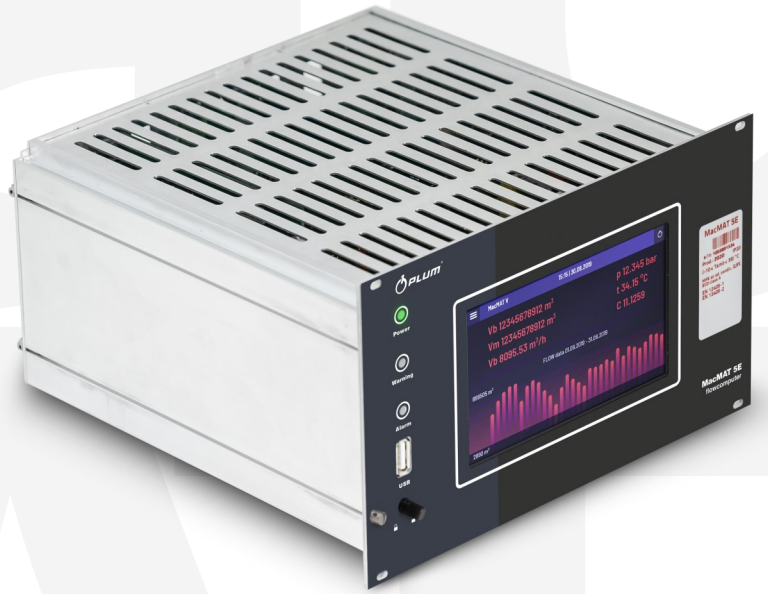
MacMAT 5E Flow Computer.

Modular flow computer designed to operate with **ultrasonic and turbine flow meters.**

MacMAT 5E is the flow computer to operate with ultrasonic and turbine flow meters. The flow is read via High Frequency pulse inputs, Encoders or RS485 communication with Ultrasonic Flow Meters. MacMAT 5E is designed to operate with up to 4 streams simultaneously. Modular design, expansion of functionality through extention cards and modules.
Standard mounting dimensions for RACK cabinet – height 3U, width ½ 19".



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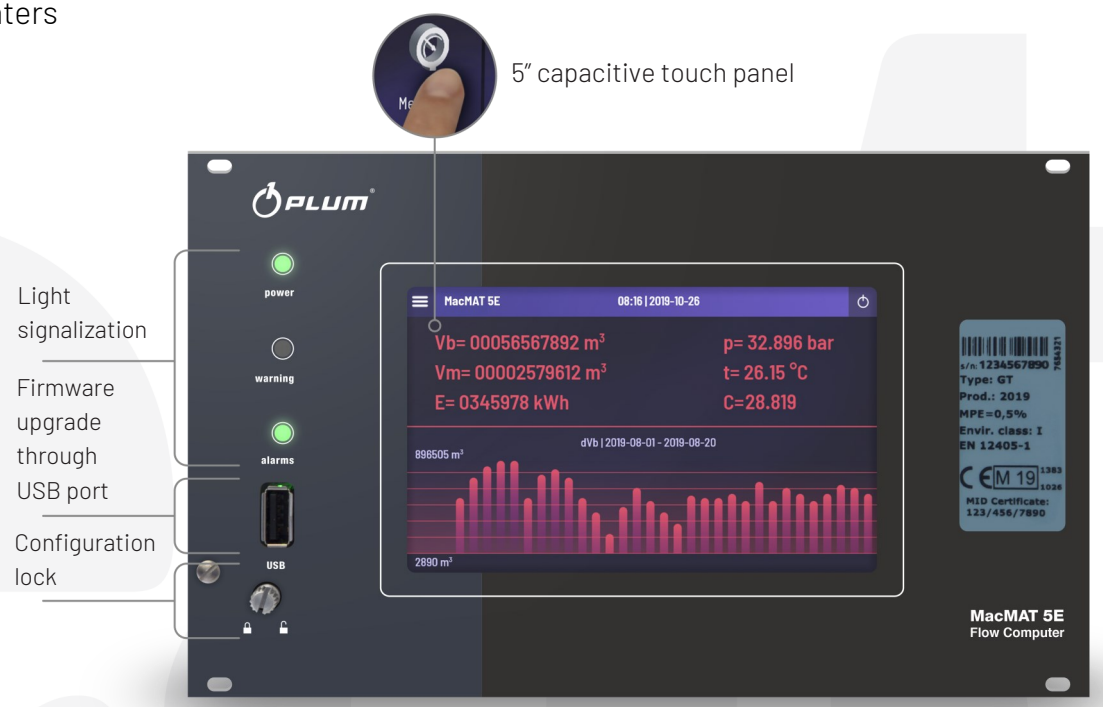
Main features.

- Up to four intependant measurement streams
- Modular design, easy replacement of the extension cards
- 5” touchscreen for easy configuration and readout of the data from flow computer
- Graphic data presentation
- Advanced security system
- Safe shutdown mode - no risk of device failure in case of power loss
- Easy installation and connection—Rack standard dimensions and standard connection sockets
- Communication with gas meter using LF, HF, Encoder or digital RS485 communication ports
- Cooperation with gas chrmatographs and printers



Software:

ConfIT!	ConfIT! volume correctors
	

Technical data.

Dimensions / Weight	Standard RACK size: Height: 3U – 133,35mm Width: ½ 19" (half-rack) – 241,3mm Depth: ~300mm
Housing material	Aluminium
Temperature range	-10°C to 55°C
Housing protection class	IP20 – indor installation
Keyboard	Touch screen working as a keyboard
Display	5" capacity display, resolution 800x480, 16M colors
Ex marking	TBA
Power supply	24V DC / 24W (external buffer power supply is advised)
Emergency power supply	Internal power supply backup allowing for emergency shutdown when in case of mains failure
Maximum permissible error	Maximum 0,5% according to EN12405-1
Calculation methods	Compressibility: SGERG-88, GERG 2008, AGA NX19-mod, AGA8-G1, AGA8-G2, AGA8-92DC, AGA10, constant K1-factor, Heating value & relative density: ISO 6976 (mass or volume based)

Measurement streams	Up to 4 intependant measurement streams
Serial ports	• 2x RS232/422/485 ports, galvanically separated, speed up to 115200b/s Optional: • 1x RS485 port for communication with ultrasonic flow meter (M5E_UFM board) • 3x or 2x galvanically separated RS232/422/485 ports, speed up to 115200b/s (M5E_COM or M5E_COM_lite board)
Ethernet/LAN	• 1x LAN port 10/100Mbit/s with AUTO MDI-X capability Optional: • 1x LAN port 10/100Mbit/s with AUTO MDI-X capability with independent IP addresses list (M5E_COM board)
Transmission protocols	MODBUS RTU, MODBUS TCP, GAZMODEM1,2,3, NTP other protocols per request
Inputs for pulse gas meter	• 3x digital pulse inputs LF/HF, NAMUR type (maximum frequency of 5kHz), DI1 with possibility to read gas meter index using NAMUR ENCODER • 1x PT100 input for analog RTD 4-wires temperature sensor • 1x analog 4-20mA input, switchable to HART, possible to work in multidrop mode
Inputs for UFM	• 3x digital pulse inputs LF/HF for active outputs (maximum frequency of 5kHz), DI1 with possibility to read gas meter index using NAMUR ENCODER Common (GND) terminal for DI • 1x RS485 port for reading ultrasonic gas meter • 1x PT100 input for analog RTD 4-wires temperature sensor • 2x analog 4-20mA inputs, switchable to HART, possible to work in multidrop mode
Outputs	• 4x digital outputs • 4x analog 4-20mA outputs: AO1-AO2 – switchable to NAMUR DI digital inputs AO3-AO4 – fixed analog outputs Common (-) terminal for AO and DI

Extension boards.

+ Seven slots for extension cards

Default equipment

M5E_MB board – main CPU board:
- 24V DC power supply connection
- 1x LAN port 10/100Mbit/s with AUTO MDI-X capability
- 2x RS232/422/485 channels – adjustable by software – galvanically separated, max speed 115200 b/s

Measurement stream boards

M5E_IN board – board designed for 1 gas stream support designed for turbine / rotary gas meters:

Ditigal inputs:
- 2x LF/HF inputs (NAMUR type, max 5kHz)
- 1x LF/HF/Encoder input, (NAMUR type, max 5kHz)

Analog inputs:
- 1x PT100 temperature sensor input (4-wires)
- 1x analog 4-20mA input, switchable to HART communication (multidrop available)

NOTE: M5E_IN board is non-Ex type. Ex intrinsically safe type board is under development.

M5E_UFM board – board designed for 1 gas stream support designed for non-Ex type ultrasonic flow meters:

Ditigal inputs:
- 2x LF/HF inputs (max 5kHz) for active outputs
- 1x LF/HF/Encoder input, (NAMUR type, max 5kHz) for active outputs

Common (GND) terminal for DI

Communication ports:
- 1x RS485 port for ultrasonic flow meter connection

Analog inputs:
- 1x PT100 temperature sensor input (4-wires)
- 2x analog 4-20mA inputs, switchable to HARTcommunication (multidrop available)

Additional boards

M5E_IO board – digital and analog outputs/inputs:

Digital outputs:
- 4x digital outputs

Analog outputs:
- 2x analog 4-20mA outputs
- 2x analog 4-20mA outputs, switchable to NAMUR DI digital inputs

Digital inputs:
- 2x NAMUR DI digital inputs, switchable to analog 4-20mA outputs

Common (-) terminal for AO and DI

Communication boards

M5E_COM board - serial and ethernet ports:
- 3x RS232/422/485 serial ports – adjustable by software, galvanically separated, max speed 115200 b/s
- 1x LAN port 10/100Mbit/s with AUTO MDI-X capability with independent IP addresses list

M5E_COM_lite board - serial ports:
- 2x RS232/422/485 serial ports – adjustable by software, galvanically separated, max speed 115200 b/s

NOTE: M5E_COM and M5E_COM_lite boards can not work simultaneously

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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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 H2
- 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 controll 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) 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 (confirmed as operational in temperature range from -40°C to 70°C)
Housing protection class	IP66 for outdoor installations
Keyboard	6 pushbuttons (version 1) 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 Certificate: FTZÚ 17 ATEX 0047X
Internal power supply	One lithium battery size D 3,6V/17Ah. Operation time: 5 years
Modem power supply	Two lithium batteries size D 3,6V/17Ah. (one, for version with p2 internal sensor in aluminium housing) 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	• Two independent serial transmission ports (COM1 - RS485 or optionall 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 • Optical interface IEC 62056-21 • NFC IEC 14443 interface • Optional integrated modem 4G LTE Cat.1 /3G/2G
Resistance to mechanical and electromagnetic conditions	M2/E2
Base conditions	Set by authorized personnel; available options: • Base pressure (absolute) pb: range (0,95÷1,05) bar, default 1,01325 bar • Base temperature Tb: range (270 ÷ 300) K, default 273,15 K (0°C) • Reference temperature determined for combustion process T1: range (270 ÷ 300) K, default 298,15K (25°C)
Maximum permissable error (MPE) according to standard „EN 12405-1"	• 0,5 % at reference conditions • 1 % at nominal operating conditions • Typical error < 0,15%
Maximum permissable 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	• Data registered in period 1-60 minutes – 36000 records (over 4 years @60min) • Momentary data (1-second logging) • Hourly data – over 16 months • Daily data – over 4 years • Monthly data – over 10 years • Alarms/Events memory – over 6000 records
Meets the requirements of 2014/32/UE (MID)	Certificates: DE-19-MI002-PTB004 - PLUM PTZ converter DE-21-M-PTB-0012 - PLUM load recorder

Technical data.

Inputs

- Up to 6 intrinsically safe, configurable, binary digital inputs, shared with:
  - 2 LF inputs, frequency 0-2Hz, WIEGAND standard 0-60Hz (option), flow direction detection
  - 1 tamper switch input - normally closed
  - 1 SCR ENCODER input (interchangeable with 1 binary digital input as an option)
- Up to 2 intrinsically safe, configurable digital inputs NAMUR type, shared with:
  - 2 HF inputs, frequency 0÷5000Hz, EN60947 5-6, ability of temporary operation on battery
  - 1 ENCODER (NAMUR type)
- MID-certified support for gas meters through LF, HF, ENCODER NAMUR, ENCODER SCR, WIEGAND and 10-point gas meter characteristics correction
- 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.
  Maximum permissible error for pressure measurements:

20 °C (± 3 °C)	(-25 ÷ 70) °C
± 0,2 % of measured value	± 0,5 % of measured value

  Typisal error of p1 pressure measurement: 0,15% of measured value
- Temperature sensor Pt1000 class A or B with cable length compensation, two– or four wires, diameter 5,7mm.
  Maximum permissible error for measurements

20 °C (± 3 °C)	(-25 ÷ 70) °C
± 0,1%	± 0,2 %

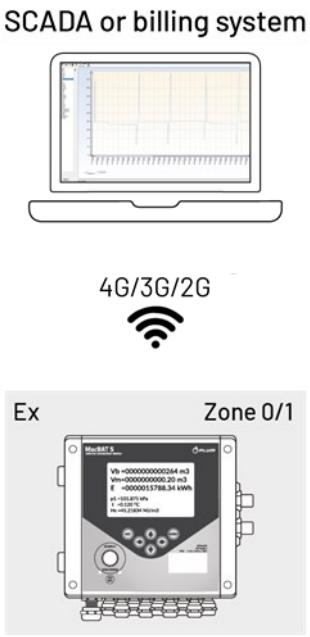
  Typisal error of temperature measurement: 0,08%
- Pressure sensor p2 – optional, internal or external – absolute or gauge pressure sensor. Gauge pressure ranges: 0÷0,1 / 0÷0,3 / 0÷1 / 0÷6 / 0÷10 / 4÷20 / 7÷35 / 5÷55 / 10÷70 / 10÷100 bar G. Absolute pressure ranges the same as for p1 sensor.
  Typisal error of p2 pressure measurement (gauge): 0,15% of range
- 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).

Control outputs

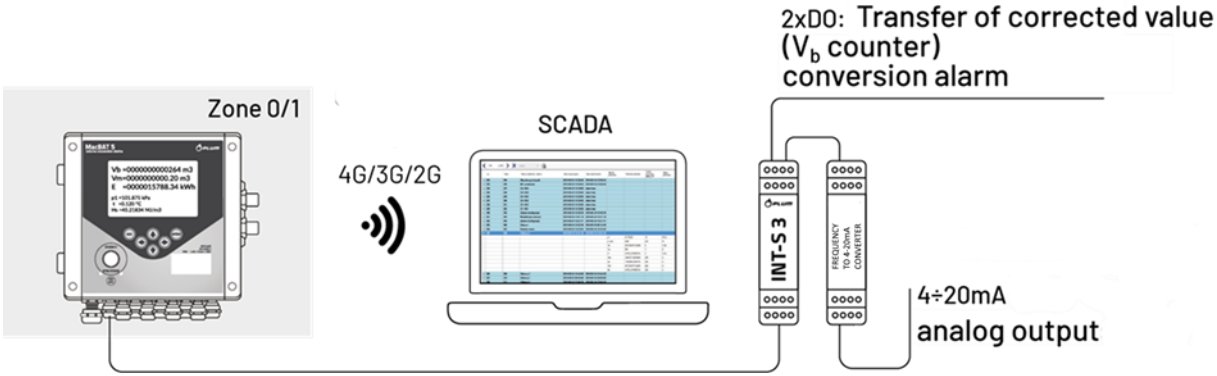
- Up to 4 intrinsically safe, configurable digital outputs (OC type):
  - 1 configurable as binary or frequency (0-5000Hz) output
  - 3 binary outputs
- Binary outputs triggered by alarm/event or counter (Vb, Vm, E, M etc.)
- Frequency output triggered by measured value (p1, t, Qb, Qm, etc.)

Application.

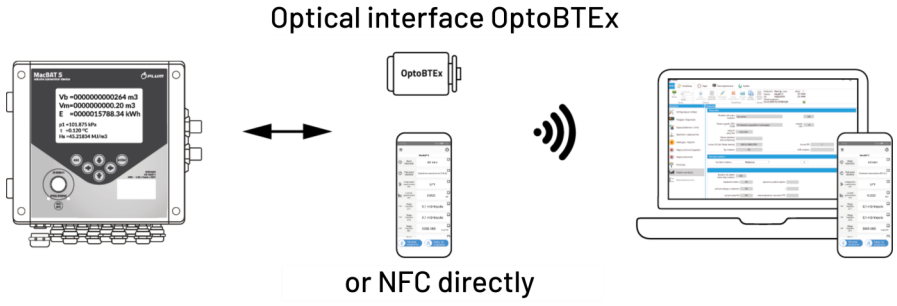
1. Direct data transmission to the system— data readout via integrated 4G/3G/2G modem on battery power supply



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

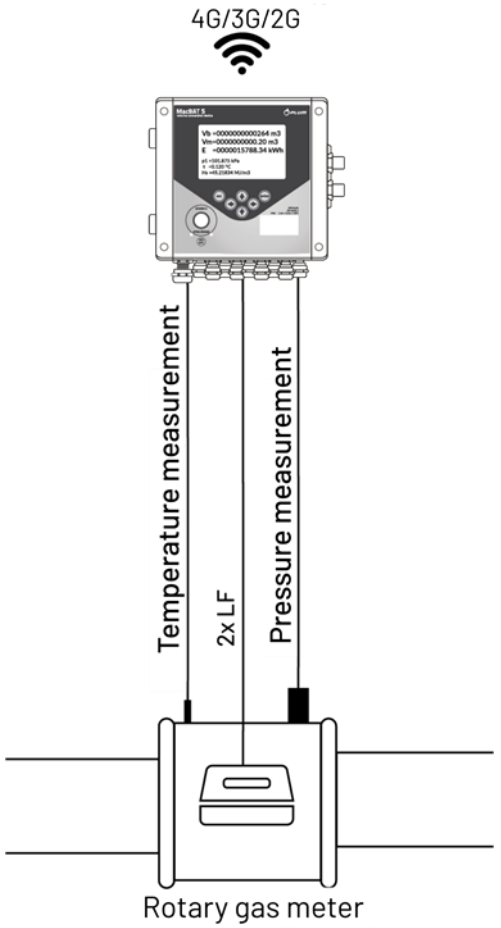


2. Local readout and configuration



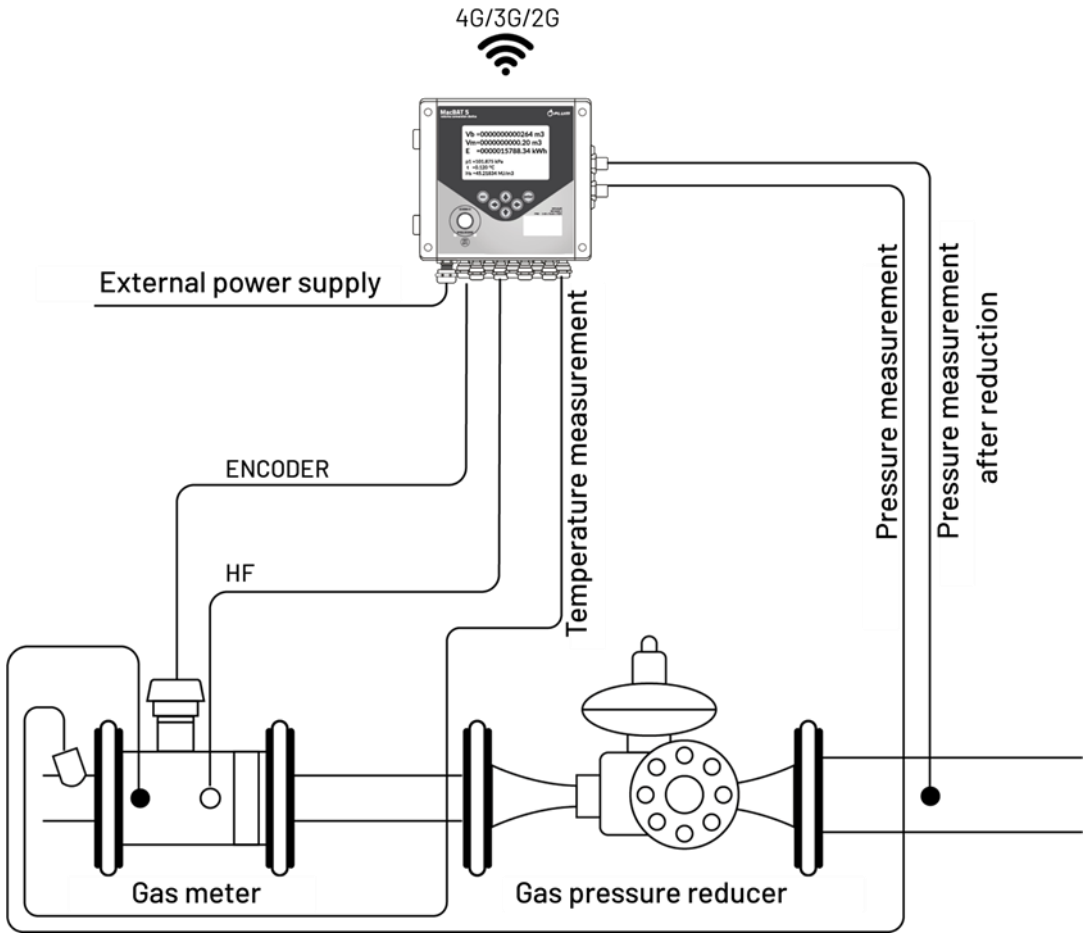
Application.

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



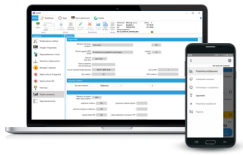
Connection via ENCODER and HF ensures direct digital gas meter readout without the need to synchronize the counter and allows gas meter adjustment after high pressure calibration.

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 reachargeable battery .
Ex mark: II 3G Ex ic IIA T4 Gc