but counts incoming LF pulses (however, the pulse conversion is not carried out before the battery is connected), and the real-time clocks operation is ensured.

The prescribed tightening torque of the batteries mounting screws to the device is 0.7 Nm.

To replace the battery:



- Press the mechanical connector lock and pull the cables gently to disconnect the battery connector **2** from the CPU module.
- Loosen the battery fixing screws.
- Remove the battery and replace it with a new one. Fix the battery in position by the screws.
- The battery cable with connector **1** must be plugged into connector **2** on the processor board.
- When the battery has been connected, the device is automatically turned on.

Fig. 41 Main battery

7.4.3 Battery cell replacement procedure (batteries B-03U, B-03DU)

ATTENTION!
In case of a double battery B-03DU, always replace both cells at the same time, do not combine differently discharged cells!

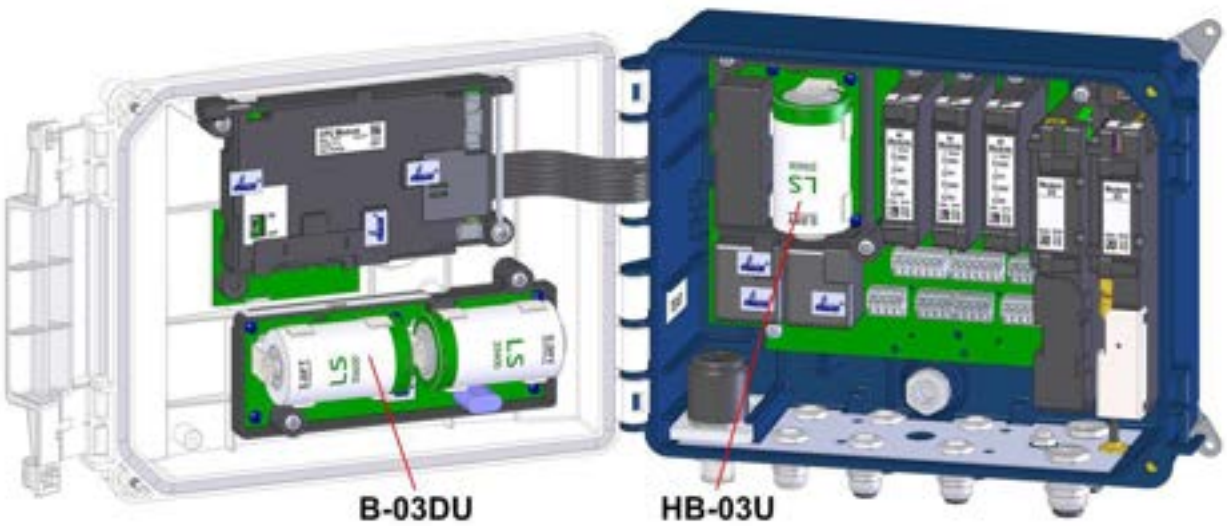


Fig 42 location of the replacement cells for the B-03DU battery and the HB-03U modem battery

Replacing the battery cell in the holder (Fig.)

- Push the battery cell in the direction of arrow 1 , i.e. from the plus pole towards the minus pole.
- Tip the battery cell upwards 2 .
- Insert the new article into the holder using a similar procedure. Check the correct polarity before inserting the article!

ATTENTION!
After replacing a dead battery cell with a new one, do not forget to set the initial battery capacity using the service software!

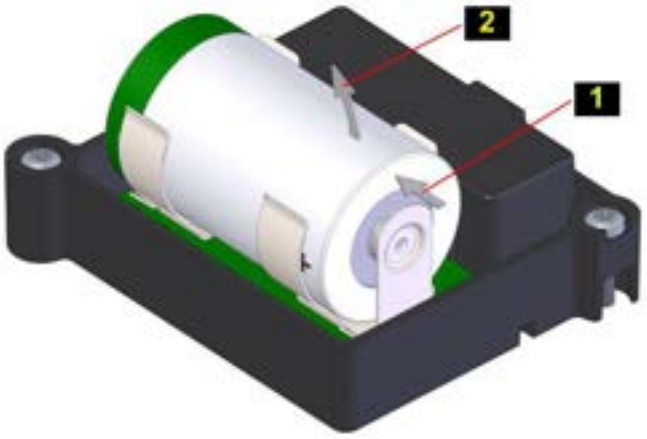


Fig. 43 Removing the battery cell from the holder (battery B-03U)

7.4.4 Battery to Power the Modem

The internal modem is powered by a separate battery pack (BP-battery pack), which contains a power battery (battery cell). The type of battery pack used depends on the internal modem used. The battery block can be supplied potted with potting compound, i.e. not disassembled, or with the possibility of replacing the battery cell located in the holder. The battery pack is connected to the internal modem board by a cable with a connector.

Discharged battery of the modem is indicated by the E27 error message in the device diagnostics; low voltage of the modem battery is indicated by the W30 warning message.

The status of the modem battery is automatically checked by the machine every 2 minutes. Replacing the battery of the modem is therefore automatically registered within 2 minutes or after resetting the device.

During modem operation, the consumed capacity is measured and calculated. The remaining battery capacity is stored in the internal memory of the battery.

Each type of applied modem requires the appropriate battery type.

Type of the modem	Battery pack (BP)	Used bat. cell in BP (size)	Rated volt.	Rated kap.	Cell connect. in BP	Lifetime *) years	
						1x/day 15 s	2x/day 15 s
M2G 2G	HB-03	1x FRIWO M20Ex(D)	3.0 V	12 Ah	soldered	6	3,5
	HB-03D	2x FRIWO M20Ex(D)	3.0 V	20 Ah	soldered	11	6

	HB-03U 17 Ah	1x SAFT LS33600(D)	3.6 V	17 Ah	in holder	10	7
	HB-03U 3.6 Ah	1x SAFT LS17500(A)	3.6 V	3.6 Ah	in holder	2.5	1,5
	HB-03U 7.2 Ah	2x SAFT LS17500(A)	3.6 V	7.2 Ah	in holder	5	3
LTE-Cat1W	HB-04	2x FRIWO M20Ex(D)	6.0 V	12 Ah	soldered	7	4,5
	HB-04U ****)**	2x SAFT LS26500(C)	3.6 V	7.7 Ah	in holder	7	5
LTE-CatM1W	HB-03	1x FRIWO M20Ex(D)	3.0 V	12 Ah	soldered	6	3,5
	HB-03D	2x FRIWO M20Ex(D)	3.0 V	20 Ah	soldered	11	6
	HB-03U 17 Ah	1x SAFT LS33600(D)	3.6 V	17 Ah	in holder	10	7
	HB-03U 3.6 Ah	1x SAFT LS17500(A)	3.6 V	3.6 Ah	in holder	2.5	1,5
	HB-03U 7.2 Ah	2x SAFT LS17500(A)	3.6 V	7.2 Ah	in holder	5	3
LTE-CatNB	HB-03U 17 Ah	1x SAFT LS33600(D)	3.6 V	17 Ah	in holder	12	12
	HB-03U 3.6 Ah	1x SAFT LS17500(A)	3.6 V	3.6 Ah	in holder	6	5
	HB-03U 7.2 Ah	2x SAFT LS17500(A)	3.6 V	7.2 Ah	in holder	11	8.5

Notes: HB-03U batteries cannot be used at temperatures below -25°C.

*) The specified battery life applies to the following mode of operation:

- GSM/GPRS data transmission once a day (modem ON for 2 minutes per day on average)
- GSM/GPRS service window once a week (10 minutes ON, average 1 minute of communication each week)
- remote download once a year
- Ambient temperature -25°C to + 25°C
- Signal strength 80%

Battery life depends mainly on the mode of use, the signal strength at the point of deployment and the ambient temperature:

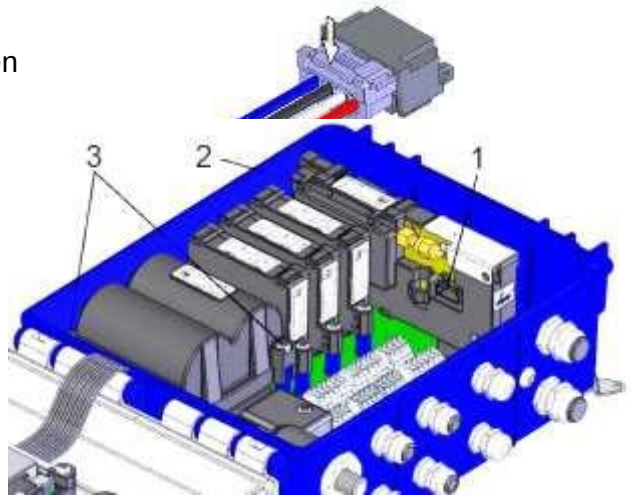
• Battery life decreases with higher ambient temperatures (to ca 90% at 50°C, to 80% at 70°C).

• Battery life decreases with decreasing signal strength (to ca 60% at 15% signal strength).

7.4.5 Replacing the Modem Battery

7.4.5.1 Modem battery pack replacement procedure

- Press the lock and gently pull the cables to disconnect the connector of the modem battery.
- Loosen the battery cables from the bracket (2Loosen the fixing screws (3).
- Remove the battery and replace it with a new one. Tighten the screws.
- Hitch the cables under the bracket (2) and connect the connector.
- Connect the cables into PWR2 terminals of the modem external power supply.
- Make sure that the battery is connected to the correct connector, see Section 5.6.2.



7.4.5.2 Battery cell replacement procedure (batterie HB-03U, HB-04U)

ATTENTION !

HB-03U and HB-04U battery packs use a combination of a battery cell and a supercapacitor. Replacement of the battery cell in the BP is only possible if the voltage of the modem BP has not dropped below the critical threshold of 2.2 V (at HB-03U), or 4.4 V (at HB-04U) . The current value of the modem voltage can be found on the display of the device from the actual values.
If the voltage of the HB-03U drops below 2.2 V(or 4.4 V at HB-04U), the supercapacitor will be damaged and the entire battery pack must be replaced!

ATTENTION!
In the case of the HB-03U 7.2 Ah battery, always replace both cells at the same time, do not combine differently discharged cells !

The installation procedure for replacing the modem battery cell is identical to the description for replacing the power supply battery cell of the device - see Section 7.4.2

ATTENTION !
After inserting a new battery cell into the holder in the HB-03U or HB-04U battery pack, it is necessary to use the service software Fehler! Verweisquelle konnte nicht gefunden werden. **or** Fehler! Verweisquelle konnte nicht gefunden werden. **to enter the modem battery replacement information into the device, otherwise the lifetime of the new modem battery will not be displayed correctly.**

7.4.6 Back-up Battery

The battery serves to backup important functions when the main battery is discharged or being replaced. The back-up battery is located in a holder on the processor board (CPU module) under the cover. The back-up battery can be replaced by an authorized service center after disrupting the official and manufacturing marks (the replacement must not be performed in potentially explosive atmospheres). Only approved battery types may be used.

The battery life of the back-up battery is specified in Section 7.4.1 .

7.4.7 External Power Supply

External power supply can be used for Corus Evo+.

The external power supply to the device does not provide power to the internal modem. For an internal modem, separate external power supply must be used.

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

External power is recommended where the operating mode of the device or modem is set to have an increased current consumption from the batteries, thus shortening the batteries life.

Using external power supply for the device (its measuring part) is necessary:

- When using EXT1 module with NAMUR HF pulse input
- When using a NAMUR encoder with the measurement frequency of less than 1 min

Using external power supply for the device is recommended:

- For frequent communication (more than once a day),
- When longer time ON of the modem than specified in paragraph 7.4.3 is requested

In order for the device or modem to be powered externally, it must be fitted with an appropriate plug-in module to which an external intrinsically safe source is connected. The supplied intrinsically safe sources must be powered from a 12 Vdc source.

The device batteries and modem batteries must be inserted and connected in the device even when external power supply is used.

In the event of the external power supply failure, the device and the modem are switched automatically to battery operation. In this case, the batteries serve as backup power supply.

External power supply	External power supply module		IS source	
	Module	Installation	Type of source	Installation
Device	S3-PWR1	SLOT 3	PS-E, PS-E/A	Out of potentially explosive atmosphere
Internal modem	S4-PWR2	SLOT 4	PS-M, PS-M/A	Out of potentially explosive atmosphere

Table 15 External power supply, components required

The wiring diagram for the external supply of the device is specified in Section 5.5.6.1.

The wiring diagram for the external supply of the modem is specified in Section 5.5.6.2.

7.5 Digital Outputs, Modified Use

Corus Evo+ has 4 digital outputs DO1 to DO4. These outputs run to the DOUT terminal block of the input/output board (I/O board). All outputs are galvanically isolated and are of the open collector type.

The basic use of these outputs required feeding these outputs externally by supplying voltage to the U0 + terminal of the DOUT terminal block. In this case, the shorting jumper JP1 must not be fitted to the I/O board.

For pulse outputs, however, it is possible to set a special mode of use for DO1 and DO2 outputs where these outputs can be operated as pulse outputs without power supply at terminal U0 +. This method of use requires a shorting jumper JP1 on the I/O board (see Fig.).

Attention: this mode reduces the operating ranges of the DO1 and DO2 outputs
(see Table 16)

Parameter	Without shorting jumper JP1	With shorting jumper JP1
DO1 and DO2 output option	Pulse, binary, data	Pulse output
Supply voltage (terminal U0+)	3.6 V ÷ 15 V	----------
Output voltage	2.7 V ÷ 15 V	3.0 V ÷ 3.6 V !!!
Output current	3 µA ÷ 100 mA	3 µA ÷ 1 mA
Max. frequency	1 Hz	1 Hz
Pulse width (closed output)	5 ms ÷ 25 s	5 ms ÷ 50 ms

Table 16 Operating parameters of DO1 and DO2 outputs depending on shorting jumper JP1

Note

If the supply voltage is not applied to the U0 + terminal, the DO3 and DO4 outputs are disabled.

Fig. 42 Placing JP1 Jumper on I/O Board

7.6 Internal Modem, Using External Antenna

The internal M2G, M4G modem is powered by a stand-alone HB-03/HB-03D battery. The modem is fully controlled by the device parameters. Due to the current consumption of the modem, it is necessary to choose the mode and timing of the transmitted data and to control the switching ON and OFF of the modem with respect to the modem battery. The internal modem can also be powered from an external power supply (PS-M, PS-M/A) using the S4-PWR2 module.

7.6.1 Using the Device with an External Antenna

The internal M2G and M4G modems are equipped with an integrated antenna that is part of the M2G or M4G modem. The antenna is located under the modem module cover and is connected to the modem board via a standard SMA connector.

In locations with poor signal quality, the internal antenna can be disconnected and an external, more powerful antenna, attached to the coaxial cable outside the device, can be connected. This modification is based on the installation of a HF cable adapter that interconnects modem antenna outlet with outer antenna plug. The required part - HF cable adapter - see Fig. must be ordered separately, it is not included in the standard delivery.

An external antenna (not included in the standard accessory) is connected to the SMA (f) panel connector at the bottom of the device enclosure.

The external antenna may be located in a potentially explosive zone or in a safe environment.

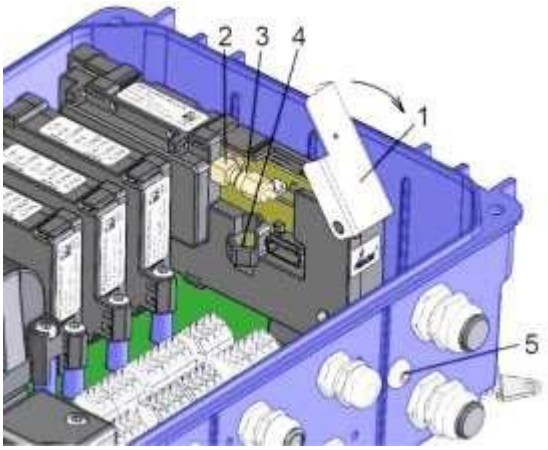
WARNING:

When designing the installation and use of an antenna other than the supplied standard one, especially when located outside a potentially explosive zone, measures must be taken to reduce the impact of the lightning strike (see EN 60079-14 and EN 62305 3).

The maximum cable length for the external antenna is 10 m.

7.6.2 Modifying the Device for Connecting an External Antenna to the Modem

Procedure:



- If external power supply of the modem is used, first disconnect power source from PWR2 terminals.
- Press mechanical lock of the connector on the modem battery cable and pull the cables gently to disconnect the modem battery.
- Put SIM card cover (1) to the vertical position, open it slightly, and remove the modem plastic cover.
- Hold the fixed part of the connector (2) with a flat key size 7 to prevent the part from slipping out of the printed circuit board, and release the nut of the inner antenna connector (3) nut with a key size 8.
- Unscrew the connector nut (3) and insert it into the holder in the cover (4).
- Remove the blind cap (5) at the bottom of the enclosure.
- Install the HF cable reducer. Insert the panel connector of the HF cable reducer with the rubber O-ring into the blind cap opening (5) and fasten it outside the enclosure using a nut and a washer. Tighten the nut gently (0.7 Nm), remember to hold the fixed part of the connector with the key. Then connect the other end of the HF cable reducer to the connector on the modem board.
- Put the SIM card cover (1) back and close it.
- Reconnect the modem battery connector.
- Connect the external power supply to the PWR2 terminals of the external power supply of the modem.

Fig. 43 External antenna cable adapter

7.7 Software

The device software (firmware, FW) is divided into 3 parts. The first part ("Loader") is used to ensure that the firmware is uploaded when it is updated.

The second part of the firmware ("Metrolog") includes software for the metrological functionality of the device, display control and keypad control, metrological data security routines and control mechanisms for error statuses detection.

The third part of the firmware ("App") contains the rest of the firmware - communication protocols, communication channel management, superstructure functionality, etc.

Each part of the FW is identified by the version number and the checksum. The version designation is stored in the form of a string; it is a decimal number with two decimal places. The version and checksum "Loader" and "Metrolog" are specified in the certificate, versions can only be modified by the notified body with official approval. Changing in version unit number means a major change, changing the decimals indicates a version with minor changes or bug fixes.

7.7.1 Downloading Application Firmware Using “Remote Download“ Method

Using this method, you can load new firmware to your device in accordance with the **Welmec 7-2 Extension D** recommendation. The loaded firmware is secured with a **digital signature**, separately in each section. This is to check the integrity of data, the authenticity and also the specificity of the device. The upgrade process is divided into several phases, delayed start of the firmware activation can be set. Information on processing of each individual phase of loading is recorded in the settings archive.

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

The digital signature contained in the application firmware file (* .srec) confirms that standard testing has been performed at Dresser Utility Solution Gmbh. , and that the "Metrolog" module complies with the valid certificate of the relevant notified body.

7.7.2 Storing Data in the Device

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

All the archives and counters are stored in 16MB **non-volatile** SPI dataFLASH memory. Important archives, counters and parameters are additionally backed up in other memories. All data is properly secured. Irregular errors are indicated in the internal diagnostics of the device. The backup battery in the device is used to back up the RAM and the RTC circuit remains in operation. The pulses are counted at the LF inputs.

7.8 Principle of the Function

7.8.1 Conversion Using State Equation

The gas flow data is obtained by means of pulses (N) from the LF or HF sensor located in the meter. From the number of pulses (N) and from the gas meter constant (kp), the volume is calculated at the measurement conditions (V).

From the temperature and pressure transducers, the device receives additional gas flow data - gas temperature (t) and absolute pressure under the measurement conditions (p). From this data, the conversion number (C) is calculated, which is influenced by other factors: absolute temperature under basic conditions (Tb), absolute pressure under basic conditions (pb) and gas compressibility factors under basic conditions (Zb) and measurement conditions (Z).

Volume under measurement conditions:

$$V = \frac{N}{k_p}$$

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 the basic conditions:

$$V_b = V * C$$

The compressibility factor of the gas expresses the variation 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, AGA8-92DETAIL, GOST 13390.2, or GOST 13390.3) can be selected for 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 substitute compressibility value.

From the input pulse frequency, the device calculates the flow of gas in real-time by mathematical filtration from the incoming signal.

Primary flow:

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

Where: ΔV ..... *increase in operating volume*

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

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

Flow rate at base conditions:

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

Base conditions remark

The base conditions are the conditions on which the gas quantity measurement is recalculated. These conditions are different in different countries.

E.g. for the Czech Republic:

absolute temperature Tb = 288.15 K (i.e. tb = 15 ° C)

absolute pressure pb = 101.325 kPa

7.8.2 Substitute volume values

For calculation under error conditions (i.e. because of a transmitter error, a value deviation from the operating range or a device error), the substitute volume counters at measurement conditions (V_s) and at basic conditions (V_{bs}) are installed in the device.

These counters are coupled with appropriate volume counters under normal (correct) conditions.

A detailed description of the behavior of the device under normal (correct) and error conditions is described in Section 8.4.1

7.8.3 Volume Correction under the Measurement Conditions

The device is equipped with the option of compensating the gas meter errors according to the correction profile data specified in the gas meter test report. This possibility to use the corrected volume V_c is in accordance with EN 12405-1 + A2. The function and the V_c parameter can be added by the manufacturer or at the ASC level. If this function is used, it must be ensured that the error rate profile of the gas meter in relation to the flow rate Q corresponds to the actual operating conditions.

The meter error is corrected using the f (Q) function. For the corrected volume, the following applies:

$$V_c = V_m \times f(Q)$$

where:

V_c	...	Corrected volume at the measurement conditions (volume corrected based on the correction profile of the gas meter)
V_m	...	Volume at the measurement conditions (primary volume)
Q	...	Flow rate at the measurement conditions (primary flow rate)

The linear interpolation method is used as the implicit interpolation method to determine the values between the calibration points.

The gas meter correction data file is uploaded to the device using the utility program

Gas meter correction values are stored in a file as a table. The table can contain up to 10 flow-dependent correction values.

Information on entering the correction profile of the gas meter in the device is stored in the settings archive.

The principal scheme of volume calculations is shown in Fig. .

Conditions for using Volume Correction

The conditions are in accordance with the requirements of EN 12405-1 + A2:

- The correction is used if only the gas meter measures at least 10 pulses per second at Qmin.
- Below Qmin, the correction is not applied, and the value of the correction factor specified for Qmax is used above Qmax.

It follows from these conditions that the correction can only be applied to gas meters with a HF pulse sensor and in the connection with EVO+ type.

7.8.4 Conversion of Volume to Energy

The device allows to recalculate the amount of consumed gas in the amount of energy E and it is therefore possible to use the device as an Energy conversion device according to EN 12405-2. The conversion of the volume to energy uses the value of combustion heat H_s. Only when the AGA8-DETAIL method is used, the gross calorific value Hs is calculated according to EN ISO 6976:2016 by the device. In the case of other methodologies, the fixed value of the gross calorific value Hs is used (the user can change this value). It is thus possible to define reference conditions (t1 / tb, pb) for the heat of combustion Hs 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:

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

For measuring in energy units, the device contains two additional counters, the energy counter E and the energy substitute values counter Es.

When configuring, the energy measurement unit can be selected from the following list: MJ, kWh, Btu.

WARNING:

When changing the unit, the absolute value of the counter E (Es) is not recalculated. The addition volume is then read observing the new measurement unit.

If the instrument performs energy calculations (Hs is activated in the device parameters), the reference conditions must be consistent, i.e.:

- pb, tb to convert the volume V to volume Vb
- p2, t2 for combustion heat to calculate E

Here the rule p2 = pb and t2 = tb is applied. This setting is checked by the service program and does not allow the saving of parameters if the conditions do not match.

The main scheme of energy calculation is shown in Fig. .

Combustion Heat H_s (for energy calculation purposes)

The heat conditions t_1 / t_b under which natural gas is sold are prescribed by the Energy Act of each state; t_1 is the reference ambient temperature of combustion, t_b is the reference temperature of V_b of the burned gas.

Note:

E.g. in the Czech Republic according to Energy Act No. 458/2000 Coll. § 98a art.1 letter A and Decree of the Ministry of Industry and Trade No. 108/2011 Coll. (amended 2017) §1 art.3 that the heat of combustion in kWh/m^3 is stated at the 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 the energy units it is necessary:

- enter the value of the gross calorific value H_s in the respective units into the device

{the value H_s is usually easily obtained as an output from chromatograph analysis under conditions (t_1, p_1; t_b, p_b) enacted in a particular state (e.g. H_s 15/15 is used in the Czech Republic}

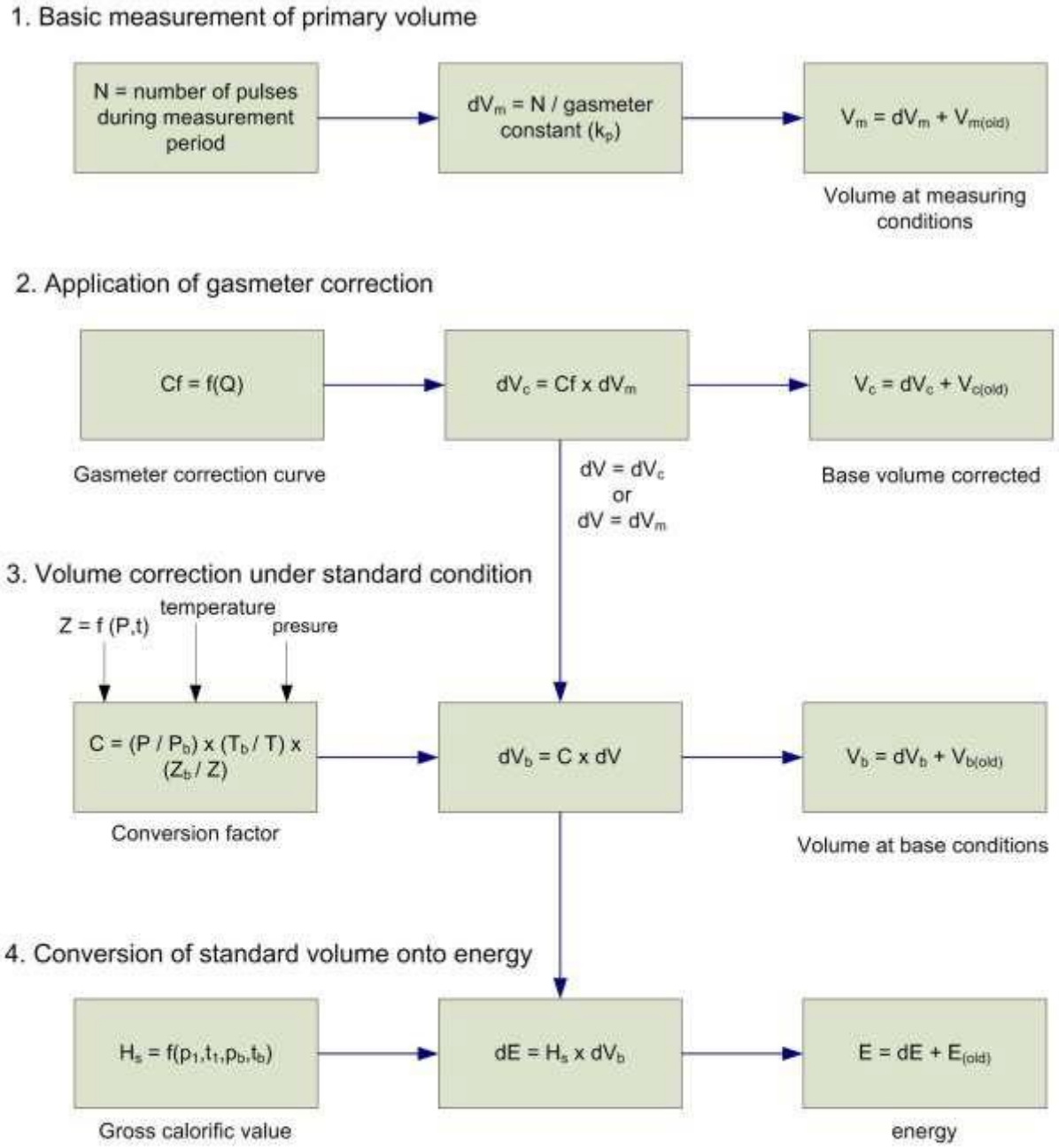
- select the appropriate t_1/t_b conditions from the device menu.

In case of selected methodology AGA8-DETAIL:

- the t_1/t_b conditions are selected.

- the calorific value is not entered (the device calculates it according to ISO 6976 from the specified gas composition). The value of H_s (t_1/t_b) is published after reading "instantaneous values".

For other methodologies, the H_s value must be entered manually.



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	adition dV_m or dV_c	V_b	volume at base condition (standardized volume)
dV_b	adition base volume	$V_{b(old)}$	standard volume at the end of previous measurement period
dV_c	adition corrected primary volume	V_c	corrected volume at metering conditions
dV_m	adition 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
Hs	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. 44 Volume and energy calculations - calculation scheme

8 Metrological Features

8.1 Temperature Measurement

To measure temperature, the device uses the EDT 101 digital transmitter with the PT1000 temperature sensor.

Mechanically, the transducer consists of a sensor in a 5.7 mm stainless steel shank with a length of 50 mm from which the cable is routed. A part of the cable is a plastic cylindrical case with electronics.

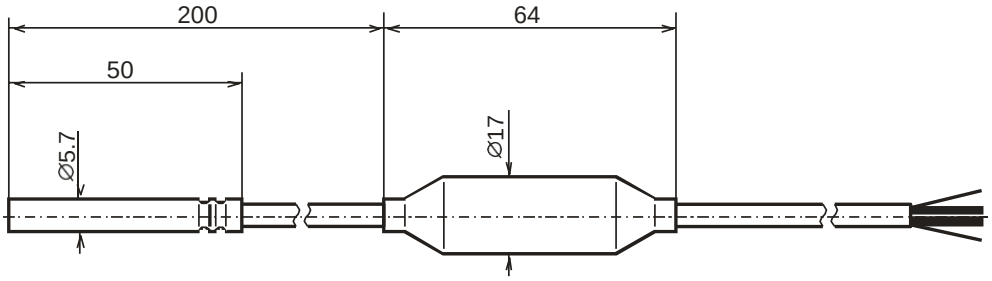


Fig. 45 Transducer dimensions

The temperature is measured using a platinum resistance sensor whose output signal is fed to an analogue-to-digital high-resolution corrector input. After converting to digital, the data is processed by a microprocessor that corrects nonlinearity based on calibration data. The calibration data is stored to EEPROM memory when the transducer is manufactured. The transmitter communicates with the device via the RS485 communication interface.

The temperature measurement range is -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 the user from 1s to 30s. The temperature measurement units are selectable by end user.

The temperature sensor replacement is protected by the manufacturer's seal (metrological seal) and can only be performed by an Authorized Service Centre (ASC).

When configuring the device, the user must enter a constant parameter ***Substitute Temperature*** in the device. This value is used instead of the measured temperature value when calculating compressibility in the following cases:

- the measured temperature deviated from the measuring range
- there is a malfunction of the temperature measurement.

8.2 Pressure Measurement

The pressure is measured using the digital EDT 96 transducer. The transducer includes a piezo-resistive 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 measuring range of the pressure transducer must be specified by the customer when ordering the device. The supplied pressure ranges are specified in Section 3.6.2.

The measurement period is common for both temperature and pressure measurements and can be set by the user within the range from 1s to 30s. The pressure measurement units are adjustable.

The temperature transducer replacement is protected by the manufacturer's seal (metrological seal) and can only be performed by an Authorized Service Centre (ASC).

When configuring the device, the user must enter a constant parameter ***Substitute Pressure*** in the device. This value is used instead of the measured temperature value when calculating

compressibility in the following cases:

- the measured pressure deviated from the measuring range
- the device has been manufactured without pressure transducer (TZ or T corrector)
- there is a malfunction of the pressure measurement.

8.3 Compressibility Calculation

8.3.1 PTZ, TZ Conversion

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 13390.2, GOST 13390.3 or AGA8-DETAIL.

The analysis of the chemical composition of the gas is carried out by chromatographs whose output is also the physical properties of the gas calculated according to ISO 6976 but with the conditions preferred for billing purposes:

- relative density *d* at temperature t_b and pressure p_b = 101.325 kPa,

- the 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 service SW to calculate the physical properties of gas to the condition 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,

- the heat of combustion H_s (applied to 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: in literatures is abbreviated as H_s (25/0)

Calculation of the compressibility factor $K = Z/Z_b$ is performed by each measuring period.

Due to the required accuracy of the device, the use of compressibility calculation methods is limited in terms of pressure and temperature ranges as shown in the following tables Table 17 and Table 18:

Pressure Measurement 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	N/A	-25 ÷ +70°C	-25 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C
80 ÷ 2000 kPa	N/A	-25 ÷ +70°C	-25 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C
200 ÷ 1000 kPa	N/A	-25 ÷ +70°C	-25 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C
400 ÷ 2000 kPa	N/A	-25 ÷ +70°C	-25 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C
400 ÷ 7000 kPa	N/A	-10÷ +70°C	-10÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C

700 ÷ 3500 kPa	N/A	-10 ÷ +70°C	-10 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C
1400 ÷ 7000 kPa	N/A	-10 ÷ +70°C	-10 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C
2500 ÷ 13000 kPa	N/A	-10 ÷ +70°C	-10 ÷ +70°C	-25 ÷ +70°C, optional -40 ÷ +70°C

Table 17 Limitation of standard applicability given by limitation in compressibility calculation (AGA, SGERG)

Pressure Measurement Range	Method	
	GOST 13390.2	GOST 13390.3
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
2500 ÷ 13000 kPa	Not applicable	-23,15 ÷ +70 °C

Table 18 Limitation of ranges applicability given by limitation in compressibility calculation (GOST)

Substitute Compressibility

For the selected method, it is checked at every calculation whether the measured value of pressure and temperature is within the range of the method validity. If a value is outside of this range, substitute compressibility is used for the conversion. The substitute compressibility value must be entered by the user when configuring the device.

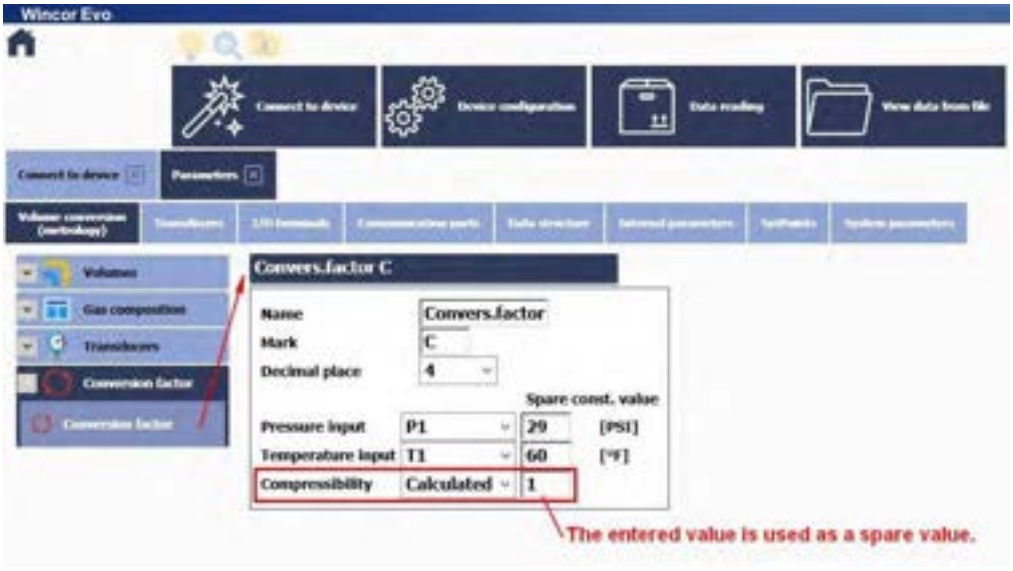


Fig. 67 Setting the substitute compressibility value K for calculating C (SW Wincor Evo)

8.3.2 PT, T Conversion

If it is required to set the device as PT or T corrector, then the device does not calculate gas compressibility, but a fixed constant value is used as the degree of compressibility K to calculate the conversion number K. The constant value of the degree of compressibility K is set in the device parameters for parameter C (Fig. 67). For the value "Compressibility" it is necessary to set instead of "calculated" to "Constant value". The range of the constant entered is not limited.

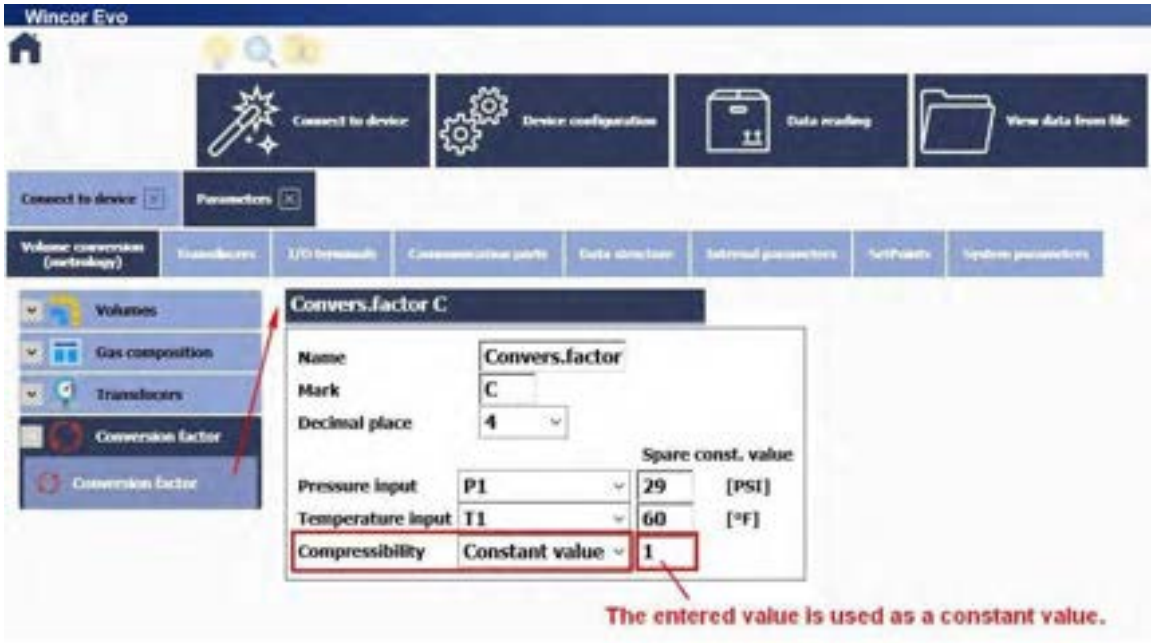


Fig. 68 Setting the constant compressibility value for calculating C (SW Wincor Evo)

8.4 Volumes Measurement and Calculation

To measure and calculate volumes, the following counters are used for each channel in the device:

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
Vs	-	Operating volume counter at error conditions (substitute primary volume)
Vb	-	Volume counter at base conditions
Vbs	-	Base volume counter at error conditions

8.4.1 Calculation of conversion number C for volume conversion

As stated in paragraph 7.9.1, the following relation applies to the calculation of volume under basic conditions:

$$V_b = V * C$$

The following applies to the conversion number:

$$C = \frac{P}{Pb} * \frac{Tb}{t+273.15} * \frac{1}{K}$$

The conversion number C depends on the degree of compressibility of the gas K, the reference conditions (pb, Tb), the gas pressure p and the gas temperature t.

8.4.1.1 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, instead of the measured pressure value, the value entered into the device as a constant when configuring the device can be used for the calculation. Then we talk about a substitute or constant value of pressure.

Substitute pressure value ps

This value is used automatically instead of the measured value of gas pressure if the so-called error conditions occur, i.e. 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:

Setting of substitute and constant pressure value

The substitute pressure value ps and the constant pressure value p are in fact the only 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 pressure parameter on the parameter card C instead of the measured value P. The size of the spare, resp. constant pressure is entered in the field "Spare const.value". The set value should be as close as possible to the real value of the gas pressure in the pipeline.

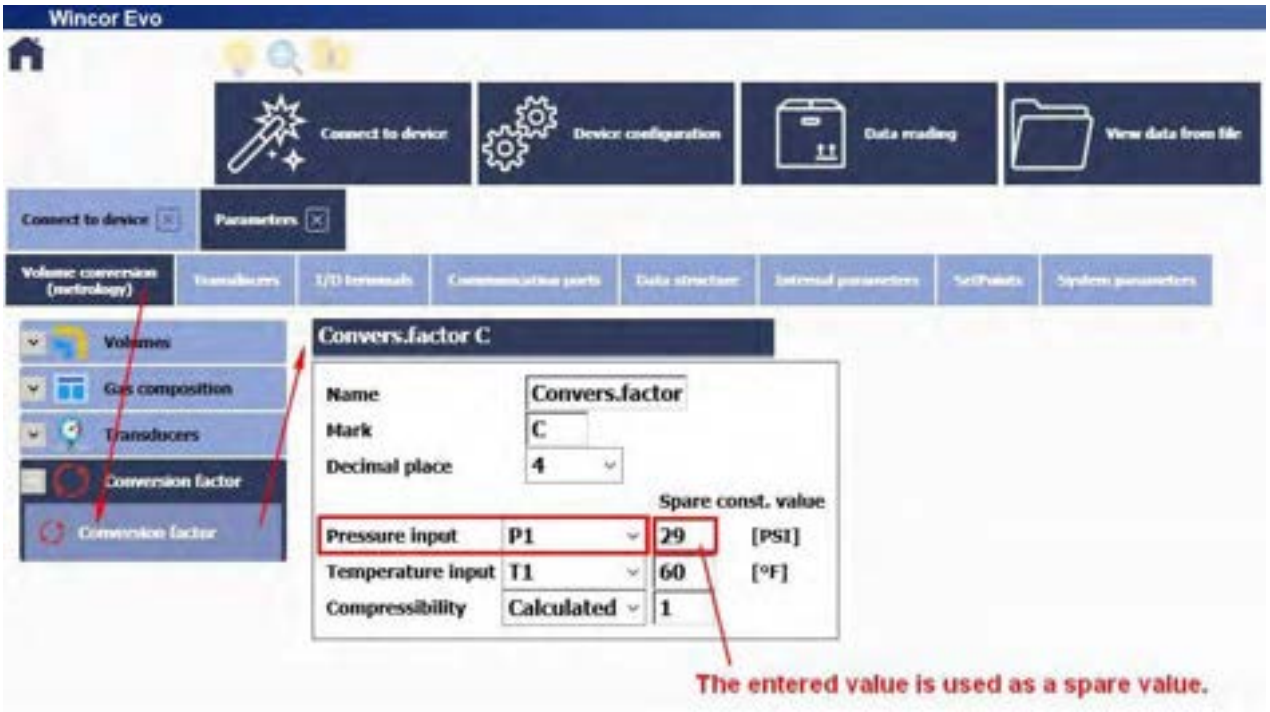


Fig. 69 Setting the replacement pressure value (SW Wincor Evo)

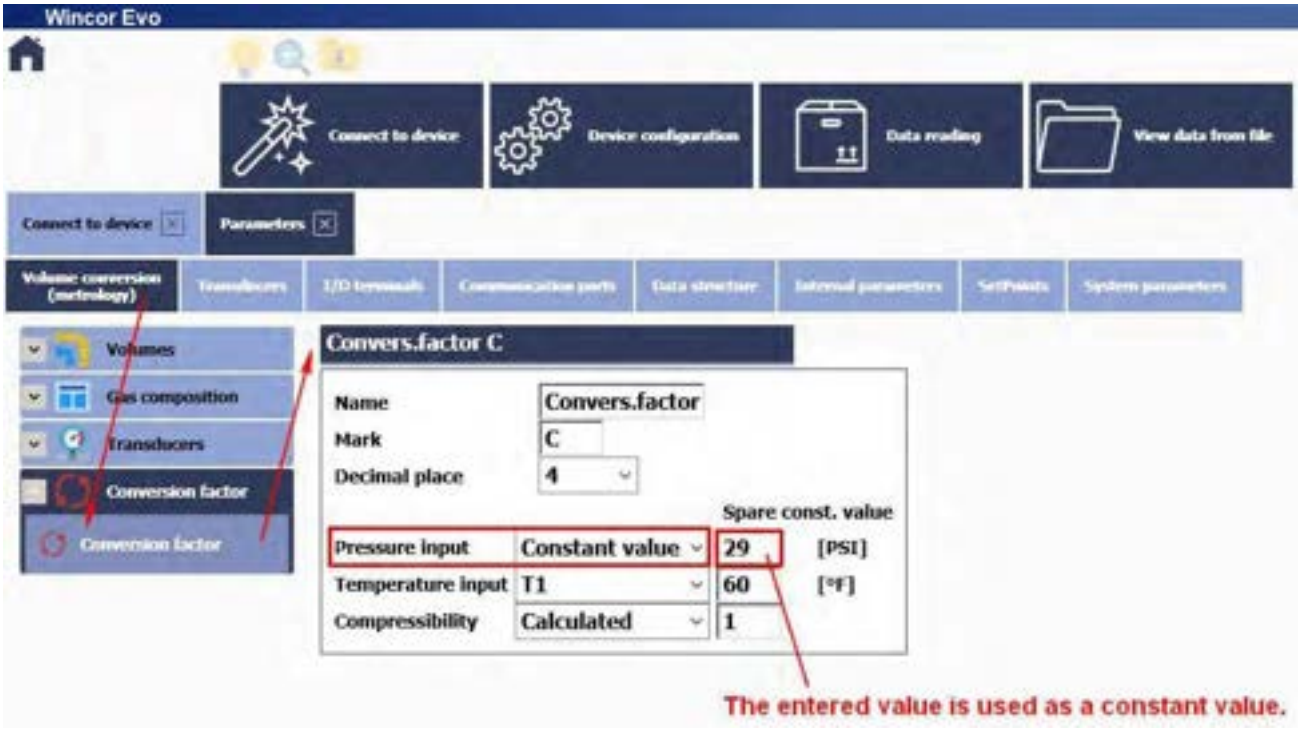


Fig. 70 Constant pressure value setting (SW Wincor Evo)

The size of the substitute value can be changed by the user after turning the service switch to the ON position. Switching measured value p / constant value is protected by a metrological switch.

8.4.1.2 Gas temperature - measured or fixed value

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

Substitute temperature value ts (Ts)
This value is used instead of the measured value of the gas temperature automatically if the so-called error conditions occur, i.e. 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 instrument is not equipped with a transmitter for measuring the gas temperature. 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 specified meter according to MID approval (certificate TCM143 / 20-5716).

Setting of substitute and constant temperature value
The substitute temperature value ts (Ts) and the constant temperature value t (T) are in fact one single 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 instead of the measured value p. Spare size, resp. constant temperature is entered in the field "Spare

const.value". The set value should be as close as possible to the real value of the gas temperature in the pipeline.

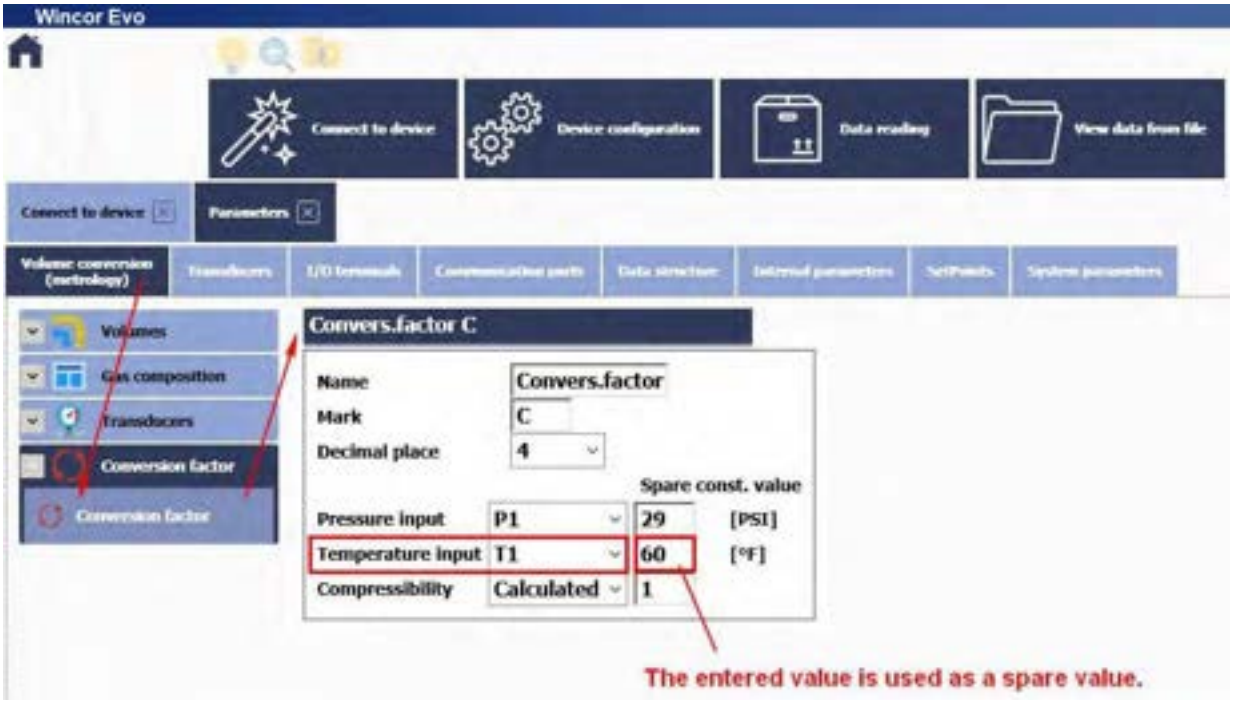


Fig. 71 Setting the replacement temperature value (SW Wincor Evo)

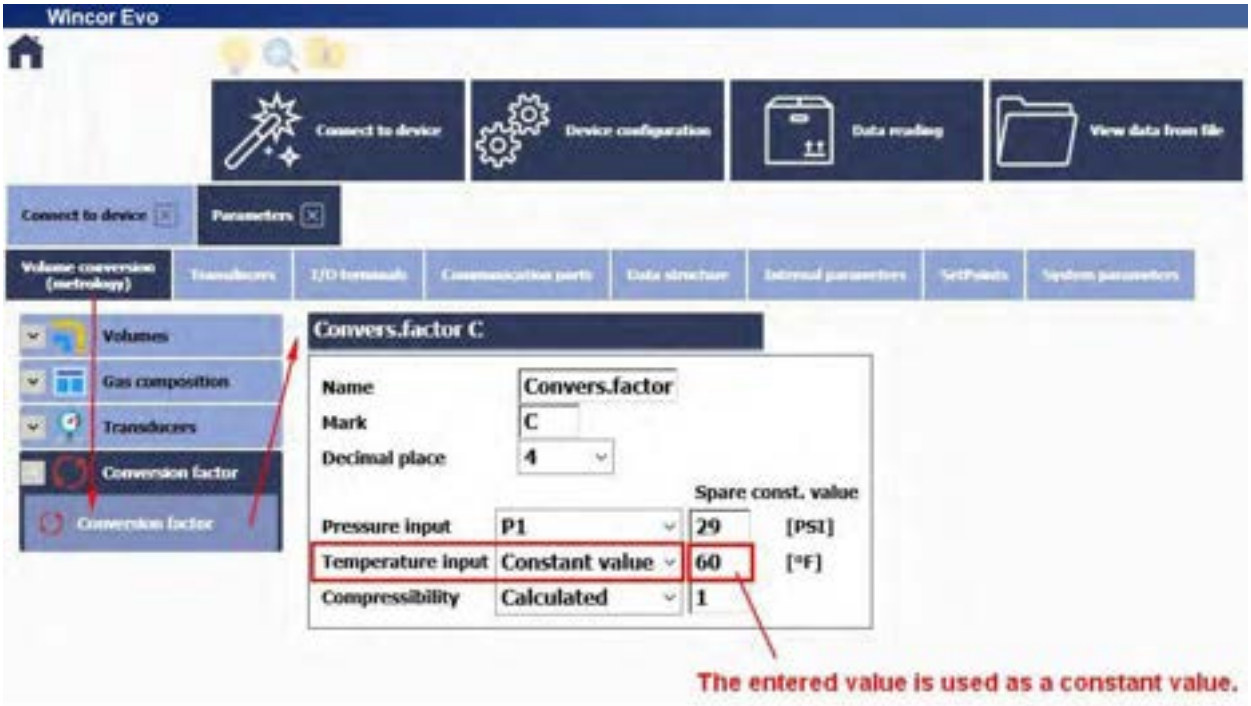


Fig. 72 Setting a constant temperature value (SW Wincor Evo)

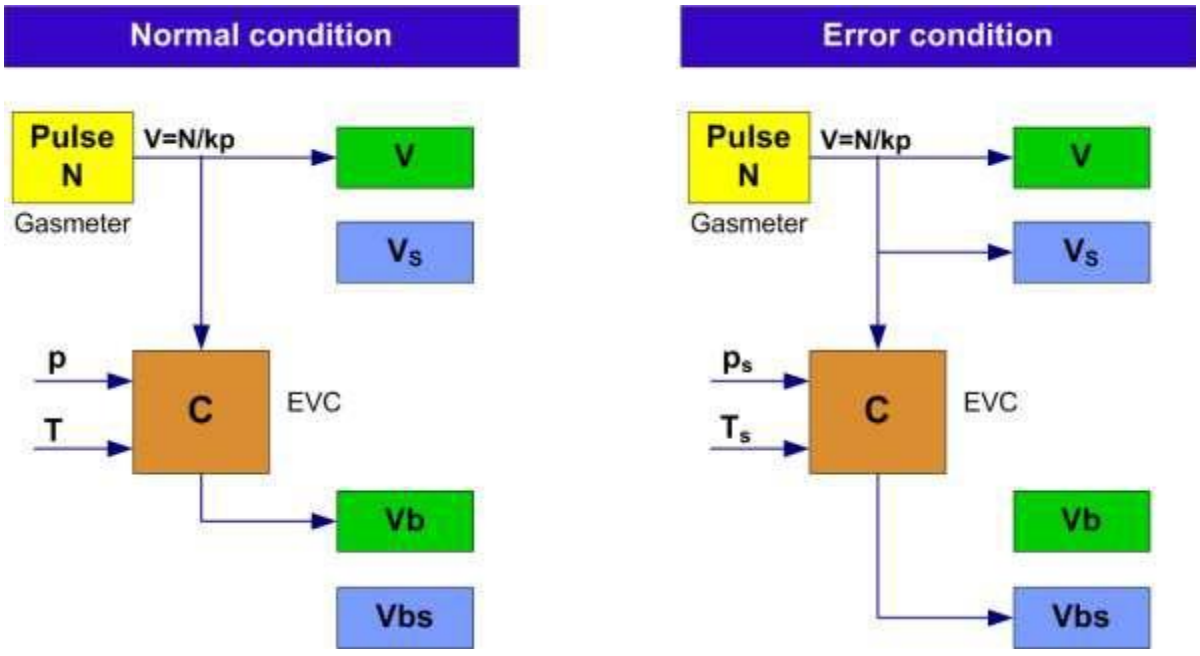
The size of the substitute value can be changed by the user after turning the service switch to the ON position. Switching measured value t / constant value is protected by a metrological switch.

8.4.2 Activities at Error Conditions Occurrence

In the event of error conditions, along counting the pulses into the volume counter at the measurement conditions (V), the device starts to count the pulses into the volume counter at the base conditions (V_b). The volume values at the basic conditions (V_b) cease to be counted in the volume counter at the basic conditions (V_b) and start to be calculated from substitute pressure or temperature values and stored in the substitute volume counter at basic conditions (V_{bs}). Under this condition, the values are not stored in the volume counter at the basic conditions (V_b).

The device error condition occurs in these cases:

1. the measured gas pressure is outside the measuring range - a substitute pressure value ps is used to calculate the conversion number C, or
2. the value of the measured gas pressure is not available - an alternative pressure value ps is used to calculate the conversion number C (e.g. in case of a sensor error), or
3. the measured gas temperature is outside the measuring range - a substitute temperature value ts is used to calculate the conversion number C, or
4. the value of the measured gas temperature is not available - an alternative temperature value ts is used to calculate the conversion number C (e.g. in case of a sensor error), or
5. If, during the calculation of the volume under the basic conditions, the measured value "p" or "t" deviates from the scope for the set calculation standard outside the permitted value (see paragraph 8.3.1 and Table 20, Table 21), and at the same time "p" or "t" are not outside the measuring range, so the substitute compressibility "C" will be used for the calculation.



Symbol		Meaning
N	-	Pulses from the meter
kp	-	Gas meter constant [pulse/m3]
p	-	Measured gas pressure
T	-	Measured gas temperature

ps	-	Substitute gas pressure
Ts	-	Substitute gas temperature
V	-	Volume counter at measurement conditions (primary volume)
Vs	-	Primary volume counter at error conditions (substitute primary volume)
Vb	-	Volume counter at base conditions (corrected volume)
Vbs	-	Base volume counter at error conditions (substitute corrected volume)

Fig. 46 Storing pulses in the counters

If the substitute compressibility is used in the calculation because of accuracy deviation outside the value permitted under the selected calculation standard, while neither p and t are outside the measuring range, the converted volume is stored in the spare counter.

If the corrected volume V_c is used, the primary volume counter at error conditions V_c can be related to V_m or V_c.

8.4.3 Respecting the Change of the Gas Flow Direction in the Gas Meter

A gas meter equipped with two phase-shifted LF rotary sensors allows detecting the flow direction of the gas.

When detecting the gas flow directing while respecting the change of direction, the corrector processes data from the meter in the following way (Fig. 47):

- If the primary volume V_m addition is positive, the volume is processed following the standard procedure (i.e. the increasing the values of counters V_m and V_b, or V_{ms} and V_{bs})
- If the direction of rotation of the meter is changed, the device remembers the reading of the primary volume counter V_m (gas meter reading) at which the gas flow direction has been reversed. If gas flows back, only the value of the primary counter V_m (and $V_{ms,}$ if applicable) is updated. All the other counters do not change the reading.
- After changing the direction, the related counters (V_b, V_{bs}) start to count the additions again (only after the state at which the flow was reversed has been restored). The primary volume counter constantly copies the status of the meter.

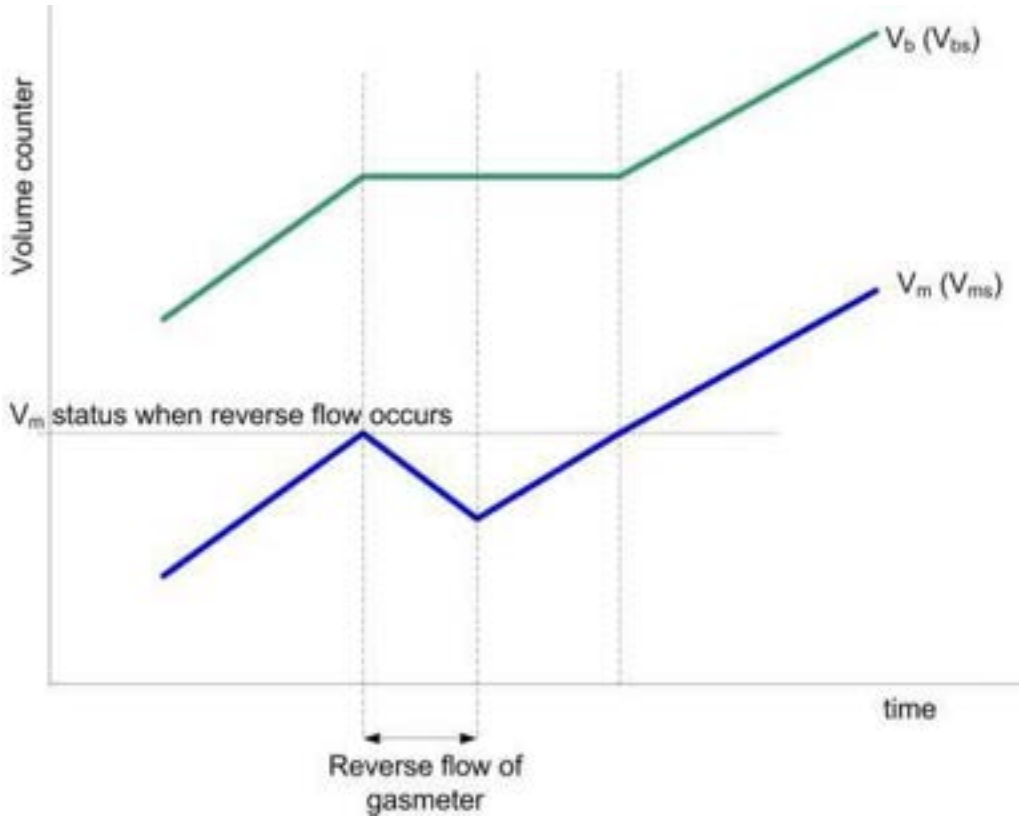


Fig. 47 Processing the volumes at the gas meter revers rotation

Note:

If the instrument is set to respect the change of gas flow direction through the gas meter, it is possible to switch on the counter in the instrument parameters, in which the amount of gas flow is stored during the gas meter return.

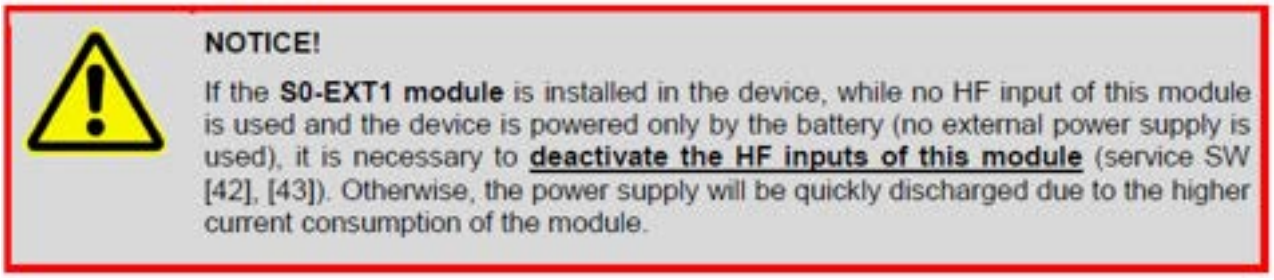
9 Connecting Inputs

The Corus Evo+ has 4 digital inputs in the basic version, marked DI1 to DI4. Other inputs can be added to the device via plug-in modules.

Digital inputs can be set by the utility SW as binary or LF pulse. The electrical connection of the meters is described in Section 5.5.2.

Inputs	Module	Terminals	Pulses	Indication of the gas meter rotation direction	Binary	Encoder
Digital input	Basic design	DI1	LF	LF direction	✓	---
		DI4	---		✓	---
		DI2	LF	---	✓	---
		DI3	LF	---	✓	---
	S0-EXT1	DI1	HF (NAMUR)	HF direction	✓ NAMUR	NAMUR
		DI2	HF (NAMUR)		✓ NAMUR	NAMUR
		DI3	LF	LF direction	✓	---
		DI6	LF		✓	---
		DI4	LF	LF direction	✓	---
		DI7	LF		✓	---
		DI5	LF	LF direction	✓	---
		DI8	LF		✓	---
	S0-NAM		---	---	---	NAMUR
	S0-SCR		---	---	---	SCR

Table 19 Options of digital inputs for the Corus Evo+



Input	Module	Terminals	Mounting options
		AI1	SLOT 0
4-20 mA analogue	S0-EXT1	AI2	
4-20 mA analogue	S1-2AI	AI1	SLOT 1 SLOT 2
		AI2	

Table 20 Options of analogue inputs for the Corus Evo+

Fig. 48 EXT1-T add-on terminal board for S0-EXT1 module

9.1 LF Pulse Inputs

There are used to count pulses from the gas meter. For these inputs, flow measurement function can be selected. The backup battery ensures that the counter readings and the LF input pulses count are maintained even when the battery is discharged or replaced. After the power supply connecting, the impulses read during the voltage outage of the supply battery are added to the spare counters.

Changing the Measurement Units, Setting the Gas Meter Constant

Pulse input measurement units can be changed by the utility.The gas meter conversion constant and the gas meter serial number can be set using both the utility SW and the device keypad. When setting the gas meter constant value, only decimal multiples or fractions within the range of 0.001 to 1000 should be used.

9.2 Binary Inputs

These inputs are used to scan the input signals with the possibility to detect the state "closed" (i.e. log 0) or "open" (log 1). The device allows to evaluate binary inputs from potential-free outputs (reed contact or open collector).

By setting the parameters, the user can select the displayed actual values, save changes to these entries in the archive, the displayed message for log. 0 and log. 1 status and the active signal level.

9.3 HF Pulse Inputs (NAMUR)

These inputs are available on EVO+ with S0-EXT1 module. For these inputs, flow measurement function can be selected. The backup battery ensures that the counter readings are maintained when the external power supply fails even when the main battery is discharged or replaced, but it does not provide for pulse counting in this case.

Changing the Measurement Units, Setting the Gas Meter Constant

Pulse input and gas meter measurement units can be changed by the utility SW. The gas meter constant and gas meter serial number can also be set from the device keypad.

9.4 Connecting a Gas Meter with an Encoder

A gas meter equipped with an encoder can be connected to the corrector. The meter counter reading is transferred to the corrector in digital form. To connect an encoder, it is necessary to install the module into SLOT 0 according to the type of encoder. Two types of encoders, a NAMUR encoder (like Itron Cyble SC) and an SCR encoder, are supported.

The use of both types of encoders is metrologically approved by EC Type Certificate TCM 143/18-5562.

The corrector is connected with the encoder by a shielded two-wire cable. The electrical connection of the encoders with the device is described in Section 5.5.2.5. When making the connection, the signal polarity must be respected.

The encoder data is transmitted to the corrector in the measurement frequency. Setting a short measurement frequency shortens the battery life. Section 7.4.1 shows the battery life when using encoders.

The period of reading the data from the gas meter encoder connected to the instrument by means of an add-on module located in the SLOT 0 position is limited according to the type of encoder and the type of module used:

encoder type	module (SLOT 0)	reading period
SCR+	S0-SCR	10 s ÷ 1 hour
NAMUR	S0-NAM	1 min ÷ 1 hour
	S0-EXT1	10 s ÷ 1 hour

Table 21 Encoders – limitation of reading period

9.4.1 Device Specifics when using the Encoders

When the encoder is connected, the data communication with the corrector takes place on a two-wire cable. In addition to transferring the absolute value of the gas meter counter reading, additional information from the meter can be transmitted (serial number, gas meter constant, number of nines to reverse the counters, etc.). This additional information is downloaded by the control firmware of *the corrector and used to parameterize the device.*

If there is a communication error between the corrector and the encoder, then:

- The "*" flag (asterisk) shows on the display of the corrector at the actual primary volume value.
- If the communication error lasts for more than 10 minutes, the volume difference is added to the counter after the communication has been restored.

The manual setting of the primary volume $\mathbf{V_m}$ value is blocked for inputs connected to an encoder.

9.4.2 Gas Meter Installing and Replacing

When the gas meter is connected to the corrector, the current reading of the meter is transferred to the corrector, i.e. the state Vm may change abruptly. In order that this abrupt change is not falsely reflected in the converted volume Vb (Vbs), the following procedure should be followed:

- In the utility SW [20] running on the PC, display the device parameters, select the "SCR Encoder" object and press the "Encoder Replacement" button. During the exchange of the encoder, the processing of volume from the meter will be stopped. (You also need to follow the instructions displayed on the PC screen).
- Connect the encoder physically to the corrector.
- After connecting the encoder, complete the installation/replacement with the OK button.

During the installation/replacement (i.e. from point 1), no increments are added to the related counters, and the corresponding counter is marked with an exclamation mark on the display. If point 3 of this procedure is not performed within one hour of the start of the replacement, the replacement mode will automatically be terminated in the utility program.

10 Communication with the Device

In order to communicate with other instruments, the device is equipped with several communication devices:

Optical interface for IR head	1
RS232/RS485 integrated communication line	-----
RS232/RS485 communication line, module S1-COM1	2
RS232 communication line, module S4-COM0	1
Internal modem	1 **)

**) Using plug-in internal M2G or M4G modem

Table 22 Communication options of the device (max. possibilities)

The table specifies the maximum numbers of communication interfaces for the plug-in modules. An external modem can be connected to RS232 communication lines (for details see 10.3.1)

The devices can operate up to two modems.

A combination of 1 internal modem and 1 external modem is allowed, or 2 external modems connected to RS232 communication lines can be used.

All listed communication interfaces work independently and communication on them can take place simultaneously and with the same priority.

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

ATTENTION!

Signals on all RS232/RS485 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).

The recommended wiring diagram is shown in Section 5.6.7.

The speed settings and communication protocol type for each interface can show on the device

display. It is also possible to change the setting from the device keypad.

The internal modems are supplied in the following versions:

Designation	Description	Battery type	Note
1. Modems for 2nd generation networks (2G)			
M2G	Data transfer in GSM or GPRS mode	HB-03, HB-03D	
2. Modems for 4th generation networks (4G)			
M4G, LTE-Cat1E	LTE cat. 1, European design	HB-04	
M4G, LTE-Cat1US	LTE cat. 1, European design	HB-04	
M4G, LTE-CatM1US	LTE-M1, European design	HB-04	mid 2022
M4G, LTE-CatNB	LTE-NB, European design	HB-04	in progress

Baud rate setting ranges

	Baud rate
Optical interface for IR head	2 400 Bd ÷ 115 200 Bd
Internal modem (Baud rate between the device and the modem)	2 400 Bd ÷ 115 200 Bd
RS232/RS485 communication line	2 400 Bd ÷ 115 200 Bd

In the current firmware version, the device is equipped with several communication protocols. The device is extendable by additional protocols according to customer requirements. By default, the following protocols are implemented:

- IFLAG Evo,
- MODBUS RTU
- MODBUS TCP
- MODBUS IGD
- M900
- GAZ MODEM

(other communication protocols are being prepared)

When using MODBUS protocols, a map of the MODBUS registers must be loaded to the device. The map assigns the numeric addresses to the measured and calculated quantities stored in the internal memory of the device. The Modbus map can be uploaded to the device by user-operated SW.

The Iflag Evo+ is the native protocol of the device. A complete set of features implemented in the device is available. The utility SW uses this protocol only; to switch to another data link layer, the Iflag Evo+ protocol is just nested in another data link layer (the tunnel). Only the Iflag Evo+ and CTR protocols can be used to download the firmware (protected by a metrological seal).

If MODBUS protocols are used, the MODBUS register map must be uploaded to the device. The map assigns numerical addresses to an individual measured and calculated quantities stored in the internal memory of the device. The Modbus map can be loaded into the device by the user service SW.

Device addressing

The communication protocols used to use so-called addresses for communication with the device,

which must be set in each device. The address of each device must be set in the device parameters. The device address can be set either from the device keyboard (section 6.7), or using the service SW.

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

The Iflag Evo+ protocol uses both parts of the address, the MODBUS communication protocol uses only Address1.

Setting the range of the communication address (network address) of the device		
	Address1	Address2
Communication protocol Iflag Evo+	0 – 65 535	0 – 255
Communication protocol MODBUS *)	10 - 247	not used

*) communication addresses 1 to 9 are reserved for the internal parts of the device

Setting range of device communication addresses

10.1 EN 62056-21 (IEC-1107) Optical Interface

In the front cover of the enclosure there is a port for communication via the optical head. The optical head is placed to the port and secured with a magnet. E.g. the optical head type HIE-04 with USB connection to the PC can be used. When the optical head is attached, the machine switches from the standby mode into a mode that allows for data receiving. Depending on the device setting, the device remains in this state either until the attached optical head isremoved from the communication interface or until the set time limit since the last communication expires (timeout within 1 to 255 seconds). The set timeout can be read and changed using the utility SW**.** (parameter "Turn IR head off after [s]:" on the Service Parameters tab).

10.2 Modules of the Internal Modems

The device contains a buil-in antenna of the integrated M2G, M4G modem. If the signal is weak at the installation site, an external antenna may be used. In this case, however, it is necessary to order a special HF cable adapter from the manufacturer to connect the external antenna. The HF cable reducer is installed as described in v Section 7.6.2.

Using the utility SW [20], the M2G modem can be set to one of the following modes:

- GSM modem
- modem GPRS modem
- GSM & SMS modem
- GPRS & SMS modem

Data transfer can be initiated either by the dispatcher station calling the device (PULL) or by the device calling the dispatcher station (PUSH).

The minimum recommended RSSI value for GPRS communication is -85 dBm (i.e. 45%). Below this value, the device displays error number 10 (see Section 6.7.3, Table 12).

Note on the SIM Card

The modem requires a SIM card in order it can be operated. The SIM card is not supplied with the device. The internal modem allows data transfer both in dial-up (CSD) mode - i.e. data transfer to GSM, and in GPRS or LTE mode. The SIM card for the given data transfer mode must be provided to the user with his mobile operator.

For dial-up connection (CSD), the mobile operator must be required to activate the data transfer on the SIM card. Data transfer activation is, of course, required even for GPRS data transfer.

Basic information about the modem connection and signal strength is shown on the device display with icons (see Table 10). In addition, some additional information on the modem current status can be displayed. This screen can be accessed from the device keypad by selecting SYSTEM DATA-> Communication. The following information can be displayed (for details, refer to Section 6.7.3):

- The numerical code of the last error of the modem and the time of its occurrence. The numerical codes of errors and their meanings are shown in Table 12 .
- For the GPRS mode, the assigned current IP address
- Signal strength (in%) at the installation site

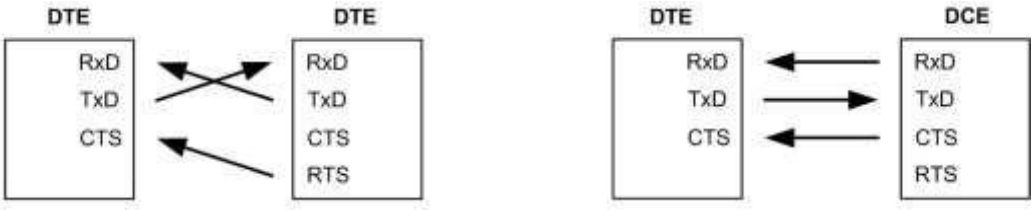
In addition, the keypad can be used, when needed, (especially for service purposes) to:

- Turn on the power of the GSM/GPRS modem,
- Initialize GSM/GPRS calls from the device to the master system (if this call option is set in the device parameters),
- Send SMS

10.3 Connecting communication devices via RS232 interface

In terms of data transmission, we distinguish two types of devices, DTE - Data Terminal Equipmentand DCE - Data Communication Equipment. **Corus Evo+ are DTE devices**. Depending on whether a device of the same type (i.e. DTE) or a DCE-type device is used, either a crossover or a direct link cable is used. For example, a PC is a DTE device, a modem is a DCE device.

Generally (RS232):



Corus Evo+ PC Corus Evo+ Modem

In case of Corus Evo+ is connected via external module B-RS, B-RS/A. This communication module includes an internal signal crossing. Therefore, connecting to a PC and modem will look like this:

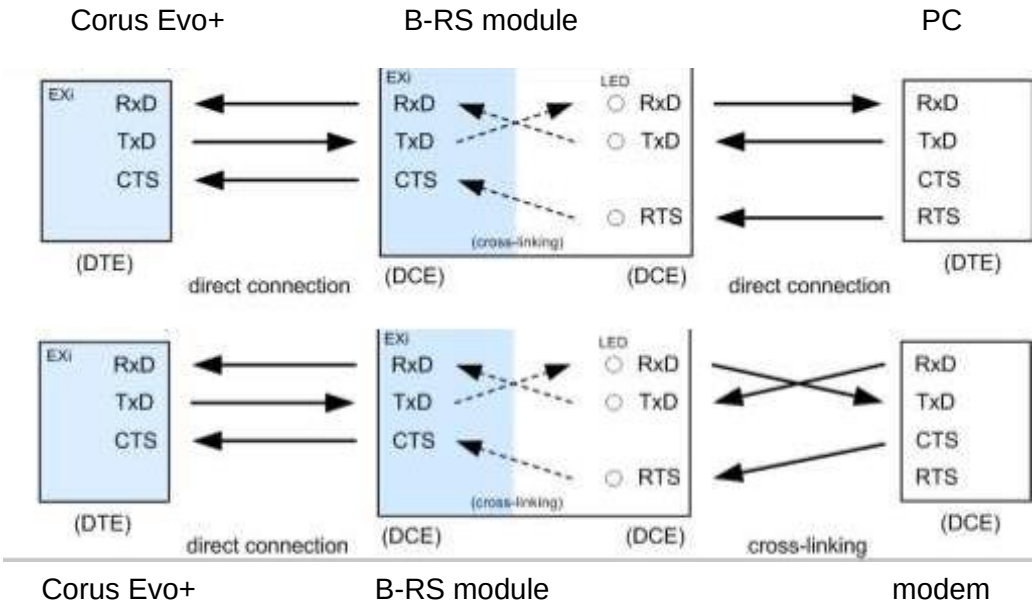


Fig. 49 Principle of connection with PC and external modem via module B-RS

10.3.1 Connecting an external modem

An external modem with RS232 communication interface can be connected to the device.

The external modem can be connected either to the S1-COM1 module, which must be located in the SLOT1 position, or to the S4-COM0 module, which must be installed in the SLOT 4 position.

Note: If S4-COM0 (SLOT 4) is used, the internal modem in SLOT 5 cannot be used.

In any case, the external modem must be connected to the device via an intrinsically safe barrier (module B-RS, or MTL5051).

If the connected modem allows it, you can use the service SW [20], to set the parameters of the external modem communication similarly to the internal modem (see par. 10.2).

10.4 Encrypting Data when Communicating with the Master System

This optional feature is implemented in the Iflag Evo+ and CTR protocols. For this purpose, the device contains cryptographic keys. Symmetric AES encryption with a key length of 128 bits is used. In addition, the packet of transmitted data includes the type of encryption key and the control signature. Thanks to this signature, the authenticity of the key can be confirmed, and consequently, the use of the decrypted data permitted. In case of incorrect decryption, the counterpart is informed by means of a standard error response. Modifying keys is only possible with highest security level. The keys from an unencrypted packet cannot be accepted.

The implemented protocols include the option to block the device response if an unencrypted packet has been queried. In the case of such a query, the device responds with a standard error packet.

11 Function Description

The device offers highly variable and user-configurable options for displaying of values and storing the quantities. The user can decide which quantities to display as actual values and which quantities should be stored in the archives.

11.1 Quantities Designation

The quantities are designated using the symbols shown in the table “Symbols and Terms” (see page 1).

Quantities Designation

- The designations of the metrological quantities in the single channel device do not include an index (Index 1 or 2 is used with dual channel devices.)
- For other quantities (non-metrological), index can be used to distinguish the quantities of the same type.

User Designation of Quantities

- This new feature allows the user to define customized designations of quantities. The original quantities designation then serves as the default designation (shown in blue in the utility program. The quantities designation must be chosen in such a way as to preserve the uniqueness of the designation. The uniqueness of the designation is checked by the utility program.
- The designation of metrological quantities can only be changed at ASC level.
- The user-defined quantities designation is used for display purposes both in the device and in the utility program and can be exported to be used in third-party software.

11.2 Actual Values

For the displayed quantities, the number of displayed digits, the units, and the displayed name are user-customizable. If the measured quantity is in an error state, this state is indicated by the asterisk at the last position in the quantity designation row.

Example of quantities that can be displayed as actual values:

- Pressure p1, p2
- Temperature t1, t2
- Primary volume Vm1, Vm2
- Substitute primary volume Vs1, Vs2
- Corrected volume Vb1, Vb2
- Substitute corrected volume Vbs1, Vbs2
- Energy E1, E2
- Primary flow rate Q1, Q2
- Corrected flow rate Qb1, Qb2
- Conversion factor C1, C2
- Compressibility factor K1, K2
- Device error
- External power supply
- Battery capacity
- Internal temperature

11.3 Archives

The values in the archives are ordered in time slots. Each time slot includes the time data of the slot 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

Besides these data archives, the device contains the following additional archives:

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

The archives with a fixed number of records (monthly, daily, binary, and limit) are stored at the beginning of the available memory of the device, and in the remaining memory, data archive is stored in (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		
Substitute primary volume – absolute state	yes	yes	yes		
Substitute 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					

Table 23 Quantities archiving options

11.3.1 Monthly Archive

The values are recorded in the archive once a month at the set "gas" hour (usually 6:00 am). The record time is stored in the archive along with the values. When the archive is filled, the new data starts to overwrite the oldest. There is an option to store statistical values for gas consumption and analogue quantities (see Table 23).

Therefore, a record dated 01.06. means statistical values of quantities in the interval 1.05. 6:00 to 1.06. 6:00.

11.3.2 Daily Archive

The features are similar to the monthly archive (for the list of options see Table 23). Also, in this archive, the statistical values of gas consumption and analogue quantities can be stored. The values are recorded in the archive once a day at the scheduled "gas" hour (usually 6:00 am).

Therefore, a record dated 13.06. means statistical values of quantities in the interval 1.05. 6:00 to 1.06. 6:00.

11.3.3 Data Archive

Archiving period: adjustable from 1s to 1h

In this archive, the quantities are stored in the defined period, which can be set by the user. The default value is 1 h. For status variables, the occurrence of the active state in the archive period is stored in the archive. For binary inputs, the active status can be set according to the actual parameter setting. Log1 is the active status for setpoints and errors.

11.3.4 Binary Archive

The archive stores the states of binary inputs together with status bits calculated and stored in the system, and the errors of each device. The values can only be stored in this archive if the status of any stored binary is changed. The record includes a time with a resolution of seconds.

11.3.5 Limit Archive

For the archived quantities, limit (minimum or maximum) reaching is stored. A value and a time are stored. When this archive is initialized, the current measured values of the specific quantities are set in both maximums and minimums registers.

11.3.6 Status Archive

The archive stores the date and time of an event change, the status word (64 bits) describing the statuses of all the monitored events in the device and the state of the primary volume counter Vm1 and the volume counter Vb1 at base conditions. The list of monitored events in the device is listed in Table 13 and in Table 14.

The content of the archive cannot be displayed directly, but it has to be viewed via the service PC software.

11.3.7 Settings Archive

The settings archive stores the parameter changes, especially if they affect the metrological properties of the device, except for changes in gas composition and the standard for gas compressibility calculation. The ID of the person who made the change is stored in the archive, as well. The record contains the time, person ID, activity description, and new and old parameter values that have been set.

This archive is different from the other archives, as it is not rewritable, i.e. when filled, no records can be stored, and further modification of the parameters is impossible. This archive cannot be displayed directly, the contents can only be viewed on a PC.

11.3.8 Billing Archive

The device contains a billing archive. This archive is used to record data of the billing period set in the device parameters. The records can be made in the archive in the following ways: first, as one-off record and according to a preset time or periodically at intervals of 1,2,3,4,6 and 12 months. At this time, all current readings of the primary volume and the recalculated volume of both the total counter and the counters of the individual tariff bands are recorded.

The device allows for setting the billing period and the time when the next billing period is due.

11.3.9 Gas Composition Archive

Changes in the gas composition or in the standard for the gas compressibility calculation 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 filled, the new data starts to overwrite the oldest.

11.4 Device Parametrization

11.4.1 SW Parameterization Using the Service SW

The device allows for setting the parameters needed for the device to be put into operation after installation directly from the device keypad, i.e. without the need to use a computer. The descriptionof the procedure is provided in paragraph 6.

The device can be fully parametrized using the supplied utility SW [20] for PC. In addition to setting up the device, the software also allows reading, viewing, archiving and printing of both actual values and the archives contents. The parameterization procedure using the utility SW is described in [17].

11.5 Other Features of the Device

11.5.1 Summer/Winter Time (DST)

The time change function (summer/winter time) is implemented in the device. This function can be activated/deactivated with the utility SW. When this function is activated, the device automatically changes the time based on the region where the device is used (Europe or USA). At the same time, it is necessary to set a deviation from the central time (GMT) for correct operation. The archives of the device then distinguish whether the record was taken in summer or winter time.

11.5.2 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 the adjustment in the setup archive and without generating the warning message W38 in the device status.

Remark for CTR communication protocol:

> *If the time deviation is greater than 60 s and less than 2 hours, then the time correction is enabled, but it is 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 alert is generated.*

In the device parameterization, if the device is equipped with a modem, it is possible to set automatic time synchronization using NTP protocol via the GPRS network or using the ETTC protocol via GSM CSD call. The time is synchronized automatically with a 20-day period, or with a 24-hour in the case of failure. If the synchronization is not successfully completed by 25th day, an E26 error is triggered and recorded in the status archive (Table 13). The amount of the time deviation detected during synchronization is always evaluated with respect to the data storage frequency so that the archives are not corrupted during synchronization.

11.5.3 Tariff Counters

Up to four tariff counters are available in the device that allow for volume calculating according to a pre-set time schedule. There are two separate schedules (Tariff Schedule 1 and Tariff Schedule 2) that can be configured independently and only one can be active at a given time. In these schedules, the tariffs can be assigned to specific time slots in the days, and it is also possible to define whether the selected day is a working day, Saturday or Sunday (holiday).

Each schedule has its own identification number and the time of activation can be set separately for each schedule.

11.6 Protection against change of Metrological Parameters

The device is protected against unauthorized manipulation (especially with data that affect the metrological characteristics of the device) with a metrological and service switch and uses password system security. Changes to the device settings and other operations are stored in the

settings archive. These measures make it possible to protect the device both in accordance with and beyond standard EN 12405-1.

11.6.1 Protection Switches

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

11.6.1.1 Metrological Switch

- Protects the metrological setting of the device. It is located on the inside of the enclosure cover (see Fig. 37) and is protected by plate secured with the manufacturer's seal (official metrological mark).

11.6.1.2 Service Switch

- The service switch is located beneath the metrological switch (Fig. 37). Opening the device and the switch accessibility can be protected with the user mark.

The ***service switch*** function depends on the settings in the device parameters. The settings are done via the utility program (Parameters Menu -> Service Switch Function). Here, the user can choose what effect the switch settings will have on each device parameter group.

This variability resolves the setting of various access options to work with the device (e.g. remote setting of the parameters via the modem ...).

Using the utility SW, the user can select one of the following functions for the service switch:

Switch function	Position	Description
Full [21)]	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 has been overridden.
	ON	
Partial	OFF	Writing to the device is blocked with the exception of non-metrological parameters (such as archiving frequency, 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).

Table 24 Service Switch Settings

11.6.2 Passwords

The device has password protection implemented. The use of passwords may be restricted depending on the communication protocol set. Maximum number of passwords that can be entered in the device is 50. When the password protection in the device is turned on (see below), the passwords must be used both for serial line or modem communication and for setting device

[21)] This function has been pre-set by the manufacturer (default setting).

parameters using the device keypad. When setting parameters from the keypad, the list of items to be edited is limited by the access level permitted.

11.6.2.1 Password Groups (Valid for Iflag Evo, MODBUS, and CTR)

The passwords are divided into 5 groups. Users of the "Administrators" group have the highest rights, the users of the "User 3" group have the lowest rights. Higher-level users have lower-level users rights, plus 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 (the user with the lowest ID in each group) can change the passwords of other users in that group. The administrator of the "Administrators" (ID = 801) group can change the passwords of the administrators of the other groups. According to the communication protocol used, the following characters can be used in a password:

Communication Protocol	Permitted characters	Note
Iflag Evo	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 rejected by the counterpart station)	password length must be 6 characters (the device allows for entering shorter password, which however is rejected by the counterpart station)
MODBUS	digits 0 to 9	password length 1 to 6 characters

Table 25 Password Format

Turning on password protection

- by entering a password with ID 801

Turning password protection off

- **by deleting the password with ID 801.**
  By deleting the ID 801 password, the other passwords set in each group are deactivated, but their settings are not lost. Once the password protection is enabled, they become active again.

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" • Loading new MSP processor firmware • Resetting metrological archives (settings archive, status archive, gas composition archive) • Transducer replacement, calibration of the corrector • Creating or removing metrological quantities • Changing the name or prefix of metrological quantities • Setting Tb and Pb • Changing the device status • Changing a restriction • Setting Vb, Vbs • Setting the schedule of the tariff currently active When the metrology switch is set to ON, 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-lever users)
Service Maintenance	811 to 820	Switching to the “Maintenance” mode and back to “Normal”
User 1	821 to 830	Depending on the service switch, the parameters are divided into groups. For the effect of the service switch, see Table 24. Parameters influencing metrological properties: • Setting the substitute 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 variables • 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

Table 26: Password Groups and their Specification

Notes:

Administrator with password identifier 801 is authorized to:

- Set passwords for the other administrators (ID 801 to 810)
- Set passwords with IDs 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.

11.6.3 Levels of Access

From the point of view of modifying parameters and other operations with the device, it is possible to divide the users of devices according to different levels of access.

User Level

- Common user of the device. At this level, reading all the data from the device and setting a large number of parameters is allowed. It is not possible to change the parameters directly affecting the metrological properties of the device. For more details, see Table 27. As a protection against misuse, protection switch together with user mark and password system can be used.
-

Accredited Service Centre (ASC)

- Designed for the workers of the center authorized by the manufacturer. The Centre is authorized to carry out operations relating to the device metrological properties. These activities require the breaking the official mark, switching the metrological switch and using a **special HW key** for the utility program [20]. For the description, see Table 28

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 substitute values for conversion	ON	

Table 27 User access level - for the "full" function of the service switch

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 assembly • Reset the archive settings and status archive • User designation of the quantities	ON	Using the HW key designated WGQOI, "Accredited Service" version

Table 28 ASC Access Level

12 Accessories

12.1 Plug-in Modules for Corus Evo+

Module	Designation	Slot
S0-SCR	Interface for SCR gas meter encoder	SLOT 0
S0-NAM	Interface for NAMUR gas meter encoder	
S0-MIE	Interface of Corus Evo+ mechanical indexer	
S0-EXT1	Extension module - 2 HF NAMUR pulse inputs, 6 digital inputs, 2 analogue inputs, 2 transducer connection	
S1-COM	RS232/RS485 communication module	SLOT 1, SLOT 2
S1-2AI	4-20 mA analogue inputs module (2 inputs)	
S1-2AO	4-20 mA analogue outputs module 4-20 mA (2 outputs)	
S3-PWR1	EVC external power supply module	SLOT 3
S4-PWR2	Module of external power supply of internal module	SLOT 4
S4-COM0	RS232 communication module	
M2G	Internal modem 2G	SLOT 5 [23])
M4G, LTE-Cat1E	Internal modem LTE cat.1-E	
M4G, LTE-Cat1US	Internal modem LTE cat.1-US	
M4G, LTE-CatM1	Internal modem LTE cat.M1-US	

Extension Internal Module

BARP	Module for barometric pressure measurement (must be specified in the order, cannot be installed by user)

12.2 External Modules

The main function of these modules is to ensure external power supply of the device and external power supply of internal modems and to ensure correct connection of other cooperating devices, which extend the utility features of the device. Since the device is intrinsically safe, the following

[22]) External power supply from S3-PWR1 is required

[23]) If external power supply for modem is not used, the internal modem module should be mounted in SLOT 4 instead of lot SLOT 5modules act as a safety barrier (except for the CLO module) to connect conventional devices.

Dual module design

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

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

"/ A" version - the module has reduced its own current consumption, therefore it is suitable for installations where the 230Vac power supply is not available and which are powered from the battery (intrinsically safe parameter Um = 60V). In this case, the power supply battery must not be charged from a power supply connected to the 230Vac power supply. The module does not have galvanic isolation of terminals.

The external modules are designed for DIN rail mounting into the switchboard. There are separate manuals for the modules. The use of external modules illustrates Fig. 50 and 51

12.2.1 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-M PS-M/A	External intrinsically safe power supply for internal 2G or 4G modem (powered from 12Vdc mains)	*)

*) *under preparation*

12.2.2 Separation and Communication Modules

B-RS B-RS/A	Separation barrier for RS485	*)
B-DI	Separation barrier for digital inputs (2 pcs)	*)
B-DO B-DO/A	Separation barrier for digital outputs (4 pcs)	*)
B-IB	Separation barrier for internal bus	*)

*) *under preparation*

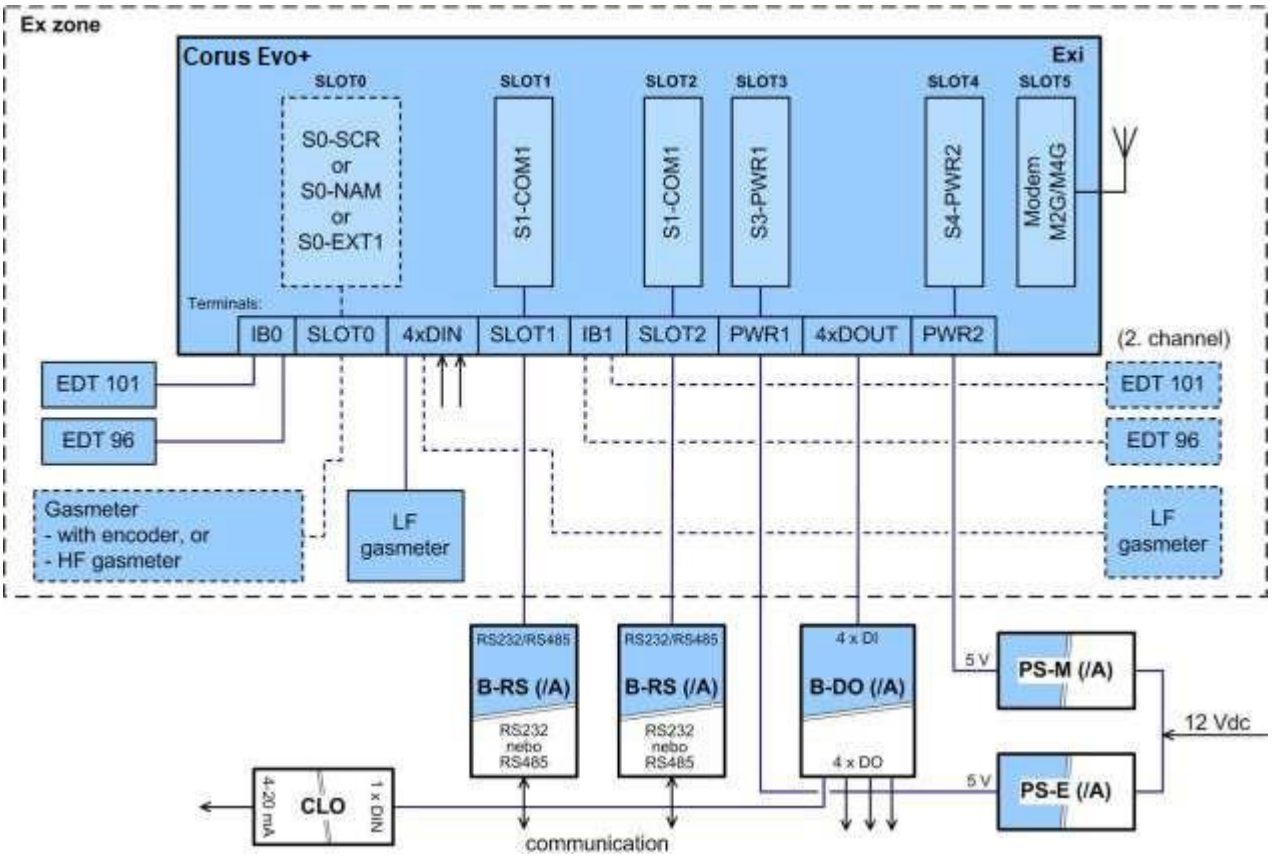


Fig. 50 Corus Evo+, example of use of external modules

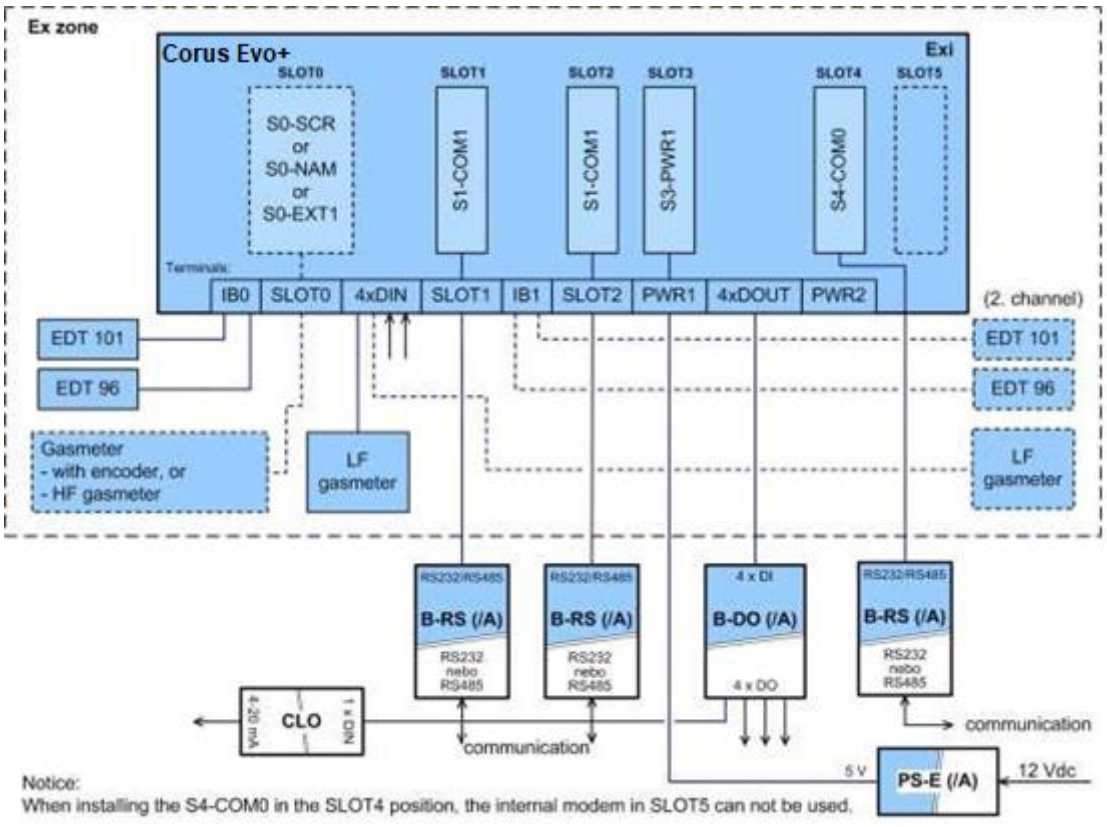


Fig. 51 Corus Evo+, example of use of external modules

12.3 Other Accessories

CLO	4-20 mA analogue output module	*)
HIE-04 B	IR head with USB communication interface (max.115 200 Bd)	
HIE-04	IR head with USB communication interface (max. 38 400 Bd) (production ceased)	
HIE-03	IR head with RS232 communication interface (max. 38400 Bd) (production ceased)	
EDT 101	Temperature transducer	
EDT 96	Pressure transducer, internal or external	

Appendix: Device variant with the segment display

1 Device operation

For viewing data, the device is equipped with a two-line segment LCD display with icons. Using this display brings these changes in the display features when compared with a standard graphic display:

- Permanent display of data (display does not switch off) while maintaining the specified battery life of the device
- Displaying data even in frosty weather below -20 ° C (i.e. at ambient temperature within the range -40°C ÷ +70°C)
- Limitations of some data, worse readability of text data

The device is not equipped with a power switch. If the battery (B-03) is inserted and connected to the device, the device is automatically in the operation mode and the device's display is permanently lit. If the B-O3 battery is disconnected or discharged, the device display goes off.

The device is equipped with a six-key keypad, the same as in the graphic display version.

The keypad is activated by pressing Enter for more than 2 seconds. The keypad activates the backlight of the display.

1.1 Standard Display

In the standard operation of the device, actual values of the measured and calculated quantities designation of the displayed quantity is displayed in the first line of the display, the value is displayed in the second line of the display. The quantities whose values we want to display can be set by the user.

Features of the Standard Display

- Standard display - periodic display of the actual values of the measured values or calculated quantities selected by the user
- The length of the display of each quantity is 5 seconds, 15 seconds in the case of the volume at base conditions Vb
- The text is displayed without diacritics

By means of parameterization of the device by the utility, individualized display of the selected quantities can be set by the user, except for the standard display of the actual values.

1.2 Display Using Keypad Keys

Using the keypad keys, the various device parameters, system data, and device diagnostics, including the status of the internal modem, can be displayed along with the values of the actual and calculated data. The data to be displayed are selected using the device menu (see 2.1). 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

- In compliance with standard EN 12405-1+A2, section 6.3.1.5, the display switches to the basic display. In the parameters, the time after which the device switches to the basic display can be selected.
- In order to simplify the operation by a non-trained user, the option to display incremental values instantly by pressing the RIGHT key. Before you first have to press the ESC key

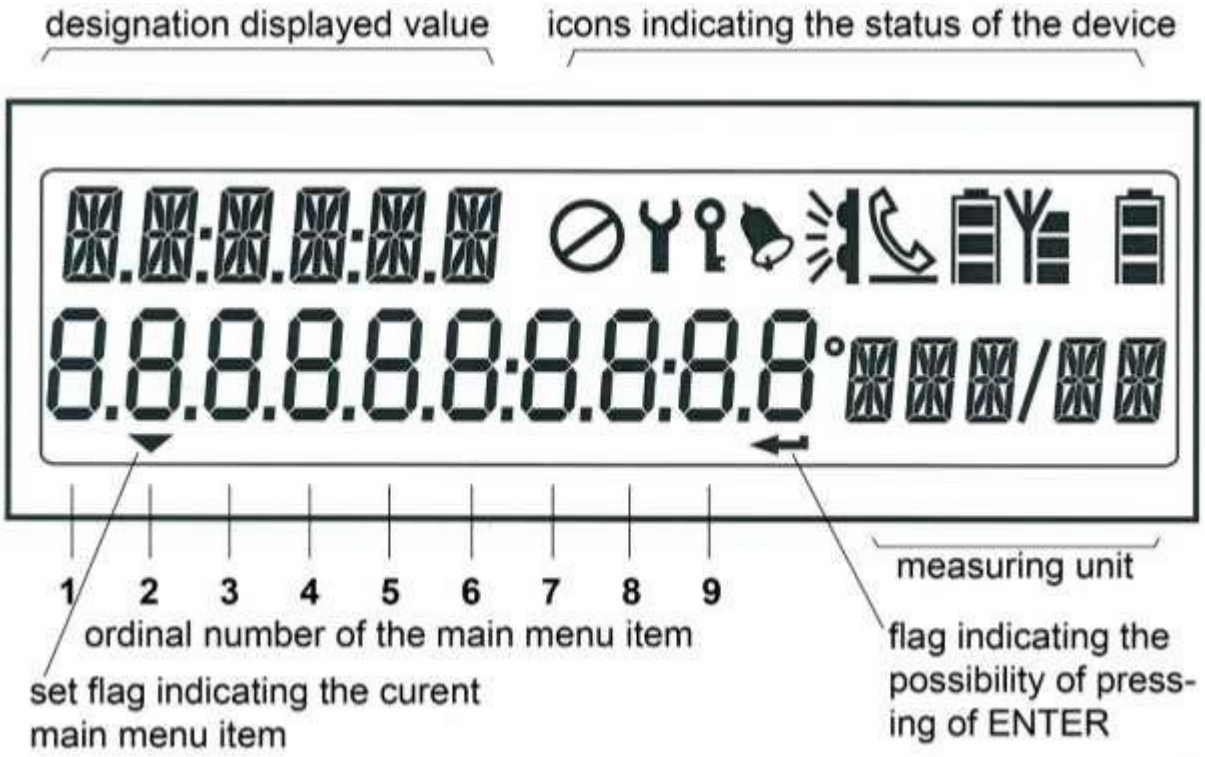
several times to the top menu level (Vb).

- In order to simplify the operation by a non-trained user, the option to display actual values one after another by pressing the RIGHT key is included. Before this, it is necessary to exit by pressing the Esc key several times to the top menu level (Vb).

The device does not display the contents of the data stored in the archives.

This can only be done with the utility SW [20] running on a PC connected to the device.

1.3 Display of the Device



	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 communication channel of the device is handled by a GSM / GPRS modem. Communication is established via dial-up connection in the GSM network. flashing: - connecting lighted: - connected
	The communication channel of the device is handled by a GSM / GPRS modem. Communication is established in the GPRS mode. the bottom-line flashing: - establishing a connection the bottom line not flashing: - logged in to GPRS
	Battery status of the GSM / GPRS modem. The number of black displayed rectangles 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: ≥75% 50÷74% 25÷49% <25%
	Device battery charge condition. The number of black displayed rectangles indicates the state of the battery. number of rectangles: 3 2 1 0 capacity: >50% 25÷50% 10÷25% <10%

Table 29 Meaning of the display icons

2 System Menu

Data that can be displayed on the device display are structured based on the menu. For the purposes of further interpretation, we call the basic menu items the highest items. By entering those items, navigate to the lower menu levels (submenus).

2.1 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 the (ENTER) key. You can scroll through one of the keys (LEFT, RIGHT). If any of the main menu items contains a submenu (e.g. PARAM, CONFIG or SYSTEM), the submenu is entered by the ENTER key.

	main menu	1st submenu	2nd submenu	3rd submenu	note
1	**Vb**				actual value of the volume counter at basic conditions
2	**ACTUAL**				actual values display
		Vb			actual value of the volume counter at basic conditions
		Vm			actual value of the primary volume counter at basic conditions
		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 basic conditions
		Vbs			actual value of the substitute value at basic conditions
		Vs			actual value of the substitute value at measurement conditions
		... etc.			other items depending on the device configuration
3	**MENU1**				user-defined display of actual values
4	*(reserve)*				*reserved*
5	**PARAM**				displaying the device parameters
		COMMUN			communication address
			COM.GEN.		general
				ADR1	communication address 1
				ADR2	communication address 2
			IR.HEAD		optical head
				SPEED	baud rate
				PROT.	communication protocol
			COM0		EVO+: communication device connected via SLOT 4,5
				SPEED	baud rate
				PROT.	communication protocol
				COM.DEV.	communication device

			COM1		EVO+: communication device connected via SLOT1
				SPEED	baud rate
				PROT.	communication protocol
				COM.DEV.	communication device
			COM2		EVO+: communication device connected via SLOT2
				SPEED	baud rate
				PROT.	communication protocol
				COM.DEV.	communication device
		SERV			service parameters
			S.N.DEV		device serial number
			VER.APP		application SW, version no., CRC
			VER.MTR		metrological firmware, version no., CRC
			VER.LDR		loader – version no., CRC
			ST.NAME		Station Identification
		CONV			gas volume conversion parameters
			STAND.C		method of compressibility calculation
			PB		pressure reference value
			TB		temperature reference value
			ZB		gas compressibility factor under reference conditions
			GAS		gas composition parameters
				CO2	CO_2 content
				H2	H_2 content
				N2	N_2 content
				DENS	relative density
				CALOR	Combustion heat (calorific value)
			P.SPARE		pressure substitute value
			T.SPARE		temperature substitute value
			K.SPARE		error gas compressibility factor value at measurement conditions
			P.RANGE		pressure measurement range
			T.RANGE		temperature measurement range
		INPUTS			input parameters
			Vm		primary volume
				GAS KP	gas meter constant [imp/m3]
				S.N.GAS	gas meter serial number
			P		pressure measurement

				P.RANGE	pressure range
				S.N. P	serial number of the transducer
			T		temperature measurement
				T.RANGE	temperature range
				S.N. T	serial number of the transducer
6	**CONFIG**				setting the device parameters from the keyboard
		SERV			setting service parameters
			ST.NAME		Station Identification
			GAS.H		hour of the start of the gas day
		COMMUN			setting communication parameters
			COM.GEN.		general parameters
				ADR1	communication address 1
				ADR2	communication address 2
			IR.HEAD		optical head
				SPEED	baud rate
				PROT.	communication protocol
			INT.MOD		communication device
				SPEED	baud rate
				PROT.	communication protocol
			COM1		RS232/RS485 interface
				SPEED	baud rate
				PROT.	communication protocol
			COM2		RS232/RS485 interface
				SPEED	baud rate
				PROT.	communication protocol
		GAS.COM.			gas composition setting
			CO2		CO_2 content
			H2		H_2 content
			N2		gas composition parameters
			CALOR		Combustion heat (calorific value)
			DENS		relative density
		DAT:TIM			
			TIME		system time of the device setting
			DATE		the date setting
		VOL1			volume setting
			GAS KP		the gas meter constant setting
			Vm		primary volume setting
			Vb		converted volume setting

			Vs		substitute primary volume setting
			Vbs		substitute converted volume setting
			E		energy setting
			Es		substitute energy setting
			S.N.GAS		gas meter serial number setting
			QMAX		maximum gas meter flow rate setting
		CLEAR.A			deleting archives contents
			DATA.AR.		deleting the data archive
			DAY.AR.		deleting the daily archive
			MONTH.A.		deleting the monthly archive
			TARIFF		deleting the tariff archive
			BINARY		deleting the binary archive
			LIMIT.A.		deleting the boundary archive
			SETUP.A.		deleting the settings archive
			STATUS		delete the status archive
			GAS.AR.		deleting the gas composition archive
		WORK.M.			working regime setting
		SAVE.PA			entering the set parameters into the device
7	**SYSTEM**				system parameters display
		TIME			system time display
		DATE			system date display
		RESET			device reset
		MODEM			modem parameters
			MODEM1		modem no.1 parameters
				GPRS.IP	up-to-date GPRS modem IP address
				MODERR	last modem error code and time of occurrence (Err.xx format hh: mm DD.MM.YY) "Xx" - modem error code (see Table 12)
				SIGNAL	Measuring the signal strength triggered by a keyboard command. Showing measurement status: BTS: test BTS: roam BTS: connect BTS: search BTS: no BTS: denied After the signal strength is successfully measured, the value in percent (SIG: xx [%], converted to dBm - see Table 11) is

					displayed. Automatic shutdown after 2 min or by shutdown by the user.
				MOD ON	Turning the modem power supply on manually from the keypad - switches on, or switches on and connects to GPRS according to the set mode - the time in seconds to automatic exit and shut down the of modem is displayed - automatic shutdown after 5 minutes or shutdown by the user
				CALL	Manual initialization of GSM / GPRS calling from the device to the master system - must be enabled in parameters - after activating the command, it displays "Working" - then you can exit the mode and the device performs the action
				PACKET	displays the number of packets sent during the active or last communication
		BAT.EVC			remaining battery capacity [%]
		Vcc			battery voltage
		LATCH			Displays and freezes the actual values on the display. This function is used to check the field operation of the device (abbreviated test). For Vb, Vbs, E, Es, the decimal part of the value is displayed when Enter is pressed.
8	**DIAG**				Device Diagnostics
		ACT.ST.			The current device status is displayed (browse by pressing ENTER)
		SUM.ST.			The device checksum is displayed (browse by pressing ENTER)
		SUM.CLR			resetting total status
		TEST			triggering the device test
9	**TARIFF**				
		ID.CURR			
		ID.PREV			
		PREV.D			

Note:

The number of display characters (digits) on the display at a time is limited to 10. If you need to display longer information (such as ST.NAME - Station Identification), the displayed information will be scrolled.

2.1.1 ACTUAL Menu – Actual Values Display

(serial number 2 of the main menu) Immediate values of metrological quantities and the set non-metrological quantities are displayed (the non-metrological quantities are set in the parameters of the instrument using the utility program [20]). In the basic view (device idle), these data are displayed periodically on the display (except as in 2.1.2).

Indication of Exceeding the Limit

If the value of the measured quantity is outside the measuring range of the instrument, the "**E**" flag appears before the displayed numeral.

2.1.2 USER 1, USER 2 Menu

(serial number 3 and 4 of the main menu)

These items are displayed only if they are set in the device. Settings can only be performed by the utility SW.

With these settings, actual values can be displayed, in the order defined by the user.

> **i** **If the USER 1 menu is set in the device, the display of the actual values defined in the ACTUAL menu item is suppressed in the device and the actual values defined in the USER 1 item are displayed.**

2.1.3 PARAM Menu

(*serial number 5 of the main menu)*

Select this menu to display the set parameters of the device.

2.1.4 CONFIG Menu

(*serial 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, you must save the changed values to the device memory using the last submenu option SAVE.PA.

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

2.1.5 SYSTEM Menu - system data

(serial number 7 of the main menu)

RESET - Device Reset

After selecting the device reset, the program jumps to the initial address and re-initializes the entire measurement system. The contents of all the archives and the states of all gas volume counters (Vm, Vs, Vb, Vbs) do not change during this operation, nor any other configured parameters. Execution of the command is independent of the position of the service switch.

MODEM

In this option you can find the assigned IP address of the device for the configured GPRS modem and the mobile signal strength of the device at the device location. In addition, you can turn on the modem and, if necessary, initiate 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 the Actual Values

The actual values measured are frozen at the display on pressing the key. The frozen values of the quantities (Vb, Vm, P, T etc.) can be displayed in the standard way when displaying the actual values. Press ESC to stop displaying frozen quantities.

The LATCH function should be used, for example, when manually copying the values of the measured actual values when checking the accuracy of the device.

2.1.6 DIAG Menu Item – the Device Diagnostics

(serial number 8 of the main menu)

V menu DIAG Information on the device condition are stored in the DIAG menu.

ACT.ST. - Actual Status

This menu displays the actual state of the device. Pressing the RIGHT key shows all the current errors and warnings of the device one after another.

SUM.ST. - Checksum

The checksum is used to monitor the occurrence of active error states (individual device status bits) since the last checksum initialization. This means that also statuses of the device that may have been already extinct are stored in the memory.

The basic status information is also displayed as a "bell" icon on the device display.

SUM.CLR. - Checksum Trigger

On selecting this option on the device keypad or via the "Clear Checksum" option from the "Setup-Diagnostics" menu from the utility SW on the PC, the checksum is triggered, i.e. the current status is set according to the actual status. To enable the triggering, the service switch must be ON. If it is switched to OFF, a message ("Not Possible") is displayed, warning that the function cannot be triggered.

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 execution is independent of the position of the service switch.

During the test, WARNING is displayed on the display. The indicated errors are identified with the prefix "E" and the identification number; similarly, the prefix "W" is used for the warnings [24]). Refer to Table 13 and Table 14 for a complete list of error messages and warnings.

[24]) Due to the limitation of character display on the customer display, the "W" is displayed as „U"

13 References

[1] EN 60079-0 (Electrical apparatus for explosive gas atmospheres — Part 0: General requirements

[2] EN 60079-11 (Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i".)

[3] EN 60079-26 ed.3 (33 2320): VII.2015 – (Explosive atmospheres - Part 26: Equipment with level of protection (EPL) Ga)

[4] EN 12405-1: 2018 (GAS METERS - CONVERSION DEVICES - PART 1: VOLUME CONVERSION Gas Meters - Conversion Devices - Part 1: Volume Conversion)

[5] EN 60079-14 ed. 4 (33 2320): IX.2014 - Part 14: Electrical installations in hazardous areas (other than mining).

[6] EN 61000-4-2 (33 3432): VII.1997 + A1: VII.1999 + Z1: XI.2001 (Part 4-2: Testing and measuring technology - Electrostatic discharge - resistance test)

[7] EN 61000-4-3 (33 3432) ed.3:2006 + A1:2008+ Z1: 2010 - (Electromagnetic compatibility (EMC) - Part 4-3: Testing and measuring technology - Radiated electromagnetic field - resistance test)

[8] EN 61000-4-4 (33 3432) ed.2:2005 – (Part 4-4: Testing and measuring technology - Fast electrical transient phenomena/pulse groups - resistance test)

[9] EN 61000-4-6 (33 3432) ed.2:2008 - (Electromagnetic compatibility (EMC) - Part 4: Testing and measuring technology - Section 6 Resistance to conducted disturbances induced by radio-frequency fields)

[10] EN 61000-6-2 (33 3432) ed. 3:2006 – (Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Resistance to the industrial environment)199/828

[11] EN 61000-6-4 ed.2:2007

[12] EN 62056-21 (35 6131): IV.2004 – (Measurement of electric energy - Data exchange for meter reading, tariff control and load control - Part 21: Direct local data exchange)

[13] Modicon Modbus Protocol Reference Guide, Modicon Inc., Industrial Automation Systems, 1996

[14] FTZÚ 19 ATEX 0035X- (EU Type-examination certificate)

[15] TPG 902.01

[16] EN ISO 12213-3:2010 (Natural gas - calculation of compressibility factor - Part 3: Calculation using physical properties)

14 Related Documents

[17] Wincor Evo – Software description. User Manual.

[18] EDT 96 Pressure transducer. User Manual.

[19] EDT 101 Temperature transducer. User Manual..

15 Software

[20] Wincor Evo,
For updating reasons, the parameterization software is not on the enclosed CD ROM but is sent separately.

16 Trade Marks Used

{1} IrDA® - trade mark of Infrared Data Association company

{2} ModBus® - trade mark of Modicon company

17 EU declaration of conformity

{3} See document on CD ROM

18 ATEX and IEC certificates

{4} See documents on CD ROM

19 List of Tables

20 Document history

Version	Date	Autor	Change
2.0	14/07/2023	C. Rinlinger	•Change to Dresser Name •Insert history table •Change LF and HF input frequency •Change drawing Dresser Name
2.1	18/07/2023	C. Rimlinger	•Add non MID Pressure range in chapter 1.2 Main Characteristics
2.2	13/11/2024	C. Rimlinger	•Add information for new battery options

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