

# MacBAT 5.



## Energy and gas volume corrector with 4G LTE Cat.1 modem

The **MacBAT 5** corrector offers calculations of **PTZ, PT or T type**. The device is powered with internal battery with possibility to connect external power supply. MacBAT 5 converts gas volume measured by the **rotor, turbine or ultrasonic gas meter** to base conditions. Gas compressibility factor is calculated using algorithms: **SGERG-88, SGERG-mod-H2, AGA92-DC, AGA8-G1, AGA8-G2, AGA NX-19-mod** or by fixed **K1** compressibility factor value. MacBAT 5 is an intrinsically safe device, which can be installed in explosion hazard zone 0.



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PLUM Sp. z o.o. reserves the right to introduce amendments in construction of the devices, without prior notice.

Functions indicated above are for illustrative purpose only, they are adjusted depending on Manufacturer/Producer and software of system concerned.

Contracting entity is obliged to inform PLUM Sp. z o.o. of required functionalities.

**2120**  
**1022**

# Main features.

- Designed for turbine, rotary or ultrasonic gas meters through direct connection: LF, HF, Encoder, Wiegand (option)
- Communication with gas meters via NAMUR or SCR encoders also possible in the battery operation mode
- MID-certified volume measurement of gas mixture which contains up to 30% of hydrogen H<sub>2</sub>
- Advanced solutions preventing differences in the measurements of gas meter and corrector, detection of gas meter reverse flow
- HF input works on battery power in backup mode
- Four independent serial transmission ports (2x RS485 (optional 1xRS232 only in non MID version), optical 62056-21, NFC IEC 14443)
- Integrated modem (option) working in 4G LTE Cat.1 and 3G, 2G networks
- MID-certified gas meter characteristics correction function
- Up to 8 intrinsically safe configurable binary inputs, including two NAMUR inputs for inductive sensors, working also in battery mode
- Intrinsically safe binary and frequency outputs
- Internal or external pressure transducers
- Integrated gas meter load profile analysis function
- Support for gas station control systems via frequency to 4-20mA current converter.
- Support for BMS (Building Management System) cooperation via MODBUS RTU, MODBUS TCP or pulses controlled by Vb and Vm counters.
- Support for MODBUS MASTER readout of up to 16 external devices with MODBUS RTU output (e.g. digital pressure or temperature transducers) (option available from firmware series S011.xx, currently non MID version)



# Technical data.

|  |  |  |  |
|--|--|--|--|
| Housing material   | Polycarbonate (version 1) / Aluminum (version 2)   |  |  |
| Dimensions / Weight  | 207x194x77 mm / 1,3 kg (version 1)<br>202x167x93 mm / 3,5 kg (version 2)   |  |  |
| Relative humidity  | Maximum 95% at temp. of 70°C   |  |  |
| Ambient temperature range  | From -25°C to 70°C<br>(confirmed as operational in temperature range from -40°C to 70°C)   |  |  |
| Housing protection class   | IP66 for outdoor installations   |  |  |
| Keyboard   | 6 pushbuttons (version 1)<br>18 pushbuttons (version 2)  |  |  |
| Display  | Graphical, 4", backlight, operation at -25°C÷70°C range of ambient temperatures  |  |  |
| Ex marking   | II 1G Ex ia IIB T4 Ga<br>Certificate: FTZÚ 17 ATEX 0047X   |  |  |
| Internal power supply  | One lithium battery size D 3,6V/17Ah.<br>Operation time: 5 years   |  |  |
| Modem power supply   | Two lithium batteries size D 3,6V/17Ah.<br>(one, for version with p2 internal sensor in aluminium housing)<br>Operation time: 5 years with two transmissions per day (for two supplying batteries).  |  |  |
| External power supply  | INT-S3 communication interface – switchable RS485 port, 5.7V intrinsically safe power supply, two digital inputs/outputs. Interface supply voltage 11-30V DC   |  |  |
| Transmission protocols   | MODBUS RTU, MODBUS TCP (available in version with integrated modem), MODBUS RTU MASTER MODE (available in firmware series S011.xx, currently non MID version), GAZMODEM1,2,3 other protocols per request   |  |  |
| Transmission ports   | <ul style="list-style-type: none"> <li>Two independent serial transmission ports (COM1 – RS485 or optional RS232 – option available only in non MID version, COM2 – RS485 – shared with MODBUS MASTER input – option available from firmware series S011.xx, currently non MID version), speed up to 256 kb/s</li> <li>Optical interface IEC 62056-21</li> <li>NFC IEC 14443 interface</li> <li>Optional integrated modem 4G LTE Cat.1 /3G/2G</li> </ul> |  |  |
| Resistance to mechanical and electromagnetic conditions            | M2/E2  |  |  |
| Base conditions  | Set by authorized personnel; available options: <ul style="list-style-type: none"> <li>Base pressure (absolute) pb: range (0,95÷1,05) bar, default 1,01325 bar</li> <li>Base temperature Tb: range (270 ÷ 300) K, default 273,15 K (0°C)</li> <li>Reference temperature determined for combustion process T1: range (270 ÷ 300) K, default 298,15K (25°C)</li> </ul>   |  |  |
| Maximum permissible error (MPE) according to standard „EN 12405-1” | <ul style="list-style-type: none"> <li>0,5 % at reference conditions</li> <li>1 % at nominal operating conditions</li> <li>Typical error &lt; 0,15%</li> </ul>   |  |  |
| Maximum permissible error (MPE) according to standard „EN 12405-2” | ECD class A  |  |  |
| Algorithms for calculation of compressibility factor               | SGERG-88, SGERG-mod-H2, AGA8-92DC, AGA8-G1, AGA8-G2, AGA NX-19 mod (all algorithms with possibility of using full gas composition), fixed compressibility factor value K=1   |  |  |
| Horizon of data registration                                       | <ul style="list-style-type: none"> <li>Data registered in period 1-60 minutes – 36000 records (over 4 years @60min)</li> <li>Momentary data (1-second logging)</li> <li>Hourly data – over 16 months</li> <li>Daily data – over 4 years</li> <li>Monthly data – over 10 years</li> <li>Alarms/Events memory – over 6000 records</li> </ul>   |  |  |
| Meets the requirements of 2014/32/UE (MID)                         | Certificates:<br>DE-19-MI002-PTB004 – PLUM PTZ converter<br>DE-21-M-PTB-0012 – PLUM load recorder  |  |  |

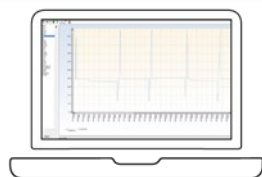
# Technical data.

| Inputs                    | <ul style="list-style-type: none"> <li>Up to 6 intrinsically safe, configurable, binary digital inputs, shared with:               <ul style="list-style-type: none"> <li>- 2 LF inputs, frequency 0-2Hz, WIEGAND standard 0-60Hz (option), flow direction detection</li> <li>- 1 tamper switch input - normally closed</li> <li>- 1 SCR ENCODER input (interchangeable with 1 binary digital input as an option)</li> </ul> </li> <li>Up to 2 intrinsically safe, configurable digital inputs NAMUR type, shared with:               <ul style="list-style-type: none"> <li>- 2 HF inputs, frequency 0÷5000Hz, EN60947 5-6, ability of temporary operation on battery</li> <li>- 1 ENCODER (NAMUR type)</li> </ul> </li> <li>MID-certified support for gas meters through LF, HF, ENCODER NAMUR, ENCODER SCR, WIEGAND and 10-point gas meter characteristics correction</li> <li>Pressure sensor p1 – measuring range up to 6 bar abs as standard. Internal or external sensor. Sensor ended with M12x1.5 (internal or external sensor) or 1/4" NPT (external sensor) thread. Pressure ranges: 0.8÷6 / 0.8÷10 / 2÷10 / 4÷20 / 7÷35 / 4÷70 / 10÷70 / 10÷100 / bar abs.<br/>Maximum permissible error for pressure measurements:               <table border="1"> <thead> <tr> <th>20 °C (± 3 °C)</th><th>(-25 ÷ 70) °C</th></tr> </thead> <tbody> <tr> <td>± 0,2 % of measured value</td><td>± 0,5 % of measured value</td></tr> </tbody> </table>               Typisal error of p1 pressure measurement: 0,15% of measured value             </li> <li>Temperature sensor Pt1000 class A or B with cable length compensation, two- or four wires, diameter 5,7mm.<br/>Maximum permissible error for measurements               <table border="1"> <thead> <tr> <th>20 °C (± 3 °C)</th><th>(-25 ÷ 70) °C</th></tr> </thead> <tbody> <tr> <td>± 0,1%</td><td>± 0,2 %</td></tr> </tbody> </table>               Typisal error of temperature measurement: 0,08%             </li> <li>Pressure sensor p2 – optional, internal or external – absolute or gauge pressure sensor. Gauge pressure ranges: 0÷0,1 / 0÷0,3 / 0÷1 / 0÷6 / 0÷10 / 4÷20 / 7÷35 / 5÷55 / 10÷70 / 10÷100 bar G. Absolute pressure ranges the same as for p1 sensor.<br/>Typisal error of p2 pressure measurement (gauge): 0,15% of range</li> <li>RS485 MODBUS MASTER input (with 3.6V power supply output) for readout of up to 16 external devices with MODBUS RTU output (e.g. digital pressure or temperature transducers), capable to operate on battery (option available from firmware series S011.xx, currently non MID version).</li> </ul> | 20 °C (± 3 °C) | (-25 ÷ 70) °C | ± 0,2 % of measured value | ± 0,5 % of measured value | 20 °C (± 3 °C) | (-25 ÷ 70) °C | ± 0,1% | ± 0,2 % |
|---------------------------|---|----------------|---------------|---------------------------|---------------------------|----------------|---------------|--------|---------|
| 20 °C (± 3 °C)            | (-25 ÷ 70) °C   |                |               |                           |                           |                |               |        |         |
| ± 0,2 % of measured value | ± 0,5 % of measured value   |                |               |                           |                           |                |               |        |         |
| 20 °C (± 3 °C)            | (-25 ÷ 70) °C   |                |               |                           |                           |                |               |        |         |
| ± 0,1%                    | ± 0,2 %   |                |               |                           |                           |                |               |        |         |
| Control outputs           | <ul style="list-style-type: none"> <li>Up to 4 intrinsically safe, configurable digital outputs (OC type):               <ul style="list-style-type: none"> <li>- 1 configurable as binary or frequency (0-5000Hz) output</li> <li>- 3 binary outputs</li> </ul> </li> <li>Binary outputs triggered by alarm/event or counter (Vb, Vm, E, M etc.)</li> <li>Frequency output triggered by measured value (p1, t, Qb, Qm, etc.)</li> </ul>  |                |               |                           |                           |                |               |        |         |

# Application.

1. Direct data transmission to the system—data readout via integrated 4G/3G/2G modem on battery power supply

SCADA or billing system



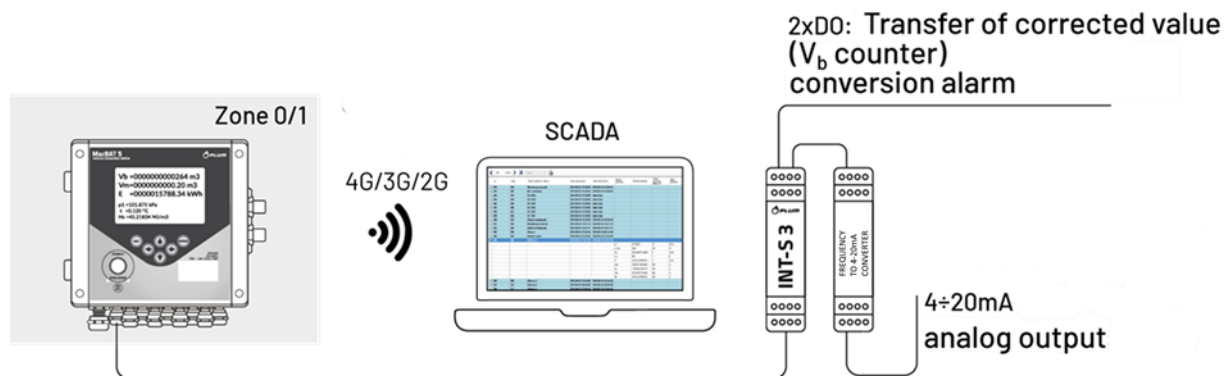
4G/3G/2G



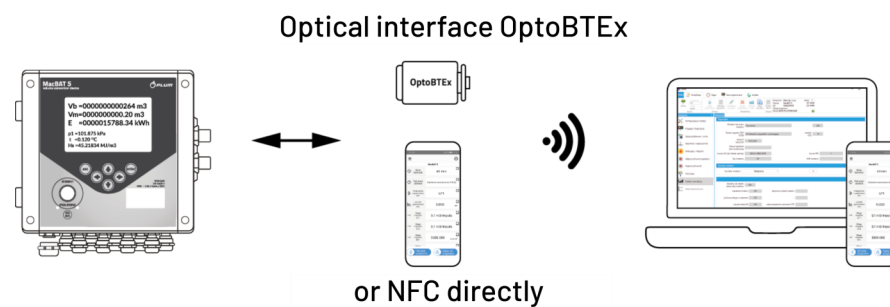
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2. Remote data readout – connection via INT-S3 communication interface and frequency to current converter

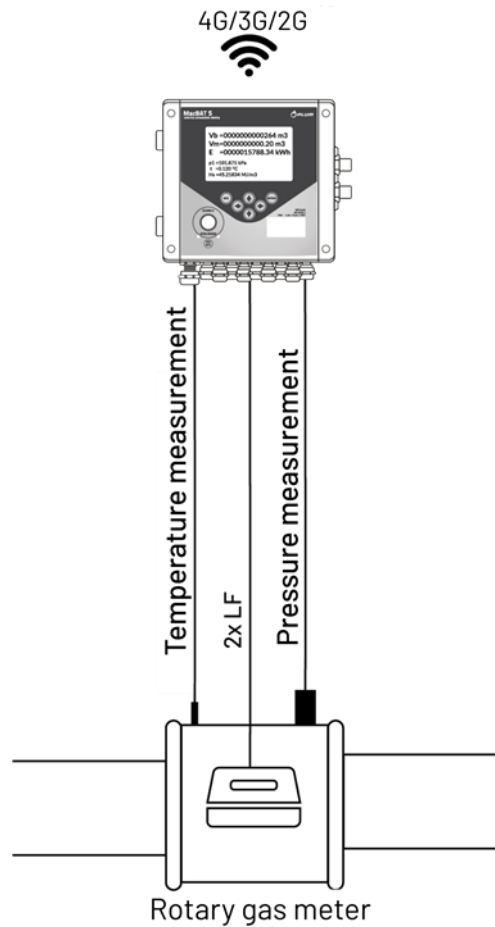


2. Local readout and configuration



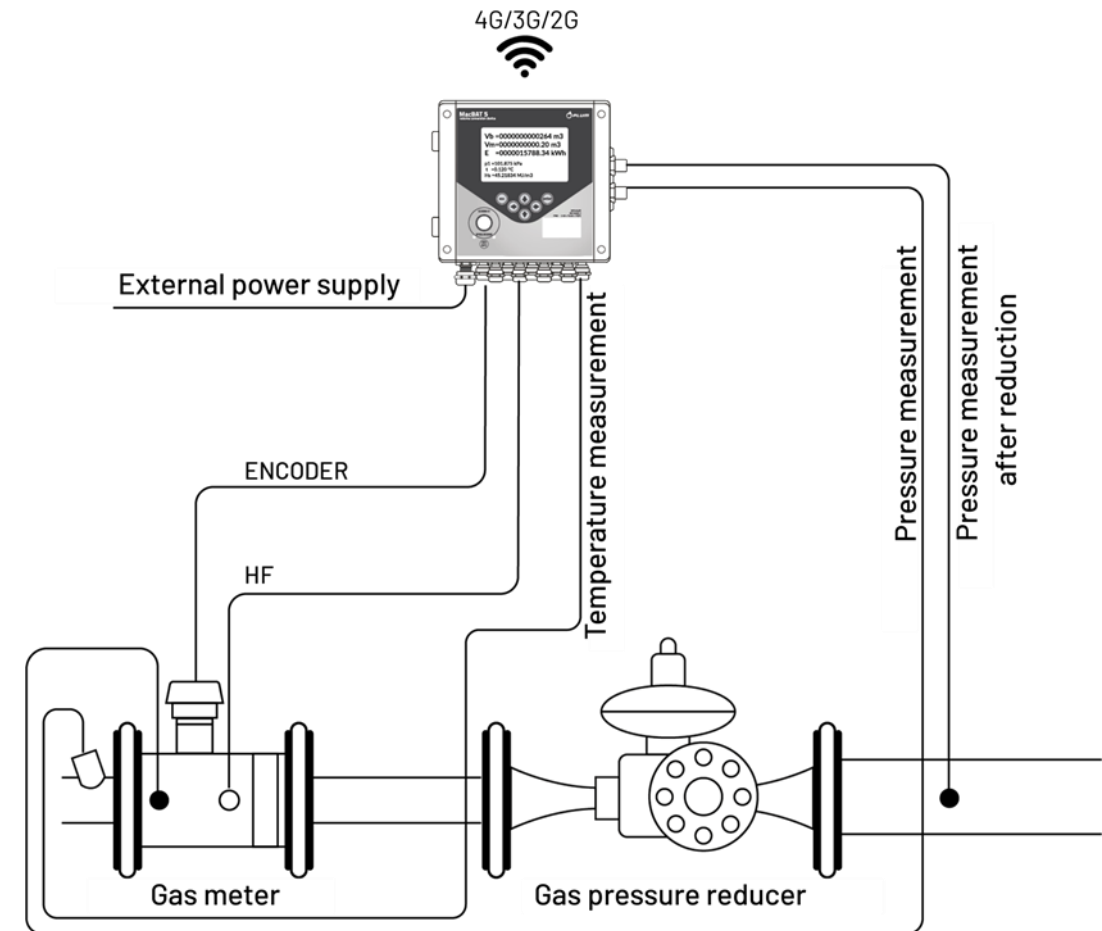
# Application.

4. Connection diagram of MacBAT 5 with rotor gas meter using external PLUM pressure sensor



Connection via 2 x LF ensures precise synchronization of gas meter counter with corrector including volume backflows on gas meter.

5. Pressure measurement using MacBAT 5 working with turbine gas meter



Connection via ENCODER and HF ensures direct digital gas meter readout without the need to synchronize the counter and allows gas meter adjustment after high pressure calibration.

# Accessories.



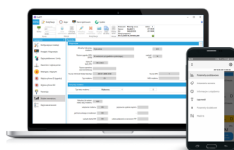
## INT-S3.

### Communication interface.

Interface ensures power supply and separation of connected measuring devices in stationary telemetry systems, powered from 230VAC mains or solar power. Data transmission is possible to computers or other devices with battery or mains supply, equipped with RS485 port. It allows for data readout from the devices placed in explosion hazard zone. It allows for control of devices in safe zone.

Power supply of interface  $V_{IN}=11-30VDC$ .

Ex mark: Ex: II (2)G [Ex ib Gb] IIA



## ConfiT!.

### Software and mobile application.

ConfiT! program allows configuration of PLUM products based on transparent graphical interface, which can be freely customised if needed. The basic functionality of the graphical device profiles allows configuration in basic and advanced mode. There is also configuration in text mode available. Each modified and unsaved value is marked with a distinctive color, so that the user is aware of each implemented modification. It is also possible to replace the software in PLUM devices without using additional interfaces or programs.



## eWebTEL.

### Software.

eWebTEL system is a platform collecting measurement results for comprehensive control of gas network. It allows locating devices, graphical visualization of data transmitted from position sensors, manometers and loggers. The software allows history overview of registered measurements and generating reports on: average pressure measurements, exceeding limits, occurrence of failures and their duration, history of values of parameters defining the status of the gas network. eWebTEL system operates with MacBAT 5 with firmware series from S011.xx, currently non MID version.



## OptoBTEx.

### Optical interface.

OptoBTEx serves for readout and wireless (bluetooth) data transmission from the devices equipped with optical communication interface compliant with IEC 62056-21 standard to configuration software installed mainly in the mobile devices with MS Windows, Android operating system (tablet, smartphone, laptop). OptoBTEx does not modify transmitted data and wireless communication takes place in Bluetooth 2.1+EDR Class 2 standard.

Power supply of interface from internal rechargeable battery.

Ex mark: II 3G Ex ic IIA T4 Gc