

GAS PRESSURE DATA LOGGER

MacR6-Z0-P

GAS VOLUME DATA LOGGER

MacR6-Z0-V

- Safety
- Specification
- Technical data
- Installation
- Configuration
- Maintenance
- Applications
- Schematics
- Software

Document version: 1.1, March 2023

Document related to:

Device firmware: MacR6-Z0-PV_H2.3.0_S011.01_49A

Device hardware: H2.3.0 / H2.3.1

Hardware variant code: Z0_3xx_xxx_xxx

Configuration software (PC): 1.2.36.262(0053)

Configuration software (Android): 1.11.66

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National Waste Database no.: 000009381

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1. Introduction and safety rules

Compliance with all safety information and instructions for use contained in this operating manual is a prerequisite for safe working processes and proper use of the device. Furthermore, the valid guidelines, standards, local accident prevention regulations, and general safety regulations must be complied with for the respective area of application of the device.

This manual forms a constituent part of the product and must be stored within the immediate vicinity of the device and be accessible to installation, service, maintenance, and cleaning personnel at all times. The graphic illustrations used in this manual serve as a visual representation of the described processes and are therefore not necessarily to scale and may deviate from the actual design of the device.



This mark is related to the significant security or safety information.



This mark means the information related to product usage or the important technical matter.

Customer service:

For the customer technical support regarding installation or usage of this product please contact Manufacturer Technical Support Channel.

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Safety measures

This measurement device can be operated only by an operator trained in compliance with the technical terms, safety regulations, and standards. It is necessary to consider any other legal and safety regulations stipulated for special applications. Similar measures also apply for special applications. Similar measures also apply for using the accessories.

The information in this manual does not have the power of a legal obligation from the manufacturer's side. The manufacturer reserves the right to implement changes. Any changes in the manual or in the product itself can be performed at any time without any previous alert, with the goal of improving the device or fixing any typographical or technical mistakes.



ATEX safety and health

This device is an equipment protected by intrinsic safety "i" intended for use in potentially explosive atmospheres according to certificate FTZU 17 ATEX 0047X. Read carefully the whole documentation.



Radio equipment safety and health

There are versions of this device equipped with a modem becoming radio equipment according to RED.

ATEX - DIRECTIVE 2014/34/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres

RED - Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC

According to Directive WEEE 2012/19/UE:

Purchased product is designed and made of materials of highest quality. The product meets the requirements of the Directive 2012/19/EU of 4 July 2012 on waste electrical and electronic equipment (WEEE), according to which it is marked by the symbol of crossed-out wheeled bin (like below), meaning that product is subjected to separate collection.



Responsibilities after finishing a period of using product:

- dispose of the packaging and product at the end of their period of use in an appropriate recycling facility,
- do not dispose of the product with other unsorted waste,
- do not burn the product.

By adhering obligations of waste electrical and electronic equipment controlled disposal mentioned above, you avoid harmful effects on the environment and human health.

1.1. Device description

MacR6-Z0-P is the device designed to measure the gas pressure from up to two independent measurement channels, which are pressure sensors ended with M12x1,5 or NPT 1/4 thread. Device is designed for Ex Zone 0.

Registered data from the device is transmitted to the data collection platform, i.e. PLUM eWebtel using internal wireless transmission module working in technologies NB-IoT, LTE-M, GPRS.

Principle of the device MacR6-Z0-P is informing gas station service when gas pressure exceeds programmed limits, what causes in immediate data transmission.

Fully equipped device contains:

- analogue inputs (pressure P1 & optional P2 – typically overpressure sensors)
- up to 2 configurable potential-free contact outputs – DO1-DO2
 - Dedicated for alarming purposes – pulse generated when alarm state is present
 - Configurable in range NC/NO
- Internal modem LTE-M, NB-IoT, GPRS (2G)
- Optical port for local temporary communication, standard IEC 62056-21
- FME socket for connection of external antenna enabling wireless data transmission

MacR6-Z0-V (or alternatively **MacR6-Z0**) is the device designed to measure the volume of the gas from up to two independent measurement channels, which are the pulse inputs from gas meter. Program configuration allows to choose does the device measure volume on one pulse input with cable continuity checking or from two inputs without cable continuity checking. Device is designed for Ex Zone 0.

Registered data from the device is transmitted to the data collection platform, i.e. PLUM eWebtel using internal wireless transmission module working in technologies NB-IoT, LTE-M, GPRS.

Fully equipped device contains:

- digital inputs – DI1-DI2 – configurable
 - o V1 + TS – input for pulses receiving from 1 gas meter with cable continuity check
 - o V1 + V2 – inputs for pulses receiving from 2 independent gas meters without cable continuity check
- digital outputs – DO1-DO2 – configurable
 - o Pulse replication from the inputs
 - o Alarming purposes – pulse generated when alarm state is present
 - o Configurable in range NC/NO
- Internal modem LTE-M, NB-IoT, GPRS (2G)
- Optical port for local temporary communication, standard IEC 62056-21
- FME socket for connection of external antenna enabling wireless data transmission

¹ – Number of digital inputs depends on the configuration of the counting inputs

The device family can be configured using the supplied Software for PC or dedicated Android Application. This software also allows the readout, display and archive of both the immediate measured values as well as the contents of the internal device archives.

1.2. Function principle – general characteristics

- Device is supplied only from internal changeable approved battery.
- With dedicated inputs device can measure the pressure or volume – depending on the device variant.
- Device can store periodical values in its memory.
- After SIM card is placed device can start connection with programmed platform, i.e. PLUM eWebtel to transmit data with programmed frequency.
- When device cannot reach network and establish communication, transmission can be repeated shortly using internal mechanism or data can be transmitted in next transmission time, then containing values from last successful transmission.
- Device can transmit data immediately after certain alarm is generated, i.e. pressure over range.

Device consists of three boards:

- Main CPU board containing CPU unit, LCD display, digital outputs, optical port for local communication and SIM card slot.
- GSM board containing wireless modem unit, submerged in protection resin.
- Terminals board allowing for connection of pulse inputs (Z0-V) or fixing pressure sensors (Z0-P).

Devices Z0-P and Z0-V share the same hardware and firmware. Functionality of Z0-P or Z0-V is determined on production stage, where proper producer options are enabled and pressure sensors are assembled or not.

1.3. Definitions

Whenever in this document is spoke of certain terms, they are related to following definitions:

- **Data logger, Device** – MacR6-Z0-P, MacR6-Z0-V
- **Volume logger, V-logger, V-device, Z0-V** – MacR6-Z0-V
- **Pressure logger, P-logger, P-device, Z0-P** – MacR6-Z0-P
- **Firmware** – program which is uploaded to data logger
- **Software** – ConfIT! application, installed on PC with Windows system, for readout and configuration of data logger
- **App, Application, Mobile app** – ConfIT! mobile application, installed on smartphone with Android system, for readout and configuration of data logger
- **Optical head / Opto** – Optical Interface according to IEC 62056 to read the data logger through infrared
- **Barrier** – INT-S3 barrier for signals separation between Normal zone and Ex Zone
- **Valve** – three way valve used to provide safe way of delivering pressure from pressure receiving point in gas meter to the data logger pressure sensor port with minimizing the risk of pressure burst on the sensor
- **DP Table** – table of parameters stored in the data logger. It contains whole configuration of the device listed in the table with names, descriptions, units and values.
- **ZD Table** – table of events appearing in the device during its lifetime. It contains device history listed in the table with names and dates of beginning and end. ZD table is limited to 128 events in case of MacR6-Z0-PV
- **Modem** – unit integrated in the data logger used for remote data transmission

1.4. Subsidiary documentation

For full acknowledgement and understanding of the data logger work and maintenance it is necessary to make use of the following documents in some certain steps, which are mentioned in further part of this document. All the mentioned documents are available to obtain from manufacturer on request.

- **ConfIT! User manual** – manual for the ConfIT! software, which is configuration program for data logger and other products which enables configuration, readout and firmware upgrade of the data logger
- **INT-S3 user manual** – manual for the INT-S3 which is the signal barrier also utilizing functionality of external power supply source for data logger
- **OptoBTEx user manual** – optical interface for readout and communication
- **MacR6 Transmission Protocol** – document explaining full philosophy of MacR6 device data transmission

Documents not related to the usage of the product:

- **Installation manual** – shortened version of user manual focused only on mechanical installation and configuration part
- **EU Declaration of Conformity** – document confirming approvals for the device

2. Safety

2.1. General safety



The device is designed for work in explosive hazardous zones 0, 1, 2, and in the low risk of mechanical impacts environment according to EN-60079-0. It is recommended to install the device in a place where it will not be exposed to impacts, e.g. inside cabinets, cages, etc.



The manufacturer's declaration of the IP66 housing protection class will be valid only if cables with appropriate diameters for the cable bushings are used, the bushings are properly tightened, and ensuring proper placement of gasket and tightening of the housing cover to the device casing.



Data logger is intrinsically-safe device. It should be used in accordance with the requirements of this documentation and the conditions specified in the ATEX certificate.



For the connection of external circuits is required to use cables with circular cross-section and an external diameter adequate to the internal diameter of used cable gland.



The person installing the device is responsible for checking the continuity of protective connections.



Under certain extreme circumstances, the plastic enclosure or plastic parts of enclosure may store an ignition-capable level of electrostatic charge. The product shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge. The product shall only be cleaned with a damp cloth.



If device is equipped with EPS pressure sensor, the product must be taken as grounded. It must be taken into account during installation



The function and parameters of some inputs/outputs depend on version of product, detailed information is written herein.



It is forbidden to open the housing in conditions allowing for water leakage or dust inside the terminals chamber – rainfall, snowfall, strong wind.



The unit should not be installed in the vicinity of strong electromagnetic fields or in places which significantly muffle the mobile communication signal



When crimping the cable in the gland implicitly counter the gland with a proper wrench, so that the gland was not rotating. Otherwise the IP protection may be lost or the device can be damaged. The manufacturer is not responsible for improper tightening of cables in glands. The cables cannot transfer any loads to the glands.



Unauthorized opening of the device, installation inconsistent with this documentation or any changes in the device design may lead to the loss of intrinsically safe features and / or characteristics of radio devices.

Under no circumstances the construction of the device must not be modified.

Any of the above events excludes the manufacturer's liability, including warranty liability.



Data logger can be ordered with GSM functionality, such device becomes a radio equipment and fulfills the requirements of the Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (RED).



Use of the device is only possible where working modem module does not interfere with the operation of other equipment (e.g. medical).



Danger of explosion if battery is replaced by an incorrect type.

While connecting the battery keep its orientation. Opposite connection may cause the device damage.



Do not cover the pressure compensation holes designed for making the atmospheric pressure and internal device pressure equal.

Connection of measurement circuits LF and digital inputs and outputs:

The intrinsically safe circuits used in data logger shall meet all conditions for intrinsically safe circuits specified in EN 60079-14, and in particular:



- **For intrinsically safe measuring circuits connect cables with separated two wires or use multi-core type A or type B cables according to point 12.2.2.8 of directive EN 60079-14.**
- Cables and wiring of intrinsically safe circuits must be kept separate from the cables and wires of non-intrinsically safe circuits.
- Cables and wiring of intrinsically safe circuits should be permanently mounted and protected from the possibility of mechanical damage.
- Cables of intrinsically safe circuits are recommended to be marked with blue color.

Connect the cable shield to the housing gland. This way grounding of the cable shield of intrinsically safe circuits will occur at one point – next to the data logger. During use of measuring transducers, cable shield should be insulated.



The external diameter of cable in the gland should be in range 3,5÷6 mm. It is recommended to use cable without shielding, e.g. LIYY 6x0,14 mm² or equivalent with maximum length of 3 m, tighten ferrules on multicore cable ends.

2.2. Ex marking and parameters

Device is approved for usage in potentially explosive atmospheres.

Marking:  **II 1G Ex ia IIA T4 Ga**

Certificate: **FTZU 16 ATEX 0051X**

Operating environment:

Device is approved to be used at the 0, 1 and 2 zones threatened with explosion of mixture of: vapors, gases and explosive vapors with air which are placed in IIA explosive group and temperature class T1, T2, T3, T4.

Intrinsically safe parameters:

Inputs DI1, DI2 to GND:


$U_o = 7.5V$, $I_o = 0.43mA$, $P_o = 1.1mW$, $U_i = 7.5V$, $L_i = 0$, $C_i = 80pF$

Outputs DO1, DO2 to GND:

$U_o = 7.5V$, $I_o = 2mA$, $P_o = 15mW$, $U_i = 7.5V$, $L_i = 0$, $C_i = 25nF$

3. Technical data

3.1. General data

Housing material	Polycarbonate
Dimensions (L x W x H)	124x90x40 124x114x40 (including cable gland and antenna socket) 146x114x40 (including two cable glands and antenna socket)
Weight	MacR6-Z0-V – 300g MacR6-Z0-P – 1,3kg MacR6-Z0-P/2P – 2kg
Ambience temperature range	-30 °C ÷ +55 °C
Humidity	Max 95%. The device can operate in condensing or non-condensing humidity
Housing protection class	IP 66
Housing UV resistance	UL746C standard
Keyboard	Magnetic button enabling device menu
Display	LCD graphic device with icons and numbers
Operating environment	Approved to use at the 0, 1 and 2 zones threatened with explosion of mixture of: vapors, gases and explosive vapors with air which are placed in IIA explosive group and temperature class T1,T2,T3,T4.
Ex housing marking	 II 1G Ex ia IIA T4 Ga certificate FTZU 16 ATEX 0051X
Inputs	<p>MacR6-Z0-V:</p> <ul style="list-style-type: none"> - digital inputs – DI1-DI2 – configurable <ul style="list-style-type: none"> o V1 + TS – input for pulses receiving from 1 gas meter with cable continuity check o V1 + V2 – inputs for pulses receiving from 2 independent gas meters without cable continuity check <p>MacR6-Z0-P:</p> <ul style="list-style-type: none"> - analogue inputs (pressure P1 & optional P2 – typically overpressure sensors) – up to 2 pressure sensors installed in one device – internal codename MacR6-Z0-P/2P <p>¹ – Number of inputs acting as digital depending on the configuration of the counting inputs ² – Pressure sensors P1 or P2 are sensors assembled on 2,5m cable by default</p>
Control outputs	<p>Digital outputs – DO1-DO2 – configurable</p> <ul style="list-style-type: none"> o Pulse replication from the inputs – Only in MacR6-Z0-V o Alarming purposes – pulse generated when alarm state is present o Configurable in range NC/NO
Power supply	1 lithium-thionyl battery (3,6V/17Ah) size D, type: LS33600 (SAFT)
Transmission ports	<p>Local: Optical port – optical interface, standard IEC 62056-21, baud rate 9600, N81, only for temporary communication</p> <p>Remote: LTE-NB, LTE-M, GPRS modem with external antenna,</p>

Transmission protocols	GAZMODEM, GAZMODEM2, GAZMODEM3. Support for TCP, UDP, NTP, HTTP
Modem external antenna	Antenna with 5dBi maximum gain with connector type FME. Formally, the length of the antenna cable is unlimited, but the usable length of the antenna cable is still determined by cable loss and signal strength at the installation site.
Internal modem available bands	LTE-M (LTE Cat.M1): B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B27/B28/B66/B85 NB-IoT (LTE Cat NB2): B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B28/B66/B71/B85 EGPRS: 850/900/1800/1900 MHz
Wireless mobile telecommunications technology, one of below:	
2G for Europe, Asia, Africa	Standard, output power: EGSM900, Class 4 (+33dBm ±2dB) GSM1800, Class 1 (+30dBm ±2dB)
LTE Cat M1 & Cat NB2& EGPRS	Standard, output power EGSM900, Class 4 (+32.5dBm ±2dB) GSM1800, Class 1 (+30dBm ±2dB) GSM 900 8-PSK, Class E2 (+26.5dBm ± 3dB) GSM 1800 8-PSK, Class E2 (+26dBm +3 /-4dB) LTE 800, LTE FDD Bd20, Class 3 (+23dBm ±2dB) LTE 900, LTE FDD Bd8, Class 3 (+23dBm ±2dB) LTE 1800, LTE FDD Bd3, Class 3 (+23dBm ±2dB) LTE 2100, LTE FDD Bd1, Class 3 (+23dBm ±2dB) GSM 900 - Operating frequency range: 880-915, 925-960 MHz - Maximum output power: 33 dBm rated GSM 1800 - Operating frequency range: 1710-1785, 1805-1880 MHz - Maximum output power: 30 dBm rated LTE FDD Band 1 - Operating frequency range: 1920-1980 MHz, 2110-2170 MHz - Maximum output power: 21 dBm rated LTE FDD Band 3 - Operating frequency range: 1710-1785, 1805-1880 MHz - Maximum output power: 21 dBm rated LTE FDD Band 8 - Operating frequency range: 880-915, 925-960 MHz - Maximum output power: 21 dBm rated LTE FDD Band 20 - Operating frequency range: 832-862, 791-821 MHz - Maximum output power: 21 dBm rated LTE FDD Band 28 - Operating frequency range: 703-748, 758-803 MHz - Maximum output power: 21 dBm rated

Wireless mobile telecommunications technology (digital cellular networks) possibilities, one of below:

Device hardware variant code: Z0_ABx_xxx_xxx		
Code	Description	Allowed codes
A	modem technology	0 - 2G, GSM 900/1800MHz - EU 1 - 3G, UMTS 900/2100MHz - EU 2 - 3G-US, UMTS 850/1900 MHz - US 3 - LTE Cat M1 / Cat NB2 / EGPRS
B	antenna connector	1 - on case FME socket for external antenna (default option) 2 - internal antenna connector, a cable inserted through the gland to external antenna

3.2. Pressure measurement

Pressure measurement applies only to MacR6-Z0-P devices. It is possible to choose two of following presented pressure sensors in any combination.

Measuring ranges:	Maximum permissible errors for measurements of p1 and p2	
	Ambient temperature	
	20 °C (± 3 °C)	(-30 ÷ 55) °C
Standard ranges for pressure p1 p2 measurement – default gauge type		
(0 ÷ 100) mbar G	± 0,5 % of range	± 0,75 % of range
(0 ÷ 300) mbar G		
(0 ÷ 6) bar G		
(0 ÷ 16) bar G		
(0 ÷ 35) bar G		
(0 ÷ 70) bar G		



Devices with sensors measuring low gauge pressure (ranges up to 1 bar) show significant effect of mechanical stress on the indication of the pressure p2. In order to achieve the declared accuracy, after installation of the device on the target location, it is necessary to perform a procedure of zeroing pressure sensor indications.

3.3. Inputs

3.3.1. Counting inputs

Counting inputs apply only to MacR6-Z0-V

Device can be equipped with following counting inputs which are determined by parameter **DI configuration** in DP table:

- V1 (**DI Configuration** = 1) – only V1 counter present on DI1 is active, collecting pulses from 1 gas meter on input number 1
- V2 (**DI Configuration** = 16) – only V2 counter present on DI2 is active, collecting pulses from 1 gas meter on input number 2
- V1+V2 (**DI Configuration** = 17) – V1 and V2 counters are active. Collecting pulses from 2 independent gas meters on inputs 1 and 2.



Turning on V1+V2 on both inputs makes device cannot work with DI functionality.

3.3.2. Digital inputs

Digital inputs apply only to MacR6-Z0-V. Role of the digital input is shared with counting inputs on common terminals. This means there is no possibility to use 2xDI and V1&V2 simultaneously. Configuration of counting inputs and digital inputs is done by modification of the same parameter **DI configuration**.

Possible configuration:

- DI1 Normally Closed (**DI Configuration** = 3) – digital input 1 reacting on circuit break
- DI1 Normally Opened (**DI Configuration** = 7) – digital input 1 reacting on circuit short
- DI2 Normally Closed (**DI Configuration** = 48) – digital input 2 reacting on circuit break
- DI2 Normally Opened (**DI Configuration** = 112) – digital input 2 reacting on circuit short



Turning on DIs on both inputs makes device cannot count volume from gas meters. It must be chosen at least one input as Gas meter input according to 3.3.1.

There is possibility of adding values of DI Configuration parameters, i.e.

- V1 (**DI Configuration** = 1) + DI2 Normally Opened (**DI Configuration** = 112) = **DI Configuration** = 113
- V2 (**DI Configuration** = 16) + DI1 Normally Closed (**DI Configuration** = 3) = **DI Configuration** = 19

3.4. Outputs

3.4.1. Digital outputs

Device can be equipped with following outputs which are determined by parameter **DO configuration** in DP table:

Available work modes of outputs:

- DO1 Normally Closed (**DO Configuration** = 3) – digital output 1 always on high state, alarm makes it low
- DO1 Normally Opened (**DO Configuration** = 7) – digital output 1 always on low state, alarm makes it high
- DO2 Normally Closed (**DO Configuration** = 48) – digital output 2 always on high state, alarm makes it low
- DO2 Normally Opened (**DO Configuration** = 112) – digital output 2 always on low state, alarm makes it high

There is possibility of adding values of DO Configuration parameters i.e.

- DO1 Normally Closed (**DO Configuration** = 3) + DO2 Normally Closed (**DO Configuration** = 48) = **DO Configuration** = 51
- DO1 Normally Opened (**DO Configuration** = 7) + DO2 Normally Closed (**DO Configuration** = 48) = **DO Configuration** = 55

3.4.2. Counter output

Mode apply only to MacR6-Z0-V:

- DO1 Pulse replication of V1 (**DO Configuration** = 1)
- DO2 Pulse replication of V2 (**DO Configuration** = 16)



There is possibility in MacR6-Z0-V to combine mode of 1 output replicating pulses and one digital output on basis given in points above by adding values of DO Configuration according to chosen modes, i.e. DO1>>V1 + DO2 NC.

3.5. Communication with data logger

3.5.1. Transmission protocol

Realization of transmission protocols is based on fact that device readout is done by host PC. Commands sent to device are to give in return specific type of information. Information received by and send from device is organized in functional blocks of programmed length. Optimal length of blocks adapted to quality of connection can have essential influence on efficiency of data sending. Device supports data transmission protocols:

- GAZ – MODEM 3 – this is native and only one available protocol of the device

3.5.2. Serial communication

Data logger is equipped with wireless transmission port in standard IEC 62056-21 (OPTO). It's designed for temporary communication. After few minutes of lack of communication, optical port is turned off.

Default baud rate for MacR6 data loggers is 9600 and cannot be changed.

Serial port allows for:

- Transmission with PC using Software.
- Transmission with Mobile App.
- Reconfiguration of the device.
- Registered data and events readout.
- Configuration backup.
- Local firmware upgrade

3.5.3. Wireless network transmission

Device is equipped with inbuilt modem NB-IoT / LTE-M / GPRS (2G) which allows for wireless data transmission to data collection platforms i.e. PLUM eWebtel.

Used modem can work in various technologies with one as a main one and second as a backup one in case first one is not accessible.

Parameters in the DP table responsible for the modem work mode are the **RAT1** and **RAT2**, where **RAT1** is primary technology and **RAT2** is secondary.

Algorithm of RAT (Radio Access Technology) choice works as follows:

During device installation:	During daily reporting:
<ul style="list-style-type: none"> - Checking RAT1 availability - RAT1 available – installation continuation - RAT1 unavailable – switch to RAT2 - Device stays in RAT2 until the end of the month - Last day of the month – device tries to reach RAT1 - RAT1 available – report continuation - RAT1 unavailable – switch to RAT2 - 	<ul style="list-style-type: none"> - Checking RAT1 availability - RAT1 available – report - RAT1 unavailable – switch to RAT2 - Next report: checking RAT1 availability - RAT1 available – report - RAT1 unavailable – switch to RAT2

RAT1 and RAT2 can accept following values depending on chosen technology:

- **RATx** = 2 – GPRS communication
- **RATx** = 5 – NB-IOT communication
- **RATx** = 6 – LTE-M communication
- **RATx** = 0 – not used – applicable for RAT2 when there is no need for secondary technology support

When device works in NB-IOT (**RATx**= 5) or LTE-M (**RATx** = 6) there is also necessity of determining the Frequency Band regulated by each Cellular Providers over the country territory. Parameters responsible for that are **Band LTE-M** and **Band NB-IOT**.

Supported bands are listed in paragraph [General data](#) of this document.

Setting of parameter i.e. **Band NB-IOT** = 20 makes the device working in band B20 = 800MHz.



Incorrect band choice may result that device cannot establish the connection. Before use, make sure which band is supported in your Country and if used SIM can support LTE-M and / or NB-IOT transmission standards.

Data transmission is done using internal modem which requires proper SIM card to work. Before use, proper configuration of the device must be done. Every SIM connects to the network by using dedicated APN which is Access Point Name. There are three key parameters for the SIM card which are listed below:

- **APN** – to write the name of APN for the SIM card for connection with the data collection platform and NTP server for time synchronization. Parameter can contain 40 characters. In case of private APNs protected by the credentials it is possible to write these in form of value: apnname:username:password (separated by colon).
- **Update APN** - to write the name of APN for the SIM card for connection with the device firmware update server. Parameter can contain 40 characters. In case of private APNs protected by the credentials it is possible to write these in form of value: apnname:username:password (separated by colon).
- **PIN** – place to input PIN for the SIM card. If card is PIN-less, there is no need to write any value there. Three login attempts result in locking SIM card and necessity to use phone and unlocking it by PUK code.

Device supports also SIM cards with roaming functionality, meaning SIM can connect to various operators under one APN and one country. Parameters responsible for this mode are **Operator Mode** and as an accompanying parameter **Operator Code**.

This means that device can be forced to connect only to one network or to choose preferred one than others.

Operator Mode Value	Description	Remarks
0	Automatic choice – device will connect to any available operator	Operator Code not used
1	Manual choice – device will connect only to programmed operator	Operator Code used
4	Preffered choice – device will make an attempt to connect to programmed operator. If failed, device will connect to first available.	Operator Code used

Operator Code parameter uses the MCC (Mobile Country Code) + MNC (Mobile Network Code) codes wherein value of the parameter must be written as MCC+MNC in one field.

For instance Poland MCC is 260 and T-Mobile MNC is 02. Value of **Operator Code** parameter should be 26002.



Use of the Operator Mode=1 with defined Operator Code for one specific network and using card coming from other provider results in device unavailability to connect completely. Always ensure proper configuration of **Operator Mode** and **Operator Code** is done.

3.5.4. Types of transmitted data by network

Device can transmit data to the data collection platform with defined period, coming from once per month to once per hour. Typical data transmission is a daily one on specific time defined as HH:MM. Device most of the time is in offline mode. Internal device enables only when the schedule is lasting. This means, device does not refresh its status online and indicators on the device display are solid values from last attempt of data transmission.

The data sent via the GSM network may contain data such as:

- current data
- data recorded with a programmable registration period
- events and alarms
- structure of DP and ZD tables
- device ID

After performing schedule operations, the device goes into the Call Window mode for a programmed time period. In this mode it is possible to query the device on demand by superior systems, e.g. SCADA.

Data listed above is the maximum set of data available to transmit.

In parameter **Report Composition** it is possible to define which values are transmitted with every scheduled connection.

Value of Report Composition	Data type
2	Device DP Table structure (only names, no values)
4	Current data from DP table (only values, no structure)
8	Logged data – defined in parameter Data Logging Read (see below)
16	Events and alarms
32	Device ID – name of the device in form of GazModem identifier

It is possible to combine the data types by adding values from table above, i.e.

- **Report Composition** = 56 – Events and alarms + Logged data + Device ID
- **Report Composition** = 60 – Events and alarms + Logged data + Current data + Device ID
- **Report Composition** = 40 – Logged data + Device ID

Default **Report Composition** for eWebtel platform is value 60.

Also logged data can be defined as written in table above using parameter **Data Logging Read** which is fixed for MacR6-Z0-P and should be changed only for MacR6-Z0-V device.

Value of Data Logging Read	Data type	Device type
3	P1 data transmission only	MacR6-Z0-P
12	P2 data transmission only	MacR6-Z0-P/2P
15	P1+P2 data transmission	MacR6-Z0-P/2P
16	V1 only	MacR6-Z0-V
32	V2 only	MacR6-Z0-V
48	V1+V2	MacR6-Z0-V



For MacR6-Z0-P and Z0-P/2P values are fixed to send always all data about the pressure. When using MacR6-Z0-V it is necessary to determine which data should be sent, as after changing DI Configuration parameter Data Logging Read does not follow. This means – first enable registering i.e. V1+V2, later ensure transmission of V1+V2 is enabled.

3.5.5. Data transmission – communication modes

Device can communicate with the data collection platform in two ways:

- According to programmed schedule – so called daily / normal schedule. Device periodically enables wireless modem and sends the data from last period, then closes the connection until the time of next connection.

Modification of the schedule is done by modification of parameters in DP table:

- **Report Hour** – determining the hour of reporting in one day
- **Report Day (Week)** – determining the day of reporting in one day (choose All to report every day)
- **Report Day (Month)** – determining the day of reporting in one month (choose All to report every day)
- **Report Delay** – minute of sending report in one hour – range 0-59.
- Alarm situation – device sends data immediately, disregarding the schedule. When properly configured, device can transmit the data when some certain alarms appear. This has mainly meaning speaking of MacR6-Z0-P loggers, when measured pressure exceeds the one in defined ranges. Configuration of this mode is done by changing value of parameter Alarm Report Cfg.



Configuration of Alarm Data Transmission is described in paragraph Device settings – Configuration using PC/Windows software

Device can communicate with the data collection platform using two protocols:

- TCP – device connects to the server using Transmission Control Protocol. This means device requires connection confirmation from the platform before it starts data transmission. Next result of this is that device must attach to the GPRS network every time it starts the schedule.
- UDP – device connects to the server using User Datagram Protocol. This means device does not have to receive connection confirmation from the platform. Result of that is faster data transmission, however without guarantee of receiving packets by the platform. UDP protocol can be used only for LTE-M and NB-IOT connections.

Device is prepared to work with various data collection systems, such as HTTP servers (eWebtel) or SCADA systems. For this purpose to switch mode of data transmission there is parameter called **Data protocol**

Data protocol = 0 – device has the HTTP headers disabled, what means data is coming according to the one configured in **Report Composition** parameter.

Data protocol = 1 – device has the HTTP headers enabled, what means each data part configured in Report Composition parameter is followed by the HTTP header containing basic information about the device:

```
POST /r/sd.aspx HTTP/1.1
Host: 109.95.7.254:8009
User-Agent: MacR6-Z0;NF1001229281;DP115;ZD1.37;S16384;<R>;<C=2>
Content-Length: 666
```

Then transmission with HTTP headers enabled is presented on schematics.

Data block with HTTP header					
HTTP	GM3	GM3	GM3	GM3

Data protocol = 2 – device has the eWebtel protocol frames enabled, what means data part configured in Report Composition parameter is followed by the eWebtel datagram containing basic information about the device.

3.5.6. Time synchronization

Device is equipped with internal clock stored in parameter **Date/Time**. Correct time is crucial when speaking of billing data reliability. Wrong time occurs in assigning samples with incorrect timestamps, meaning present volume counter or pressure values are connected with actual time on the device, not the real one.

Device has possibility to synchronize the time using following methods:

- Local synchronization using PC or mobile application to adjust the time to one from PC or phone using dedicated application.
- Automatic synchronization using NTP (Network Time Protocol) server. NTP synchronization is performed every 7 days. Device connects to NTP server and downloads the UTC time saving it into **Date/Time** parameter.

Configuration of NTP server address is done by writing the address of it into parameter named **NTP Server**.

3.5.7. Time adjustment – time zones

Time synchronization with NTP server results in adjustment the time to the UTC (Coordinated Universal Time). Device has settings to make it working in various time zones with using the time shifts.

- **Standard Bias** – difference of the time in minutes between the UTC and local time. Example: proper setting when device is used in UTC-3 – 180.
- **Daylight Bias** – difference of the time between the Winter and Daylight Saving Time in minutes.

Device is also equipped with function of automatic time change, which results in automatic synchronization while switching from Standard (Winter) Time to Daylight Saving Time. Parameter responsible for this mode is **Time Auto Change**.

Possible values to set in **Time Auto Change** parameter.

Value	Description
0	Automatic time change
1	Only Standard Time
2	Only Daylight Saving Time
3	UTC time only
128	Forcing device to synchronize time with NTP on demand



After setting Time Auto Change to value 128 it will come back to previously set value, as 128 is a temporary value used to execute only one single time synchronization.

Dates of the switching from Standard to Daylight Saving Time are determined by parameters **Standard Date Change** and **Daylight Date Change** which are the definition of month, week, day of the time change.



Changes of the parameters mentioned below is easier when using the Software, as creating a decimal value from the single bytes is difficult process.

4. Archives and device memory description

4.1. Archival data with programmable period (registration type R – periodic)

Registration period can be programmed in range from 1 to 60 minutes (only whole divisors of 60), set by **Registration Period** parameter.

Registration is synchronized by internal clock. Cycle of record registration always contains the beginning of hour. If registration period is programmed to 12 minutes, counting from 12:00, registration records will be as following: 12:00, 12:12, 12:24, 12:36, 12:48, 13:00, 13:12, 13:24 etc.

Memory area is organized in the form of a circular buffer, i.e. when the memory is full, entering the current sample automatically deletes the oldest data fragments.

Registration type R can store up to 6816 records. Each record has its own unique index which is the factor to find the precise data in memory.

- Definitions:

- INDEX – order number of saved value in the memory. First ever registered sample has index 0. If parameter registered every hour, its index from next day after first registered sample will be 24
- RECORD – sample from specific hour. Reading 1 record – 1 hourly data, reading 24 records – 24 samples from PARAMETER. 1 record is marked in yellow in table.
- PARAMETER – as it is named, space in memory containing some specific value as Vb, Qm
- NOTE – one RECORD from i.e. 16 PARAMETERS will have the same INDEX. No matter if you read the parameter P1min from 2021.02.17 13:00 or P2max from the same date – both will have the same index.

		P1Min	P1Max	P2Min	P2Max
Index	No in DP	0	1	2	3
1111	00:00				
1112	01:00				
1113	02:00				
...	(...)				
1134	23:00				

Data horizon in the device depends on the **Registration Period**.

Examples:

Registration Period [min]	60	30	20	15	12	10	6	5	3	2	1
Amount of samples from 1 hour – H	1	2	3	4	5	6	10	12	36	30	60
Amount of samples from 1 day – D = 24*H	24	48	72	96	120	144	240	288	864	720	1440
Data horizon in days 6816/D	284	142	94,67	71	56,8	47,33	35,5	6,67	14,2	9,467	4,73

4.2. Alarms and events

Device can store up to 128 alarms and events in the memory. Once memory is full, oldest events are deleted for the purpose of the newest one.

Events in the devices are divided into momentary and lasting, which are defined as:

- **Momentary** – events aimed for indication of actions happening in the device, mostly related to configuration changes, such as: Schedule change, Erasing, Installation, Gas Meter 1 Change Gas Meter 2 Change, Time Change, Device Start.
- **Lasting** – related to events indicating continuous process action, such as Pressure Limits exceeding, Battery discharging, Modem error.

Each event is stored with its beginning and end timestamp.

Momentary events are stored with beginning and end timestamp equal, as they started and ended in the same moment.

4.3. Firmware update

Data logger is equipped with function for program updating. Periodically device can connect to the Update service platform called UpIT! to check availability of the new firmware.

There are specific parameters in the DP table which determine the frequency of the UpIT! server connection looking for the new firmware.

- **Update Type** – determining the frequency of UpIT! connection. Once a day, once a week, once a month, turned off.
- **Update Day** – determining the day of connection.
- **Update Hour** – determining the hour of connection in the day.
- **Update Delay** – minute of connection in the hour – range 0-59.

When device connects to the UpIT! server it downloads the firmware to the buffer. Firmware update process is performed most often at night (MacR6-Z0-P) and / or in the moment of lowest gas consumption (MacR6-Z0-V).




Firmware does not appear automatically on the UpIT! platform. This operation is done manually by Manufacturer staff.

5. Device labelling and marking


5.1. Labels

Some important information is imprinted directly on the solid elements of the device housing. The specific, additional information contain the plates below.

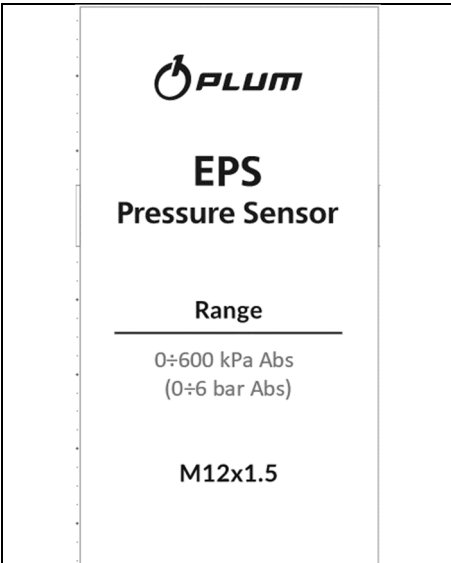
Common device front:

	<p>Device front which is common for all the devices contains following information:</p> <ul style="list-style-type: none"> - Marker saying about currently displayed value - Marker saying about currently set pressure unit (MacR6-Z0-P) - Optical interface indication - ATEX Certificate number - ATEX Marking - Range of temperatures - IP level
--	---

Front label (unique for each device):

<p>VARIANT: Z0-P S/N: 100164323</p>  <p>Z0_123_456_789 Mfg.date 09.2022 PLUM sp. z o.o. ul. Wspólna 19, 16-001 Ignatki, POLAND</p>	<p>Stickers attached to the devices contain following information:</p> <ul style="list-style-type: none"> - Device variant (Z0-P or Z0-V) - Unique serial number (S/N:...) - Barcode with same SN - Code with device hardware variant – internal marking of chosen options (Z0_xxx_xxx_xxx) - Production date (Mfg.date...) - Manufacturer data
---	---

Pressure sensor (if equipped):

	<p>Engraved marking on the pressure sensor housing contains following information:</p> <ul style="list-style-type: none"> - Name of the pressure sensor - Range of the pressure sensor written in bar and kPa unit - Thread type: M12x1,5 or 1/4 NPT
--	---

6. Device installation

6.1. Safety rules



MacR6-Z0 data logger is the device designed for installation in hazardous explosive zones 0, 1, 2.



Antenna socket should be covered by special sleeve attached to the antenna cable.



In case of water leakage of the opened device immediately take off the battery. That device has to be examined by the manufacturer.



Protection level will be kept only with proper cables diameters usage, tightening cable glands, sealing ring arrangement and tightening the front cover with 0,65Nm momentum (maximum 0,75Nm).



Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres are prescribed in Directive 1999/92/EC of the European Parliament and of the Council of 16 December 1999 (ATEX 137 'Worker Protection Directive').



Battery replacement, SIM card insertion and cable connection (including antenna) are allowed only out of the hazardous explosive zone by qualified personnel.



Installation environment must guarantee the strong GSM network signal of the vendor whose SIM card is used in MacR6.

6.2. Tools list

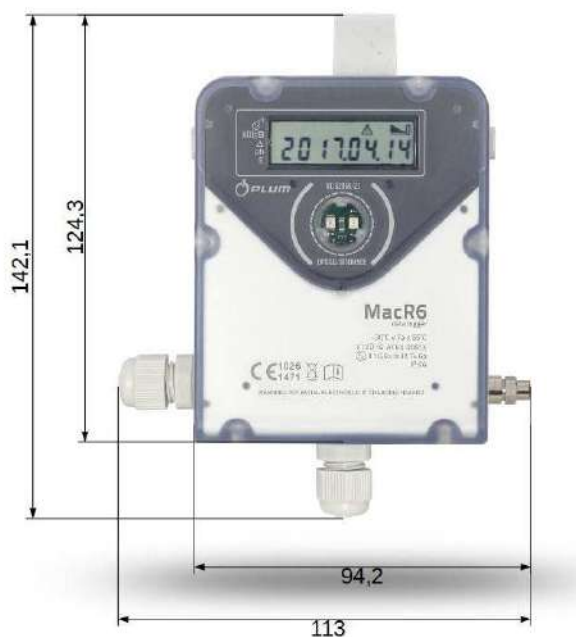
Installation of the device requires set of various tools to perform the process correctly. Below it is listed what tools are required and what is their purpose in the process of installation:

Fork spanners	Tightening the cable glands, pressure sensors ports. Remember to have various sizes of spanners and additionally one adjustable
TORX T10 screwdriver	Opening and closing device housing
Allen keys	5mm – to tighten the device 5 to mounting plate, to tighten the three-way valve to the mounting plate
Crimping tool	Crimping tool for insulation sleeves in the end of the wires



Remember to use safe tools when performing installation in vicinity of gas atmosphere

6.3. Devices dimensions



MacR6-Z0-V appears in version with 2 cable glands – side and bottom.

MacR6-Z0-P appears in version with 1 side cable gland, or without cable glands. Bottom part of this device is occupied by pressure sensors. Side cable gland can be replaced with a plug once Digital Outputs are not used.

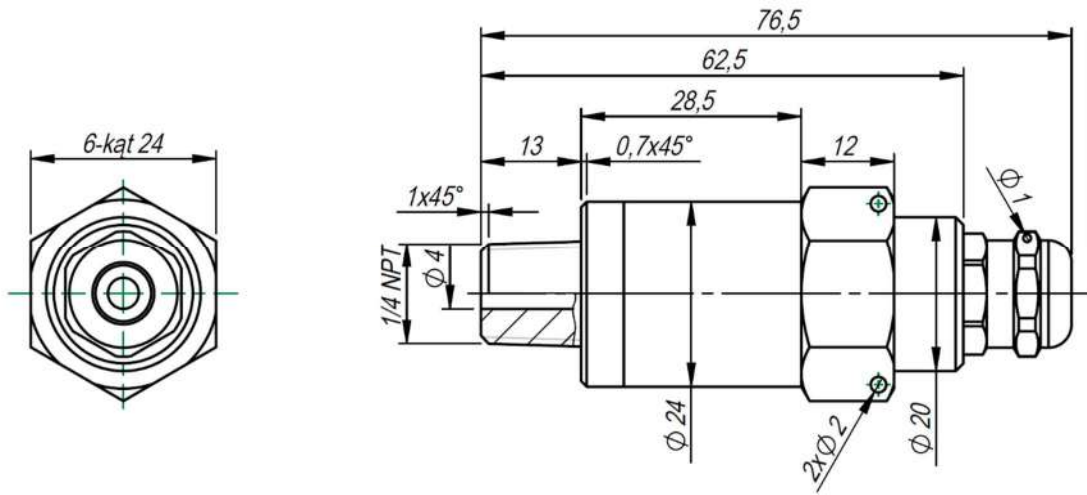
6.4. Pressure sensors types and dimensions

Manufacturer distinguishes two types of pressure sensors installed in the device:

- External pressure sensor with M12x1,5 thread



- External pressure sensor with 1/4" NPT thread



6.5. SIM card installation

SIM card installation is the first step which should be done. Without SIM card device cannot work with its basic principle which is wireless data transmission.



Required SIM card for the device must be size of MINI SIM which complies with ETSI TS 102221 v. 9.0.0 or Embedded-SIM standards

<p>1. Open the device cover. SIM slot is visible on the marked area.</p>	<p>2. Slide the Mini SIM card from the bottom side. SIM must bend on the edges of the holder in the upper part. Notch must be present on the right bottom corner of the card.</p>

6.6. Device wiring

Before final installation device must be wired properly according to the prerequisites gathered in paragraph **General safety**.

Wiring of the device applies only to following actions.

- Connection of Digital Outputs from the device – MacR6-Z0-V and MacR6-Z0-P
- Connection of Digital Inputs to the device – MacR6-Z0-V
- Connection of pulses from Gas Meters to the device if using cable connection – MacR6-Z0-V

6.6.1. Wires preparation

Wires must be prepared according to instruction presented below.

	<ol style="list-style-type: none"> 1. Insulation sleeves 2. Single wires 3. Outer insulation
--	---




To connect Digital Outputs it is recommended to lengthen the single wires to around 80mm.


To connect Digital Inputs / Gas Meter it is enough to leave it 55mm long.

6.6.2. Device wiring

MacR6-Z0-P has four terminals to connect the Digital Outputs only as the external circuits. These are located on the device mainboard in place.

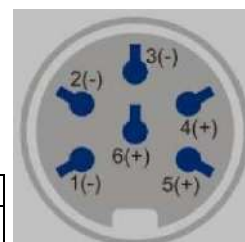
	<p>Legend:</p> <ol style="list-style-type: none"> 1. DO1+ terminal 2. GND terminal 3. DO2+ terminal 4. GND terminal
--	---

MacR6-Z0-V in addition has terminals board on the bottom of the interior, under the battery to connect there Digital Inputs or pulses from Gas Meter.

	<p>Legend:</p> <ol style="list-style-type: none"> 1. DI2+ (V2) terminal 2. GND terminal 3. GND terminal 4. DI1+ (V1) terminal
--	---

In order to connect the signals from gas meter it is required to check its nameplate to obtain the pinout, prepare the plug and make proper connection between the gas meter and data terminals.

Example of the gas meter outputs socket:



Signals	Terminals in gas meter	Terminals in MacR6
LF1	1 - LF; 4 - GND	IN-board: 2 or 3 - GND 4 - V1 input
TS	3 -TS - 6 - GND	IN board 2 or 3 - GND 1 - V2/TS input



After connection remember to configure properly the pulse inputs options: type, pulse factor of the used inputs. These steps are explained in [Measuring inputs – MacR6-Z0-V](#)

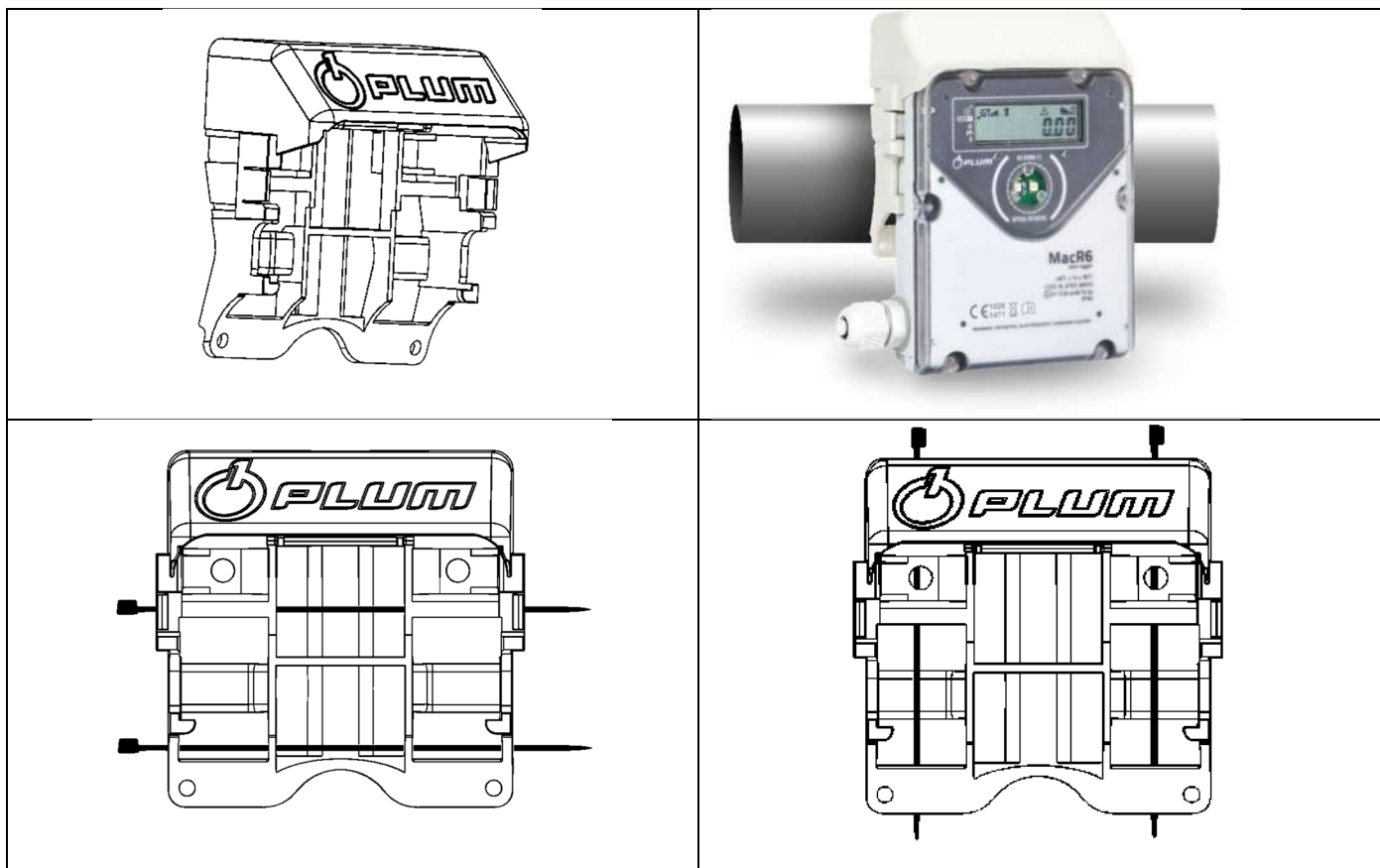


For this connection it is required to use the ferrules of size for 0,14mm² wires and presented trapezoidal crimping method. Other types may result in permanent stuck of the wire inside the terminal causing its later damage.



6.7. MacR6-Z0-P – pressure logger installation

Data logger with pressure sensors can be mounted on a wall or gas pipeline using the accessory called Wall / Pipe Holder presented on picture below.



It is enough to slide the device into the holder until it clicks and holds firmly inside. It is possible to seal the device in the wall holder by using the bottom holes – to drive wire through.

6.7.1. Pressure sensor connection

Device MacR6-Z0-P equipped with pressure sensor must be installed with keeping following rules to prevent the sensor from damage.



Do not tighten the sensor with the pipe pliers as this can cause in permanent damage of the sensor.



When installed, apply the pressure on the sensor steadily, do not make the pressure burst as this can cause permanent damage of the sensor.



Installation of the sensor must be done with usage of the valve in the end. Do not connect the sensor directly to the gas pipe.

6.8. MacR6-Z0-V – volume logger installation

Data logger with volume measurement can be installed as well as the MacR6-Z0-P. This installation is dedicated when MacR6-Z0-V is intended for working with the gas meter over cable pulse transmitter. Then refer to the paragraph Błąd! Nie można odnaleźć źródła odwołania. in regards to rules of installation using the holder.

6.8.1.




6.8.1. Installation on the ITRON RF1 meter


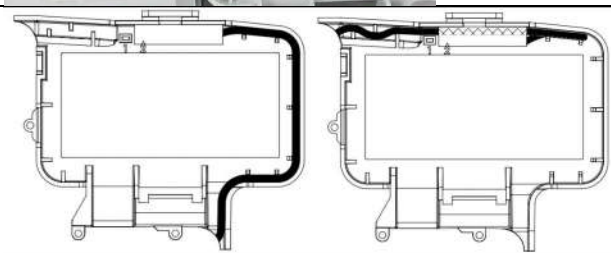
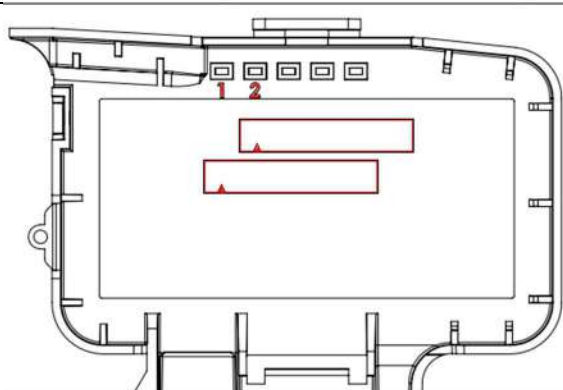

MacR6 offers also installation on the ITRON RF-1 meter with usage of the adapter mounted on the totalizer, however not using the magnetic coupling but cable connection.

ITRON adapter set contains of following equipment:

- Plastic adapter – main part
- Separate front cover for MacR6
- Torx T10 3x12 screws – 2 pieces
- Torx T10 3x8 screw – 1 piece
- Sealing element

Steps to follow:

<p>1. Remove default front cover and prepare the one with cable and emitter put through the corner. Connect the wires according to the schematics.</p>	<table border="1"> <thead> <tr> <th>Pin</th> <th>Signal</th> <th>Wire</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Tamper Switch (DI2+)</td> <td>Yellow</td> </tr> <tr> <td>2,3</td> <td>GND</td> <td>Brown</td> </tr> <tr> <td>3</td> <td>Pulse input Digital Input (DI1+)</td> <td>Green</td> </tr> </tbody> </table>	Pin	Signal	Wire	1	Tamper Switch (DI2+)	Yellow	2,3	GND	Brown	3	Pulse input Digital Input (DI1+)	Green
Pin	Signal	Wire											
1	Tamper Switch (DI2+)	Yellow											
2,3	GND	Brown											
3	Pulse input Digital Input (DI1+)	Green											
<p>2. Arrange the cable inside the device cover between the edge and blocking bolts to avoid the cable squeezing, or other damage caused by exerted elements of electronic parts</p>													
<p>3. Preliminarily tighten the cover with screws only in holes, which will not be used to attach the adapter</p> <ol style="list-style-type: none"> TOP installation – tighten standard screws to marked places in GREEN SIDE installation – tighten standard screws to marked places in PURPLE 													
<p>4. Attach the adapter depending on the way of installation:</p> <ol style="list-style-type: none"> TOP installation – tighten 3x12 screws to marked places in ORANGE SIDE installation – tighten 3x12 screw to marked place in GRAY & 3x8 screw to the place marked with a YELLOW arrow 													

	
<p>5. Properly align the cable inside the adapter depending on the type of chosen installation.</p>	
<p>6. Place the pulse emitter in 1 or 2 position, according to indication on RF-1 totalizer</p>	
<p>7. Lock the adapter using sealing plug. Installation type does not make a difference</p>	

6.8.2. Device sealing

Data logger as a technology device, after a successful installation should be protected against unauthorized access. To do this, it is recommended to use the wire over the dedicated sealing holes in the adapters, what is widely described in paragraph



Installation staff is obligated to verify condition of seals after mounting of device. If the seals are damaged, the proper functioning of device must be checked by the installer or manufacturer authorized service.



Unauthorized opening of the device, mounting inconsistent with this documentation or any changes to construction of the device can lead to loss of intrinsically-safe features and/or radio equipment characteristics. Damage of any sealing marks causes loss of confirmation of: intrinsically-safe, radio equipment features of the device.



In accordance with the directive RoHS 2011/65/UE, where applicable, it is unacceptable to use lead seals.

6.9. INT-S3 connection – signals separation out of Ex zone

Description:

1. MacR6 does not utilize INT-S3 functionality which is an external power supply for connected device and transmission port separation, as this device does not support external power supply and wired transmission port.
2. There is one single cable coming out from INT-S3 to data logger
3. INT-S3 serves for MacR6 only in one purpose. To transmit the DO1 and DO2 signals from Ex zone to the Normal zone and to connect them to PLC.



When data logger works in Ex Zone only INT-S3 can be connected directly to its terminals. Any other equipment must be connected to INT-S3 side marked as N – black terminals.



INT-S3 requires supply voltage 10,5-30V DC. Do not connect 230V mains directly to its terminals!



For further information refer to document INT-S3 user manual.

7. Device usage

7.1. Battery dividers

Once received, data logger can be equipped with the battery dividers which must be removed before use to supply the energy from battery.

For the transport purposes battery can be disconnected by the divider. Divider is inserted between + pole of the battery. This prevents from battery discharging while device is stored. Removing the divider ensures proper device work.

Pull the battery dividers both sides simultaneously.

Once batteries are operating, put back the dividers rotated on 90 degrees as shown in the picture. This ensures, if batteries are removed in the future, battery removal parallelly to the battery sockets.



After removing the dividers please set the device time and date. Wrong date and time will cause in improper timestamping of registered data and sending reports in inaccurate time.

7.2. Entering data into the device

Configuration data can be entered into the data logger using Optical Interface and dedicated PC or Android software available from manufacturer's website.

Configuration can be performed after logging in with adequate authorization level.

Download software from website:
[Click here](#)



7.3. Passwords and privileges

Authorization system distinguishes 2 levels of privileges that may be used for logging into device

- (5)** SERVICE – SERWIS-1
- (0)** USER – USER-000

Main features:

- a) Most parameters are available for modification using USER-000 privileges;
- b) Service access using SERWIS-1 account allows for changing parameters responsible for Service / Update channel data;
- c) Service access requires daily generated password for account SERWIS-1 which is generated by Manufacturer on request;
- d) Service access allows for modification of parameters requiring user access;
- e) User password is user changeable, default one is 4096.

In detail:

- SERVICE
 - privileges for data readout
 - privileges for configuration of all device's parameters (including calibration of pressure and temperature sensors)
 - privileges for setting Update server address
- USER
 - privileges for data readout
 - privileges for configuration of device parameters typically altered during installation process and basic configuration of the device

7.4. Device clock

Device is equipped with real time clock. Synchronization of clock is possible via:

- Locally using the PC / Android Software to synchronize the time with local time of PC / Phone
- Using inbuilt modem, device synchronizes the time once a week (per every seven modem connections) with programmed NTP Server



Details about the time synchronization options are explained in the paragraph [3.5.6Time synchronization](#)

Information about clock modification is saved into device's events memory (time before and after modification). Access to time modification with use of keyboard is protected by password.

7.5. Device start up

Device can be delivered in turned off state and / or with the battery divider described in [7.1 Battery dividers](#) paragraph.

Turned off device has an OFF mark on the display if the battery is inserted.

In order to start up the device it is necessary to wake it up using special procedure.

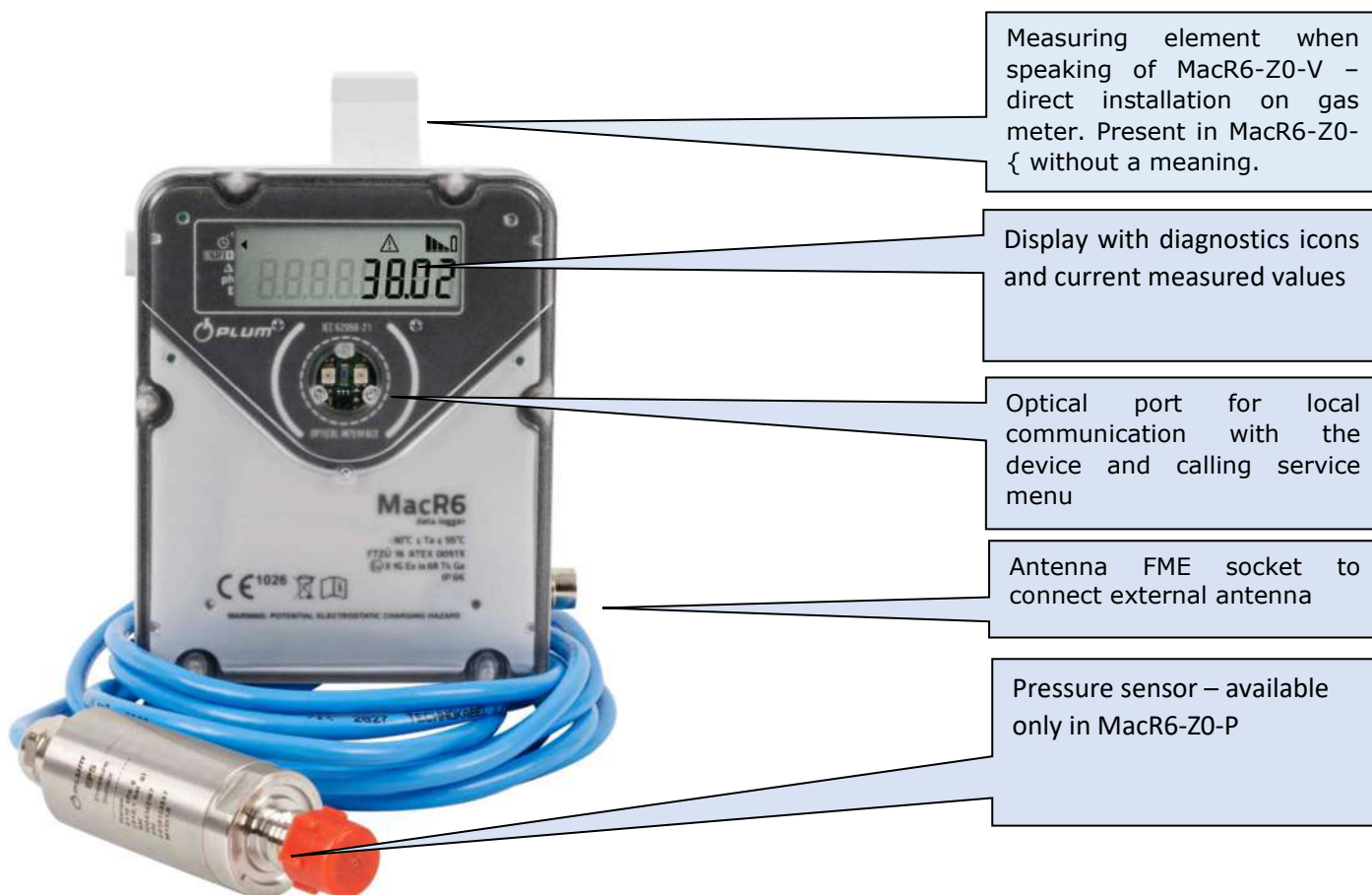
1. Remove the spacer located on + pole of the battery.
2. Turn on the device is able by placing the magnet (i.e. OptoBTEX head) to the OPTICAL INTERFACE window. This will cause showing the "SLEEP 3" information on the display. All of indicators on the left side of the display will flash, and then they will be shutting down in a row. Repeated magnet closing before the indicators disappearing will result the "SLEEP 2" information on the display, next "SLEEP 1" and "START" - after the indicators shutdown the device will turn on.



If the device is delivered without battery, display is blank. Once the battery is inserted, device will go through screens: INIT – device initialization. START – few seconds until the auto diagnostics procedure will pass.

7.6. Device front overview

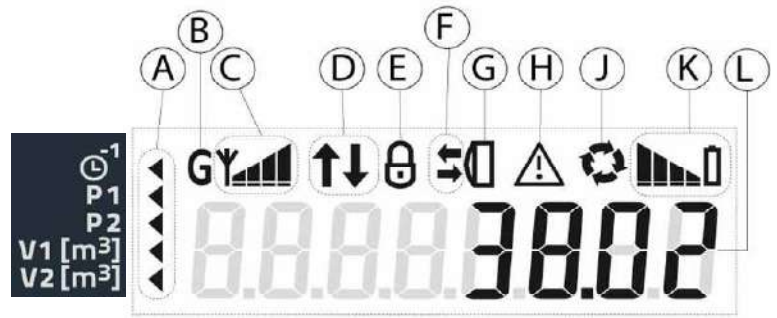
Local communication between user and device is realized by graphic display. There is no physical keyboard in the device. Actions with the device display can be done using the Optical Interface as in case of waking up the device what is described in paragraph [7.8 Menu navigation – service menu called with OptoBTEX](#)




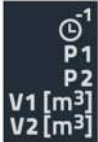

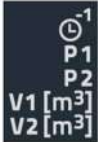

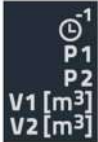

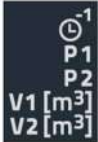








7.7. Display

Devices display contains of following information:

- Markers for indication type of periodically presented values – (A)
- Maintenance icons – (B-K)
- Periodically presented value – (L)



Markers description:

MacR6-Z0-V			
	Current value of volume V1 counter		Current value of volume V2 counter
			
			
			Date and Time, alternately
MacR6-Z0-P			
	Current value of pressure P1		Current value of pressure P2
			
			
			Date and Time, alternately

ICONS DESCRIPTION

MOBILE NETWORK OPERATION:

Blinking icon - active GPRS connection (connected to APN of SIM card)
 Constantly flashing icon - last GPRS connection successful.
 No icon - no GPRS connection in last attempt or device restarted.



MODEM OPERATION:

Blinking icon - active modem connection.
 Constantly flashing icon - last modem connection successful.
 No icon - lack of internal communication with modem in last attempt or device restarted.



MOBILE NETWORK RANGE:

Blinking icon - SIM card issue or not detected.
 Constantly flashing icon - SIM registering during last modem connection successful. Signal strength is indicated by the number of bars
 No icon - SIM card not registered in mobile network or low signal strength.



SIM LOCK:

Blinking icon - incorrect PIN code in last registration attempt.
 Constantly flashing icon - incorrect PIN in last three attempts - SIM card locked, PUK code needed.
 No icon - PIN code correct.



DATA TRANSMISSION:

Blinking icon - active data transmission
 Constantly flashing icon - UP arrow: successful data transmission to the server. DOWN arrow: successful configuration download or data read.
 No icon - no transmission in last attempt or transmission failed.



LOCAL TRANSMISSION:

Constantly flashing icon - presence of the interface near OPTICAL INTERFACE window.
 No icon - no interface present.
 Blinking arrows - local data transfer active.
 No arrows - local data transfer inactive.



TAMPER SWITCH:

Constantly flashing icon - gas meter magnetic field interruption.
 No icon - no interruption.
 Icon does not apply to MacR6-Z0-P



PULSE COUNTER:

Simultaneous blinking icons - gas meter type detection.
 Alternate blinking icons - counting pulse from the gas meter.
 No icons - no changes on the pulse input or gas meter not connected.
 Icon does not apply to MacR6-Z0-P



BATTERY LEVEL:

Battery level is presented by number of bars. More = better.
 Flashing battery icon - battery level below 10%.
 No battery icon - battery level too low to turn the GSM modem on.



7.8. Menu navigation – service menu called with OptoBTEx

Data logger has user available-text menu which allows for instant data transmission, checking GSM signal range or performing installation process.

Menu is built as a single level, working in loop, switching from one to another until the menu can be turned off without any action. Passing to next menu is done by closing the magnet on the next options until the desired show up or menu is turned off.

Passing to the menu is done by waiting 5 seconds on the chosen option without moving to the next ones.



Once markers on the left side of display count from 5 to 0, menu will start.

Service menu structure:

<p>Autotest procedure required after installation - data sending to server.</p>	<p>Dynamic GSM signal control procedure (CSQ test). Estimated time to pass - 1 minute.</p>	<p>Forced data sending - from the beginning of the month.</p>
<p>Battery replacement procedure.</p>	<p>Immediate pressure check - available only in Z0-P logger. Pressure value is presented on display for 1 minute.</p>	<p>Exit the Service Menu - no option, returning to the normal device state.</p>

7.9. Device main battery

The device is powered from 1 lithium 3,6V/17Ah, size D battery, LS33600 manufactured by SAFT. Only this type of battery is permissible.

Life time of battery depends on registration period, amount of monthly reports, current temperature, mobile network signal level etc.. Battery should last for over 5 years, assuming:

- Registration period set on 60 min.
- Optical interface is not used.
- Operating temperature equals minimum of ambience temperature, -25° C;
- Provided maximum pulses frequency on LF input (2 Hz);
- CSQ – mobile network signal range is equal or higher than 25 (max 31);
- 3 communications per day (maximum 2 minutes each).

When battery charge reaches 10% of its remaining capacity, an alarm will be generated (**Battery low**), it's recommended then to perform battery replacement procedure. Device will stay active until full depletion of the battery, what eventually causes modem is unable to start data transmission.

8. Device settings – Configuration using PC/Windows software

This paragraph presents the software designed for configuration and diagnostic of devices. The user-friendly graphic interface allows for basic and extended configuration. It also stores a list of previously connected devices and allows for quick navigation between them.

To connect with the device use Optical interface using Optical Head – e.g. OptoBTEx

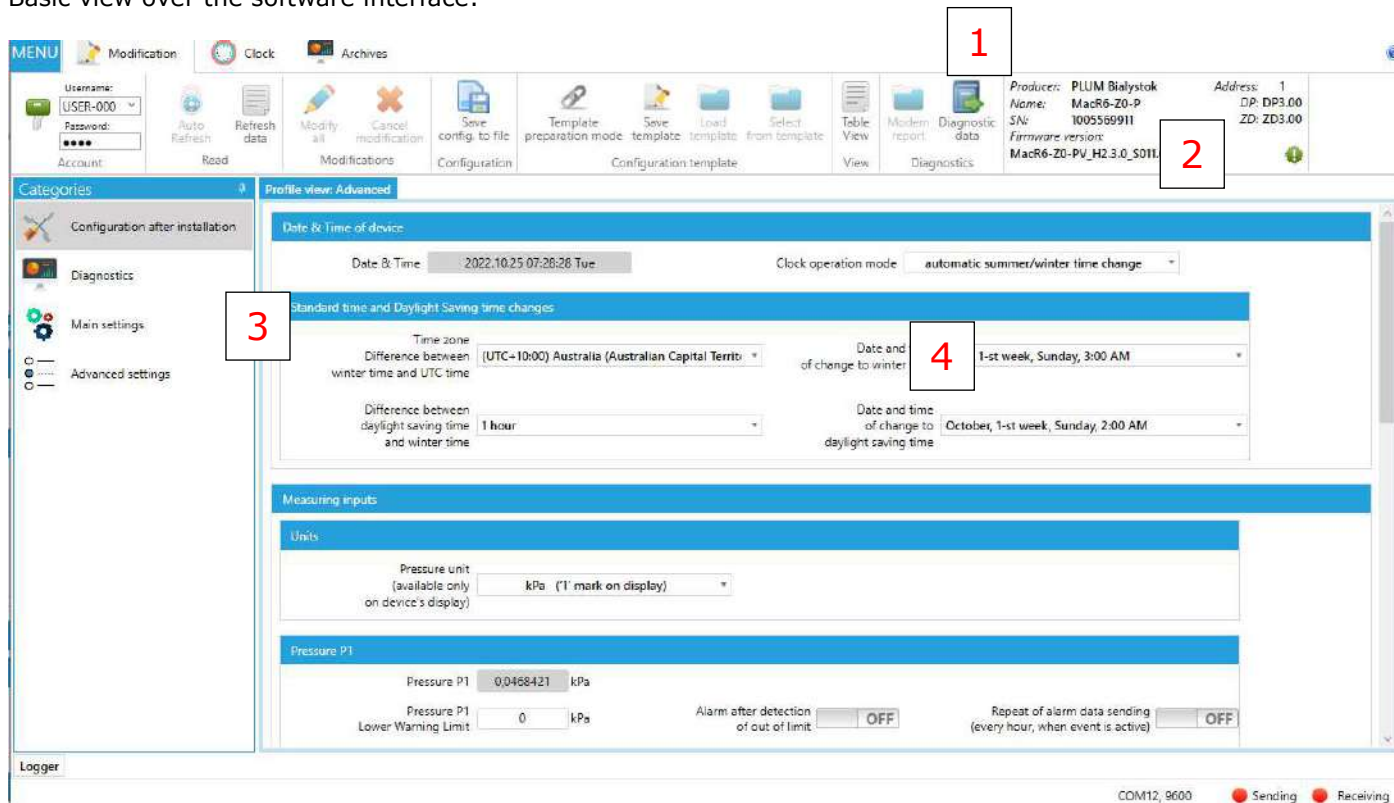


Full manual explaining Software work and principles is available as the auxiliary document. Read the manual before starting device configuration.

8.1. Device searching and main program view

- Choose proper COM port in computer corresponding to connected interface.
- Adjust the baudrate to the one set in the device configuration – MacR6 always 9600
- Click on proper button to start device searching

Basic view over the software interface:



1. Main tabs panel – switching between software functions
2. Function buttons
3. Categories with thematically grouped parameters
4. View of parameters inside the category

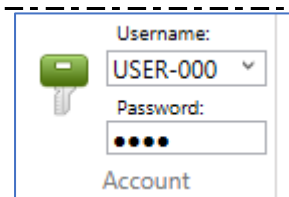
View consisting of 3 & 4 is called later PROFILE



When software does not show the profile for the device, only list of parameters, please inform Technical Staff of Manufacturer.

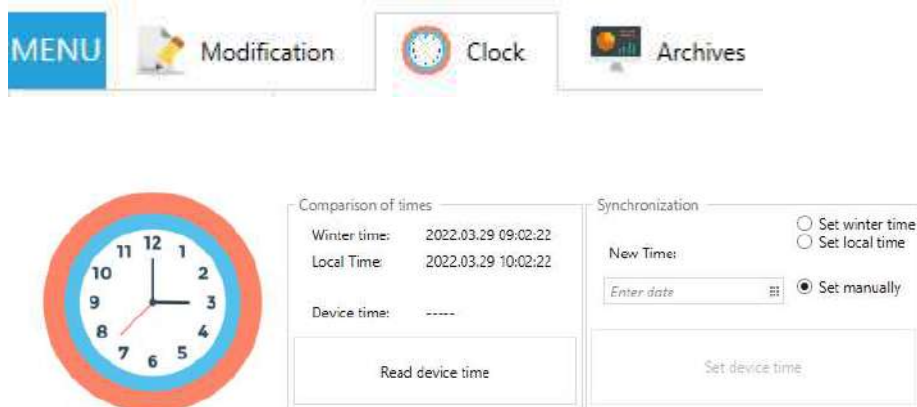


Remember to use proper username and password when saving the data to the device. Usernames and passwords are described in paragraph **7.3. Passwords and privileges**



8.2. Clock adjustment

First setting which is worth mentioning and important from the point of view of device configuration is clock setting done in Clock tab:



Clock can be set according to following assumptions:

1. Setting local time – downloaded from PC which is used for device configuration.
2. Setting winter time – downloaded from PC which is used for device configuration. Device uses also programmed time shift between winter and daylight saving time to show winter time.
3. Manual time – type the time from keyboard.

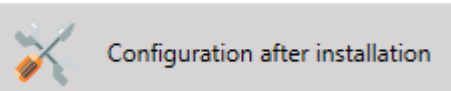


Wrong date and time will cause in improper timestamping of registered data and making the modem to execute the schedule in wrong time (correct for data logger, not real time).

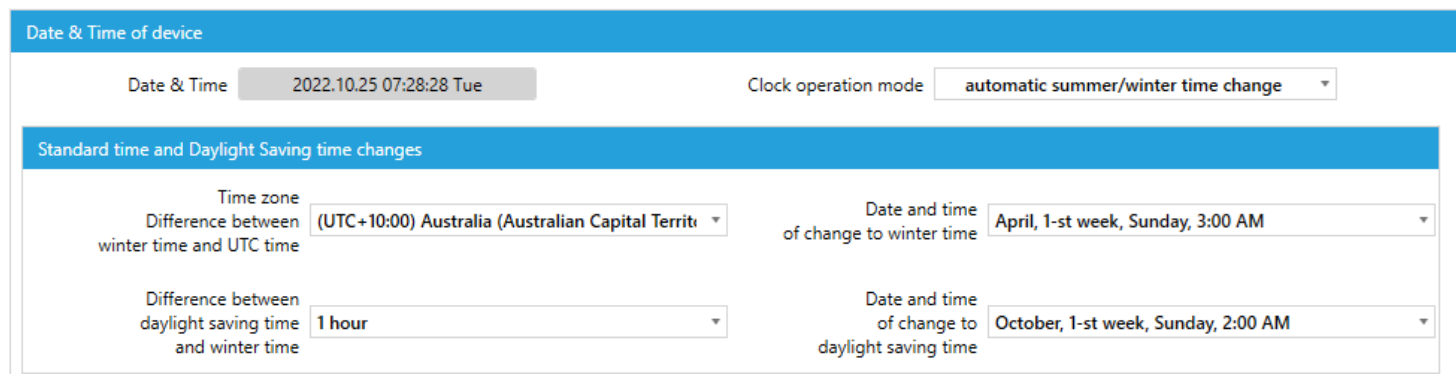
8.3. Configuration after installation



First category in the profile is most essential for the successful device configuration. All the parameters from this section are necessary for basic device operation.



8.3.1. Date and time settings



Settings found in this category are as follows:

- Clock operation mode
 - Automatic summer/winter time change – according to the settings in next sub category, device will be automatically changing time from winter to summer and opposite in given time.
 - Only winter time – device will be working only in the time programmed in field below corresponding to the choice of time zone
 - Only summer time – device will be working only in the time programmed in field below corresponding to the choice of time zone
 - Only UTC time – device will be working only in the UTC time
- Standard time and Daylight Saving time changes – available options in this sub menu depend on choice below.
 - Time zone difference – choice of the time zone of device work.
 - Difference between daylight saving and winter time
 - Times of switching time from winter to daylight saving and opposite chosen from the standard ones, depending on the country

8.3.2. Measuring inputs – MacR6-Z0-V

Digital inputs DI configuration			
Digital inputs DI configuration <input type="text" value="DI1 – LF1 (V1) / DI2 – LF2 (V2)"/>			
Gas meter #1 counter (V1) (DI1 input)	<input type="text" value="568,500"/>	m3	
Gas meter #2 counter (V2) (DI2 input)			<input type="text" value="1122,000"/>
Gas meter #1 pulse factor (DI1 input)	<input type="text" value="0,001 m3/pulse [1000 pulses/m3]"/>		
Gas meter #2 pulse factor (DI2 input)			<input type="text" value="0,001 m3/pulse [1000 pulses/m3]"/>
Gas meter #1 serial number	<input type="text" value="-----"/>		
Gas meter #2 serial number			<input type="text" value="-----"/>
Capacity of Volume counter #1	<input type="text" value="0"/>	m3	
Capacity of Volume counter #2			<input type="text" value="0"/>

- Digital inputs configuration: field responsible for choice, should the inputs be configured as: V1 only, V1+V2, V1+TS (Tamper Switch)
- Gas meter #1 fields are always visible.
- Gas meter #2 fields visibility depends on the choice in parameter DI Configuration and they represent the same features as for the Gas meter #1
 - Gas meter counter – current value of the gas meter totalizer which should be rewritten to the MacR6-Z0-V device
 - Gas meter pulse factor – ratio of pulse, how much of volume is transferred via one pulse. Obtained from gas meter name plate.
 - Gas meter serial number – obtained from gas meter.
 - Capacity of volume counter – maximum capacity of the gas meter which result in reverting its state to 0. For instance, value possible to set there should be 99999999,99 (number of digits in total including decimal parts with coma in proper place).

8.3.3. Pressure settings – MacR6-Z0-P

Measuring inputs

Units

Pressure unit (available only on device's display) kPa ('I' mark on display) ▼

Pressure P1

Pressure P1 0,0468421 kPa

Pressure P1 Lower Warning Limit 0 kPa	Alarm after detection of out of limit <input type="checkbox"/> OFF	Repeat of alarm data sending (every hour, when event is active) <input type="checkbox"/> OFF
Pressure P1 Upper Warning Limit 0 kPa	Alarm after detection of out of limit <input type="checkbox"/> OFF	Repeat of alarm data sending (every hour, when event is active) <input type="checkbox"/> OFF
Pressure P1 Lower Alarm Limit 0 kPa	Alarm after detection of out of limit <input type="checkbox"/> OFF	Repeat of alarm data sending (every hour, when event is active) <input type="checkbox"/> OFF
Pressure P1 Upper Alarm Limit 0 kPa	Alarm after detection of out of limit <input type="checkbox"/> OFF	Repeat of alarm data sending (every hour, when event is active) <input type="checkbox"/> OFF

Zeroing of indications of pressure P1 ▼

- Units of pressure – pressure indication on the display. Note: registered pressure is always presented in kPa unit. Different unit can be chosen by eWebtel.
- Warning and alarm limits of the pressure. To know the idea of four thresholds of the alarms it is necessary to look on the diagram below:



- Warning limit – limit which should inform supervisory that some incident may now be appearing on the measuring site, however this does not require immediate intervention
- Alarm limit – limit which should inform about incident requiring immediate intervention

Next settings are related to immediate sending of the data while any of the limit is set and the alarm is raised in MacR6-Z0-P. In short – immediate informing of supervisory.

Same settings are applicable for P2 sensor if present.

8.3.4. General network settings

Location of device	
Latitude (in the form of DD)	<input type="text" value="0"/>
Longitude (in the form of DD)	<input type="text" value="0"/>

SIM card	
PIN code of SIM card	<input type="text" value="*****"/>
APN of SIM card network and authentication data for communication with data server	<input type="text" value="iot.1nce.net"/>
APN of SIM card network and authentication data for Upltd service channel	<input type="text" value="iot.1nce.net"/>

Data sending	
Data server address and port number	<input type="text" value="ewebtel.com:88"/>
Format of sent data	<input type="text" value="GM protocol + HTTP [TCP, 2G] (required for eWebtel)"/>
Type of logged data to send	<input type="text"/>

Down in the "Configuration after installation" there are basic settings for the network connection

- Latitude and longitude – these are the GPS coordinates which are given in degrees. Through PC software they must be manually found and written here. It is more convenient to use the option of autocomplete location through mobile app.
- SIM settings:
 - PIN – as the name suggests. PIN to the SIM. If card does not use a PIN, leave this field untouched.
 - APN (Access Point Name) for connection with main data server and firmware update channel. APN is related to used SIM card in the device.
- Data sending:
 - Address of data server. Data server is the destination server where the archives and readouts from MacR6 shall be delivered to. By default the server is PLUM eWebtel available on address ewebtel.com:88. Change must be done to either IP or domain server with port followed by colon.
 - Format of sent data: way of how data should be formed. We distinguish three options where:
 - eWebtel protocol – data transmitted in GazModem protocol with simplified identification information.
 - GM protocol + HTTP headers – standard data transmission protocol, where data is transmitted in GazModem protocol with identification information included in HTTP header.
 - GM protocol – only data transmitted in GazModem protocol. Default mode for SCADA systems.
 - Type of logged data to send: this choice matters when we want to reduce amount of transmitted data. Data will be stored in the device, however only chosen part of them is transmitted. To have full data scope, it is recommended to leave all the data to be sent.

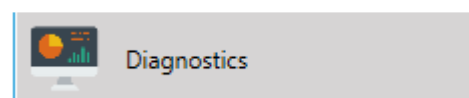
Other	
Registration (logging) period	60 min
Billing Hour Time of sending full report	06:00
GM address of device	1
Site ID	-----
Passwords	
USER-000 password	*****
Installation process	
Perform installation process [InStAL]	no
Perform immediate logged data sending [rEPort]	no

Last settings in this category are related to following options:

- Registration period – frequency of saving data samples in device memory. This setting is described in paragraph **4.1 Archival data with programmable period (registration type R – periodic)**
- Billing Hour – primary hour of sending full report to the system – time of waking up the modem and data transmission.
- GM address of the device – option to set an internal address used in GazModem protocol. Not used for eWebtel or local transmission using Optical Interface
- Site ID – text field to name the place or area where the device is installed.
- USER-000 password – standard password modification
- Installation process:
 - Perform installation process – option which should be used after performing installation process, so mounting the device on the meter / pressure receiving point, setting counters, limits. With this option device will immediately transfer necessary data to eWebtel system
 - Immediate logged data sending – option to send logged data only. Can be used after performing installation process to get the initial billing data transferred to eWebtel system

8.4. Diagnostics

This category is mostly designed to make a diagnosis of the device, observe the service counters or maintenance parameters.



Diagnostics	
Mobile network signal strength [CSQ]	Marginal
Battery level	85 %
Perform service menu	
CSQ value	4

Available fields:

- One modifiable option is to perform service menu. This is an extension of the option given in previous paragraph, because of adding two new options:
 - GSM signal strength test – device will check the GSM range without sending any data and just displaying the current value of GSM signal strength for 1 minute on display.
 - Pressure measurement test – valid only for MacR6-Z0-P – when executed, pressure value measured every 1 second is displayed for 1 minute.

- Mobile network signal strength with its value – these fields represent the quality of the signal, which is defined in range from 0 to 31, where 0 is the worst, 31 the best. How to improve signal level: raise the antenna higher, use longer antenna. In case CSQ is 0, no antenna or no SIM is present.
- Battery level – percentage battery level

Session Status of last schedule of full report

255

launching of the modem	OK	mobile network signal level (CSQ) > 7	OK
communication with modem	OK	registration to GPRS network	OK
communication with SIM card	OK	connection parameters (ping to data server)	OK
registration to GSM network	OK	sending data to server	OK

- Session status is the diagnostic feature allowing for diagnosis of the connection issues. If device works well, then all fields above should be marked as OK and the status on the top should have value 255.

Session Status of last schedule of data sending

7

launching of the modem	OK	GSM signal level (CSQ) > 7	ERROR
communication with modem	OK	registration to GPRS network	ERROR
communication with SIM card	OK	connection parameters (ping to data server)	ERROR
registration to GSM network	ERROR	sending data to server	ERROR

If there is any issue with any step, device will mark this and next steps with ERROR message as it could not proceed to next steps. On the example above there is presented scenario where SIM card was present, but logging in to GSM was not possible.

<p>Device information</p> <p>Name of device: MacR6-Z0-V</p> <p>Serial number: 1004971042</p> <p>Firmware version: H2.3.1_S011.00_V1307</p> <p>Bootloader version: H2.3.0_S001.02_V2110</p> <p>Modem firmware version: BG95M3LAR02A03_01.009.01.009</p> <p>Modem IMEI: 864351056629886</p> <p>Hardware configuration: "D11, D12, DO1, DO2, LTE BG95 M3, "".""</p> <p>Site ID: -----</p>	<p>Device information</p> <p>Name of device: MacR6-Z0-P</p> <p>Serial number: 1004149226</p> <p>Firmware version: H2.3.0_S005.11_V1307</p> <p>Bootloader version: H2.0.1_S003.04_V1307</p> <p>Modem firmware version: BG95M3LAR02A03_01.005.01.005</p> <p>Modem IMEI: 864475045203659</p> <p>Hardware configuration: P_0_0_0_0_LTE BG95 M3</p> <p>Site ID: -----</p>
--	--

- Device basic information such as the name, serial number, firmware version, IMEI and hardware configuration of the unit.

Service counters			
No SIM	681	Voltage Drop	1310
No Log GSM	1144	Modem Timeout	0
Low Lvl CSQ	374	Max Data Limit	0
No Log APN	47	Battery Counter	156821063
No TCP	4077	Memory Counter	0
Connect TCP	0	RING Counter	0
Disconnect TCP	0	Erasing Counter	3
Connect Time TCP	0	Reset source	0
No FTP	0	Loading Cap Ratio	0
Resets	133	Loading Cap Timeout	1549
Modem Turn On	5863		
Uptime	1021		
Timelife	323		

- Last section in this category are the service counters. Some of them have natural increment due to device work, such as numbers of connection or their time, modem turnings on number. These counters are also valued when speaking of device diagnostics – i.e. No SIM increasing while SIM is inside.

8.5. Main settings

Main settings is the tab similar to the Configuration after installation, extended with number of advanced parameters.

Time of sending report

00:00	<input type="checkbox"/>	OFF	06:00	<input type="checkbox"/>	OFF	12:00	<input type="checkbox"/>	OFF	18:00	<input type="checkbox"/>	OFF
01:00	<input type="checkbox"/>	OFF	07:00	<input type="checkbox"/>	OFF	13:00	<input type="checkbox"/>	OFF	19:00	<input type="checkbox"/>	OFF
02:00	<input type="checkbox"/>	OFF	08:00	<input checked="" type="checkbox"/>	ON	14:00	<input type="checkbox"/>	OFF	20:00	<input type="checkbox"/>	OFF
03:00	<input type="checkbox"/>	OFF	09:00	<input type="checkbox"/>	OFF	15:00	<input type="checkbox"/>	OFF	21:00	<input type="checkbox"/>	OFF
04:00	<input type="checkbox"/>	OFF	10:00	<input type="checkbox"/>	OFF	16:00	<input type="checkbox"/>	OFF	22:00	<input type="checkbox"/>	OFF
05:00	<input type="checkbox"/>	OFF	11:00	<input type="checkbox"/>	OFF	17:00	<input type="checkbox"/>	OFF	23:00	<input type="checkbox"/>	OFF

Report sending delay (fixed) [in minutes]

Set random value of fixed delay

Day of week of sending report

Every day (if month day is also set to 'every day') yes

Monday	<input checked="" type="checkbox"/>	ON	Friday	<input checked="" type="checkbox"/>	ON
Tuesday	<input checked="" type="checkbox"/>	ON	Saturday	<input checked="" type="checkbox"/>	ON
Wednesday	<input checked="" type="checkbox"/>	ON	Sunday	<input checked="" type="checkbox"/>	ON
Thursday	<input checked="" type="checkbox"/>	ON			

Fields in section presented above are used to adjust the time of sending report more precisely – up to single minute. Switch the slider to position ON to turn on the data transmission on chosen hour. Same applies to the day of the week and day of the month when sending report.

Additional data sending settings

Amount of report repeating (if failed) <input style="width: 80%;" type="text" value="3"/>	Cycle of report repeating (hours) <input style="width: 80%;" type="text" value="1"/>
---	--

Types of data to send to data server

DP and ZD table (required for e.g. ewebtel.com) <input checked="" type="checkbox"/>	
Current data (required for e.g. ewebtel.com) <input checked="" type="checkbox"/>	Report Frame <input style="width: 80%;" type="text"/>
Registered (logged) data (required for e.g. ewebtel.com) <input checked="" type="checkbox"/>	Type of logged data to send <input style="width: 80%;" type="text" value="V1"/>
Events (required for e.g. ewebtel.com) <input checked="" type="checkbox"/>	
Identifier of device (required for e.g. ewebtel.com) <input checked="" type="checkbox"/>	

- Section above is used to configure the additional report sending when failed.

Initial scenario: device sends data typically on 6am. For some reason device failed to send data this time.

When using a mechanism of sending report when failed:

- Amount of report repeating – this is the number of how many times device will repeat report sending. In this example it is 3.
- Cycle of report repeating – this is the number of how often the device will repeat report sending. In this example it is 1.

Summary: device failed at sending data on 6am. Then it will repeat this transmission on 7am, 8am, 9am. If device successfully sends data on 7am, no more attempts are performed.

- Data to send

In this section we can decide which data should be send to the platform. In case of PLUM eWebtel whole set is necessary. Depending on the system, data to send can be turned off, as the system may independently ask for the data. This is how SCADA systems are working.

Alarm data sending configuration

Device Start	<input type="checkbox"/>	OFF	V1 Change	<input type="checkbox"/>	OFF
Time Change	<input type="checkbox"/>	OFF	V2 Change	<input type="checkbox"/>	OFF
Schedule Change	<input type="checkbox"/>	OFF	Imp LF 1 Change	<input type="checkbox"/>	OFF
Modem/GSM Error	<input type="checkbox"/>	OFF	Imp LF 2 Change	<input type="checkbox"/>	OFF
Battery Discharged	<input type="checkbox"/>	OFF	Gasmeter 1 Change	<input type="checkbox"/>	OFF
Battery Replace	<input type="checkbox"/>	OFF	Gasmeter 2 Change	<input type="checkbox"/>	OFF
Erasing	<input type="checkbox"/>	OFF	Magnetic/Cable Interruption	<input type="checkbox"/>	OFF
Installation	<input type="checkbox"/>	OFF	Case Opened	<input type="checkbox"/>	OFF
Tranistion by 0	<input type="checkbox"/>	OFF			

Last section in this field refers to the alarms in the device. By turning the slider corresponding to alarm on, it is possible that device will send the report regardless of the schedule. This means that device reported an alarm, what should be considered as urgent to examine. In PLUM eWebtel alarms are presented on device main page.

8.6. Advanced settings

This is the section with rarely used parameters for a typical device configuration.

Upltd service channel			
Upltd server address	<input type="text" value="upit.ewebtel.com:7001"/>		
APN of SIM card network and authentication data for Upltd service channel	<input type="text" value="iot.1nce.net"/>		
Type of schedule for Upltd service channel	<input type="text" value="once a week"/>	Schedule day for Upltd service channel	<input type="text" value="Thursday"/>
Schedule hour for Upltd service channel	<input type="text" value="10:00"/> h	Schedule delay against full hour	<input type="text" value="2"/> min

UpIt is the functionality which enables the remote firmware upgrade. Settings are as follows:

- Time of connection – hour up to single minute
- Frequency of connection: once a day, once a week, once a month
- Day of executing the connection – applicable only when using option once a week or once a month

Mobile communication			
Radio access technology #1 (main)	<input type="text" value="LTE-M (LTE Cat.M1)"/>	LTE-M (LTE Cat.M1) Band	<input type="text" value="B20 (800MHz)"/>
Radio access technology #2 (secondary)	<input type="text" value="---"/>		
Data transmission protocol	<input type="text" value="UDP transmission"/>		
Duration of transparent mode	<input type="text" value="30"/>		

LCD display configuration			
current date	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
current time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
volume counter V1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
volume counter V2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

In this section we can make a configuration of the Radio Access Technology which is called RAT. MacR6-Z0-V and Z0-P are equipped with wireless module allowing for usage LTE-M, LTE-NB and GPRS communication methods.

- RAT1 is the main technology used. Device always try to communicate with network using the first one.
- RAT2 is the secondary technology. When RAT1 is failed to reach, device switches to RAT2 for the next days up to the end of the month.
- LTE-M or LTE-NB bands: frequency bands used depending on the national availability. Not relevant when using GPRS.
- Data transmission protocol – TCP or UDP. UDP is suggested for LTE-NB. TCP is suggested for GPRS.

LCD display configuration	
current date	ON
current time	ON
volume counter V1	ON
volume counter V2	OFF

LCD display configuration: slider switched to ON makes the corresponding values showed on the display periodically.

8.7. Table view

PC software allows also for the full configuration over the raw device parameters table.



Modification of parameters through the raw table is burdened with risk of adverse effect This mode is aimed for advanced users knowing the data structure and meaning of each parameter.

There are no hints or text descriptions of each value. Each modification is done by editing the numeric values representing functions. In some cases, wrong modification can lock the device.

MENU
Modification
Clock
Archives

Username:
 Password:
 Account

Parameters (DP table)
Alarms/Events (ZD) table
Collective alarms

Drag a column header and drop it here to group by that column

Index	Name	Unit	Actual Value	New Value	Long Description
0	P1 min	kPa	0,01429176		
1	P1 max	kPa	0,0468421		
2	P2 min	kPa	0		
3	P2 max	kPa	0		
4	V1	m3	0		
5	V2	m3	0		
6	P1	kPa	0,0468421		
7	P2	kPa	0		
8	Device Type		MacR6-Z0-P		
9	Serial Number		1005569911		
10	Gasmeter S/N 1		-----		
11	Gasmeter S/N 2		-----		
12	Date/Time		2022.10.25 07:28:28 Tue		
13	Battery Lvl	%	51		
14	Events		0		
15	Session Status		255		
16	RAT Act.		2G		

Modification is done similarly to the one in graphic profile mode. New value must be put in the "New Value" column and left there for modification. Field with changed but not accepted value will be highlighted in orange.

Gray boxes in the New Value column mean this parameter is not modifiable.

9. Mobile application overview

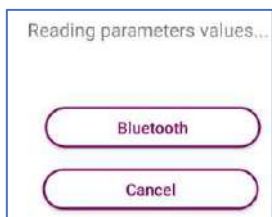
Another way of device configuration is mobile application designed for smartphones with Android system.

Mobile app allows for device configuration using Optical interface OptoBTE_x using Bluetooth communication or interface-free mode using NFC.



9.1. First connection

Connection with the device is done in following steps:



Start the app. Choose Bluetooth option in the main window.

Turn on OptoBTE_x and place it on the Optical interface area on the device housing.

If the OptoBTE_x is not paired with the phone proper notification window will appear to pair the phone. Use proper PIN code for pairing.

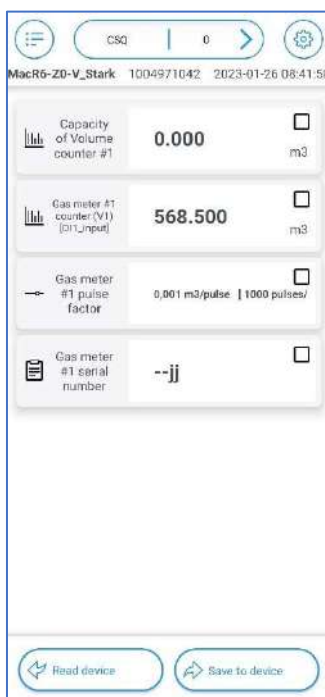
When the progress bar will reach the end, app will pass to the main window showing all the parameters.

9.2. App overview

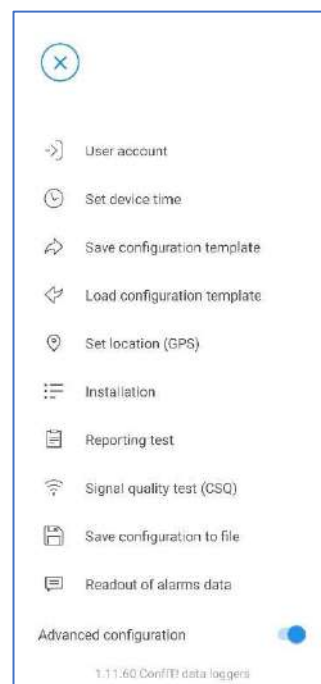
Regardless the communication method, app will pass to the main window.



Swipe from the left – categories section. Parameters grouped thematically.



Main window with parameters to modify in the device.

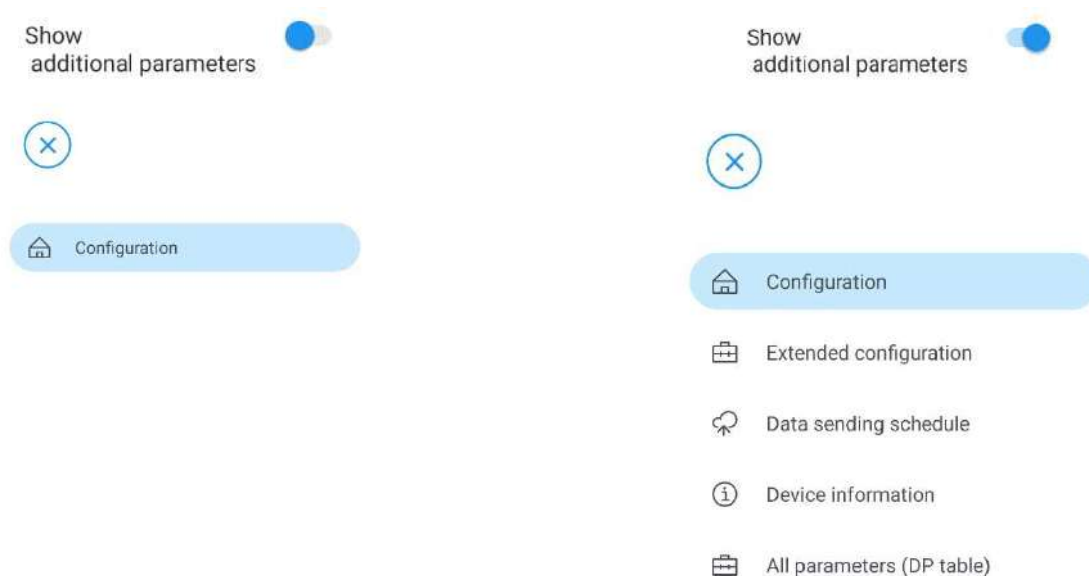


Swipe from the right – options section. Account choosing, advanced view, time settings and save/load configuration.

9.3. Basic and advanced view

App allows for two variants of interface – basic and advanced. In basic one there is possibility to configure only parameters related to gas meter and gas composition. Simple configuration on the object. Advanced view allows for configuration similar to the one available with PC software excluding modem schedules settings and modem full diagnostics.

To switch between the views it is necessary to switch the “Additional parameters” slider.



9.4. Parameters modification



To modify the parameter click on its value and make the change.

Changed, but not saved parameter is marked on blue:



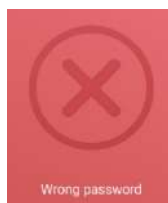
Click and wait for confirmation of the success

Possible errors during configuration:



Modification was unable to success. Possible reasons:

- Parameter out of programming range
- Optical head turned off – when using Bluetooth



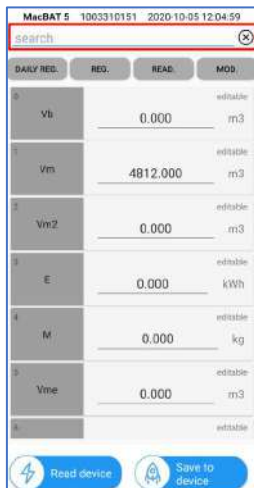
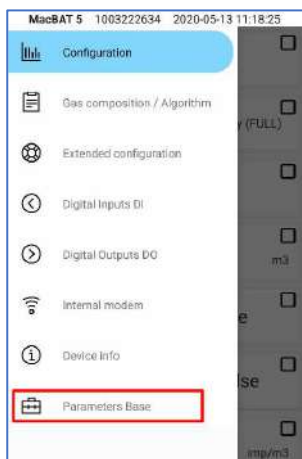
Modification failed due to wrong password. Check used login and password.

9.5. Table view

Mobile app provides similar functionality as desktop configuration tool to review and configure the device using table of parameters with raw numeric values instead of graphic profile.

Table view is available in two ways:

- No graphic profile defined for read device
- Manual choice



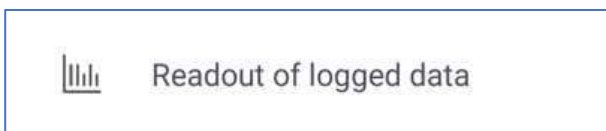
If the profile to read device exists, it is necessary to manually go to the table view

Table view supports search bar the which uses names of parameters

Navigate to desired parameter using its name from data structure and edit it by putting numeric parameters values.

9.6. Registered data readout

Swipe right in the main app window to pass to the additional options. One of them is the Readout of Registered Data



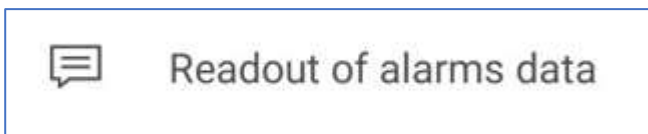
Once entered, app passes to the window of choice which data should be downloaded along with the time range of this download.

Once chosen, click on READ LOGGED DATA and wait.



9.7. Alarms readout

Similar step can be performed when there is a need to download the alarms list from the device by choosing the option Readout of Alarms.



Once entered, there are only two choices in here:

- Read all – application will read all available alarms from the device
- Set the time range of the alarms downloading

Once chosen, click on READ ALARMS and wait.

 A screenshot of a mobile application interface. At the top, the title 'Readout of alarms data' is centered. Below the title, there is a checked checkbox followed by the text 'Read all'. Underneath, there are two rows of input fields. The first row is labeled 'readout from:' and contains two rounded rectangular buttons labeled 'date' and 'time'. The second row is labeled 'readout to:' and also contains two rounded rectangular buttons labeled 'date' and 'time'. At the bottom center of the screen, there is a prominent blue rounded rectangular button with the text 'READ ALARMS' in white.


Process of downloading the registered data may take long time, depending on chosen horizon of data to download. Typically data download should not exceed 6 months.

10. Device maintenance

10.1. Battery replacement

The battery replacement procedure must be carried out in accordance with the instructions given in this chapter.



Data logger is the intrinsically safe equipment. The housing of the device should be sealed – replacement of the battery can only be carried out by an authorized person, i.e. a factory or authorized service representative or other persons authorized by the manufacturer.



It is forbidden to replace the batteries in the explosion hazard zone.



For power supply of data logger only batteries of the types: LS33600 (Saft).



Opening of device's housing is forbidden under conditions that allow ingress of water (for example rain, snow) or dirt inside the unit.



Always replace the battery with a new, full charge batteries.



Battery replacement causes break in measurements of pressure and volume but allows working of real time clock. Settings and registered data are not affected.



Inserting of „old“, partly discharged batteries will cause incorrect readouts of charge level and may lead to unexpected device operation (such as restarting, errors in counting, errors in archives and in current values).



Discharged batteries are in the hazardous waste category, therefore they must not be disposed together with common waste.

Device can be equipped with one battery with following properties:

Voltage: 3,6V

General capacity: 17Ah

Battery amount: 1

Estimated lifetime: 5 years

BATTERY REPLACEMENT PROCEDURE:

1. Detach and open the device by removing six TORX T10 screws from the back of the cover.

2. Using strong magnet or OptoBTEx activate the "r.bAtt" (replace battery) option. Wait until indicators on the left side will mute.



3. When activated "bAt 3" information will appear. Close the magnet to the OPTICAL INTERFACE until the "bAt 0" information will appear. Wait until indicators on the left side will mute.



4. "Lo bAt" information will appear. Take out the old battery and insert new one.



5. Repeat the step 3, close the magnet to the Optical Interface and perform bAt 3 to bAt 0 operation. After closing the magnet bAt 3 should automatically appear.



6. New battery recognition will be signed by "Hi bAt" information. Battery level will be set to 100%, and the icon on display will show the full bar.



7. Close the cover, place the recorder on the gas meter. Synchronize the counters.

10.2. Device erasing

Device erasing can be done using software or mobile app. Erasing requires additional authorization.

Steps to follow:

- Start the software, go to the Table view
- Find parameter ERASING
- Type in this parameter one of the following values

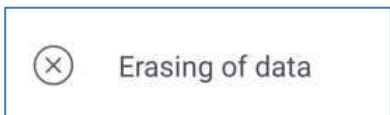
Values possible to set:

1	Settings reset – device erases settings and configuration
2	Counters reset – device erases values of the counter
4	Archives reset – device erases all the collected archives
8	Alarms reset – device erases alarms list



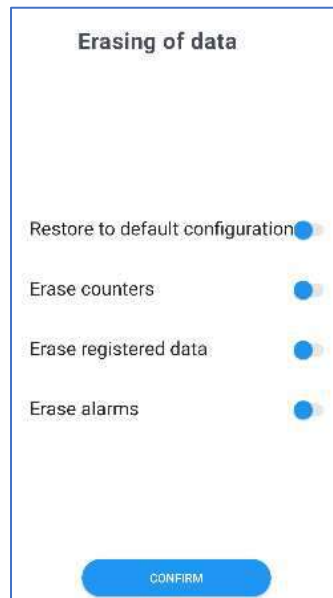
It is possible to combine the erasing types, by typing for example value 15, which means full device erasing (1+2+4+8).

Software erasing using mobile app:



Erasing of data is performed by choosing types of data to erase.

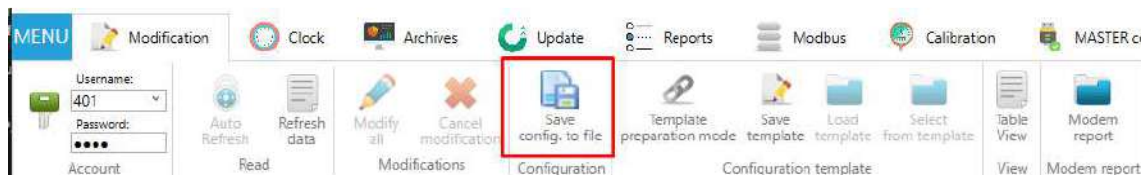
Once chosen app will ask for the password to perform the operation. Password required for this is a USER password.



10.3. Diagnostics data for Technical Staff

data logger is an electronic device which may affect damage or malfunction. For Technical Staff it is mandatory to receive following data for the diagnosis. Lack of any file may occur in diagnosis process difficult or impossible.

- **Device Parameters table**



Output file contains list of all parameters in the device – so called DP table in *.csv format.

Example Filename: _2553_1004178176_config.csv

- **Events file**



Archives Reader

Archive Type:



File Path:



Events file contains full list of events happened during device lifetime with the beginning and end date. Also lasting alarms are included in this list. Output file is saved in *.csv file format.

Example Filename: `_1004178176_alarms_20220412123546.csv`

• Periodic data



Output file contains a log with archival parameters which were registered by the device. Time range of this parameter must not be shorter than 6 months, preferably longer. Output file is in *.csv file format.

Example Filename: `_1004178176_periodical_20220412124044.csv`

• SUMMARY

PLUM Technical Staff shall receive 3 files:

- Device Parameters table: data logger_2553_1004178176_**config**.csv
- Device Events table: data logger_1004178176_**alarms**_20220412123546.csv
- Device archives (at least 6 months back): data logger_1004178176_**periodical**_20220412124044.csv

10.4. Troubleshooting

Once installed, device does not require special actions and supervision. Proper installation guarantees uninterrupted work of the device within its full lifetime. Device requires only periodical examination according to EN 60079-17 standard.

Periodical examination frequency: minimum once a year. Close eye inspection required.

Spontaneous examination frequency: adjusted depending on environmental conditions. Detailed close eye inspection required.

In some certain conditions device can work improperly, due to lasting alarms or configuration mistakes. In the table there are presented most common appearing malfunctions with reasons and solutions for these.

ISSUE	REASON	SOLUTION
Device does not start after removing divider from battery pole	Startup procedure not executed properly	Follow the SLEEP-3 to SLEEP-0 procedure to wake up the device
	Battery damaged/discharged	Measure the battery voltage, it should be around 3,6V. If any other, replace the battery.
	Device malfunction	If battery has correct voltage and despite replacement device is not waking up it can be malfunction of whole unit.
Fast battery discharging	Often data schedule	PLUM declares battery lifetime on 5 years in specific conditions. When device is sending data often, battery lifetime can be shortened.

	Battery damage	Measure the battery voltage, it should be around 3,6V. If any other, replace the battery.
	System reads out data too often or too long – in case of system working in call window modes	Check setting in the system. Typical time of connection should be not more than 2 minutes. If connection time is higher, check settings in the system.
	Constant low level of CSQ	Device requires more energy when time of sending data is extended what can be caused by low level of GSM signal. Replace the antenna or place it outside of the cabinet or hole.
Device does not measure gas volume	Wrong gas meter type chosen	Check in the configuration apps if the correct type of gas meter is chosen. Any other than Elster/Honeywell and Metrix/Apator must be cable type.
	Magnetic interferences	Check if the triangle icon is blinking on the devices display. This can mean magnetic field presence interrupts the measurements
	Wrong pulse factor chosen	Check in the configuration apps if the correct pulse factor is chosen. Wrong pulse factor can cause improper pulses counting
	Incorrect cable connection in terminals chamber	Check if the cables are correctly connected. Pulse cable shall be connected to terminals DI1+/GND. Tamper switch to DI2+/GND
	Damaged gas meter	Gas meter can be also damaged. Reed switch may not generate pulses – speaking of cable connection, or magnet in totalizer of diaphragm meter is not present or moved not allowing for pulse inputs activation.
Device does not measure pressure or measures wrong	Atmospheric pressure indication has impact on the measurement	Using mobile or desktop app and perform procedure of pressure indication zeroing before installation.
	Incorrect installation of the sensor	Improper sealing, crooked tightening of the sensor can cause gas leaks and pressure drops. Ensure installation is performed with keeping all standards.
	Sensor malfunction	If another device works well in the same location and the one faulty does not work anywhere and pressure fluctuates it means the damage. Device must be sent to Manufacturer.
Despite installed SIM card device does not send data	Not working SIM card or badly installed	Replace the SIM card and try once again to connect. Ensure if the SIM is placed correctly – especially for micro-nano SIM cards which are thinner than only micro SIM.
	Wrong APN	Ensure in the mobile or desktop app if the APN is correct. If yes, try the next steps.
	Wrong PIN	Ensure on the display if the lock icon is not present. If not – follow to the next step.
	Wrong data server address	Ensure in the mobile or desktop app if the destination address of data sending is correct. If yes – try the next steps.
	Low GSM signal level	In some certain conditions like installation in deep environment, underground, device can have limited GSM range what sometimes may cause data sending discontinuity. Try to use higher gain antenna or SIM of another provider
	Broken antenna	Replace the antenna and try again

	No antenna	Attach the antenna if missing
	Low battery	When battery is low it may not generate enough energy to launch the modem. Check battery voltage in moment of modem start – it should be around 3,3V. Any lower indication may inform about low battery. Replace the battery and try again.
Local readout through optical interface does not work	Optical interface not connected	Optical interface, i.e. OptoBTEx must be turned on and paired with the smartphone or added to PC Bluetooth devices list.
	No communication between application and optical head	Pair the device with mobile phone or PC and try again. Turn on Bluetooth in mobile phone or PC.
	Malfunction of optical head or MacR6 circuits	Check the icons on the device display. If optical head is connected, proper icon should appear. If there is transmission – two arrows should be visible. If not – manipulate the optical head position. If still nothing – replace the interface and restart the test.
	Dirt or any obstacle making difficulties in communication	Ensure if the surface of the optical elements in interface is clean and the same for optical window in MacR6. Prevent from making scratches on both surfaces.
	Wrong or outdated application	Ensure if the app is correct – is it ConfIT data loggers, not ConfIT volume converters. Always keep app updated.
	Improper COM port chosen in PC or wrong speed	Ensure if the port is proper and if speed is set to 9600.
	Optical interface circuit shut down	When optical interface is placed on MacR6 for more than 5 minutes without any transmission, circuits shut down to prevent battery discharging. Take out and put the optical head once again to turn on the circuits.
Parameters modification does not work	Wrong app used	Ensure if the app is correct – is it ConfIT data loggers, not ConfIT volume converters. Always keep app updated.
	Outdated app	Update the app
	Wrong password for modification	Ensure if the user is chosen to be USER-000 with password 4096 in mobile or desktop app.
	Value out of programming range	Ensure if the programmed value is not out of the range, i.e. possible values; 1 to 3. Input value – 4.

10.5. Alarms list

This paragraph contains of full list of alarms with short description of appearing conditions:



There are two types of the alarms – lasting and momentary. In lasting alarms, beginning and end date and time is different, according to time when alarm started and ended. Momentary alarms have the same date and time of beginning and end.

CODE	NAME	DESCRIPTION	ALARM TYPE
0	Device start	Device start after storage mode or after restart (firmware change)	Momentary
1	Time change	Modification of internal clock	Momentary
2	P1 limit warning min	P1 warning limit min exceeded	Lasting
3	P1 limit alarm min	P1 alarm limit min exceeded	Lasting
4	P1 limit warning max	P1 warning limit max exceeded	Lasting
5	P1 limit alarm max	P1 alarm limit max exceeded	Lasting
6	P2 limit warning min	P2 warning limit min exceeded	Lasting
7	P2 limit alarm min	P2 alarm limit min exceeded	Lasting
8	P2 limit warning max	P2 warning limit max exceeded	Lasting
9	P2 limit alarm max	P2 alarm limit max exceeded	Lasting
10	P Zero setting	Zeroing of the pressure sensor indication performed	Momentary
11	Schedule change	Modification of the reporting hours	Momentary
12	Report error	CSQ level is less than 7 during sending report. This does not have to mean report sending is failed. Data transmission can be successful even with low signal level.	Lasting
13	Battery discharged	Battery level is 10%	Lasting
14	Battery replaced	Battery has been replaced successfully	Momentary
15	Erasing	Device was erased	Momentary
16	Installation	SER-5 / INSTAL menu has been performed	Momentary
17	Transition by 0	Counter reached it maximum capacity and reverted to 0	Momentary
18	V1 change	V1 counter value was changed	Momentary
19	V2 change	V2 counter value was changed	Momentary
20	Imp LF1 change	Pulse factor for V1 was changed	Momentary
21	Imp LF2 change	Pulse factor for V2 was changed	Momentary
22	Gas meter 1 change	Gas meter SN 1 was changed	Momentary
23	Gas meter 2 change	Gas meter SN 2 was changed	Momentary
24	Magnetic/cable interruption	There is a magnet or cable cut detected	Momentary
25	Case opened	Device case is opened	Lasting