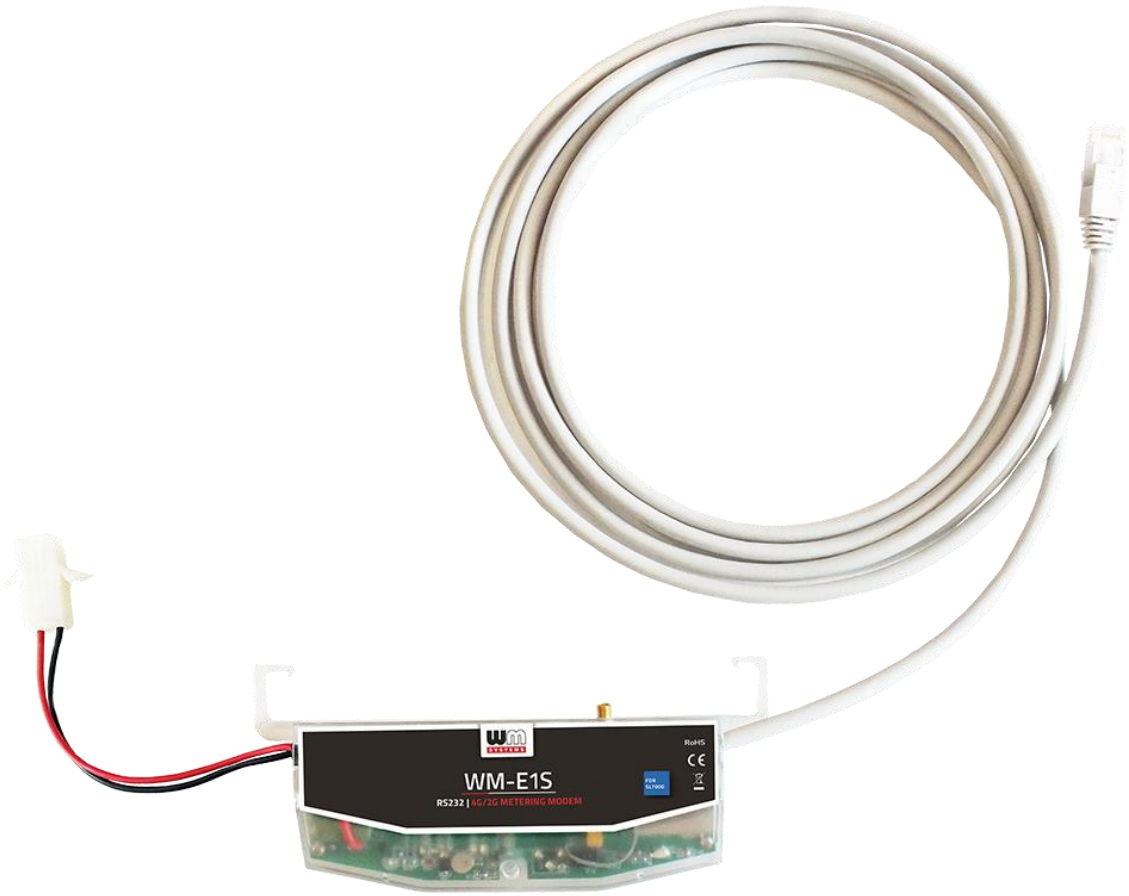
Datasheet and User manual for WM-E1S® 4G modem to the Itron® SL7000 electricity meters



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Document specifications

This documentation was made for presenting the installation and configuration steps of the WM-E1S 4G® electricity metering modem.

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Chapter 1. Introduction

The **WM-E1S 4G**® is a modem, which is suitable for automated remote reading of electricity meters remotely, on the 4G LTE-based cellular network.
You can save money by using our modem, because there is no further need of manual readout of the connected meter systems.

Wireless communication

Over the 4G communication, the device has 2G fallback feature, therefore in case of outage/inaccessibility of the 4G network it is communicating further on the 2G network.
It supports the multi-operator SIM and the roaming feature, and it is compatible with SIM-Toolkit.
The modem has been designed to provide transparent data link from the meter to the server.
It can be used with push data transmission method, thus the modem can initiate the communication with the AMR centre periodically at a pre-programmed time interval or triggered by an alarm (power outage, cover removal, reverse run, etc.)
The communication module is a part of the Smart Metering concept. The device provides a SIM-card independent- and mobile operator independent solution.

Design and installation

This modem was especially developed for the 3-phase **Itrón® SL7000** electricity meters, which can be connected to the meter by its design and its connection interface. It is installable to the meter as an external modem – due its DIN-rail adapter (provided to the modem) - which allows to fix the device.

Operation properties, features

The modem is suitable for reading the meter's actual and stored consumption values, access the recorded event log, read the load profile data, and read or modify the parameter set of the meter - remotely. It can be accessed remotely through the cellular network (by the Telit® module) and it is able to send data on the Internet by using an APN.

Power source and power outage

The device can be powered from the meter's mains connection (by general 100V-240V AC voltage).

The modem can be connected through the following modes:

a.) the meter is connected to the 57.7/100V AC power network: the modem must be connected to **line** voltage (100V, L1..L2 or L2..L3 or L1..L3)

b.) the meter is connected to the 230/400V AC power network: the modem must be connected to the **phase** voltage (230V, L1..N or L2..N or L3..N)

Configuration

The modem is configurable via TCP/UDP port remotely (or via local serial connection) and operating on the wireless network by configuring the APN, username and password (APN information is provided by your local mobile operator).

All settings can be configured with our administration tool (the WM-E Term® software), but also API available so our partner can easily adapt their current administration environment.

The configuration is possible by one device or for a group of devices.

The WM-E Term® tool is password protected and user management is also possible. The configuration tool requires Windows® platform to be executed, and it is available in several languages as well.

Firmware refresh

The WM-E Term® also provides safe firmware change for one or group of devices – by locally or remotely.

Security

The product's firmware is encrypted and prevented against to upload firmware or data from other devices. The modem cannot be upgraded by any other 3rd party firmware – its safe.

The data communication between the modem and the meter is transparent (optional TLS (Transport Layer Security) capable firmware can be requested).

Status and notification

The modem is continuously monitoring the mobile network and device communication health, and can send status information (signal strength, QoS).

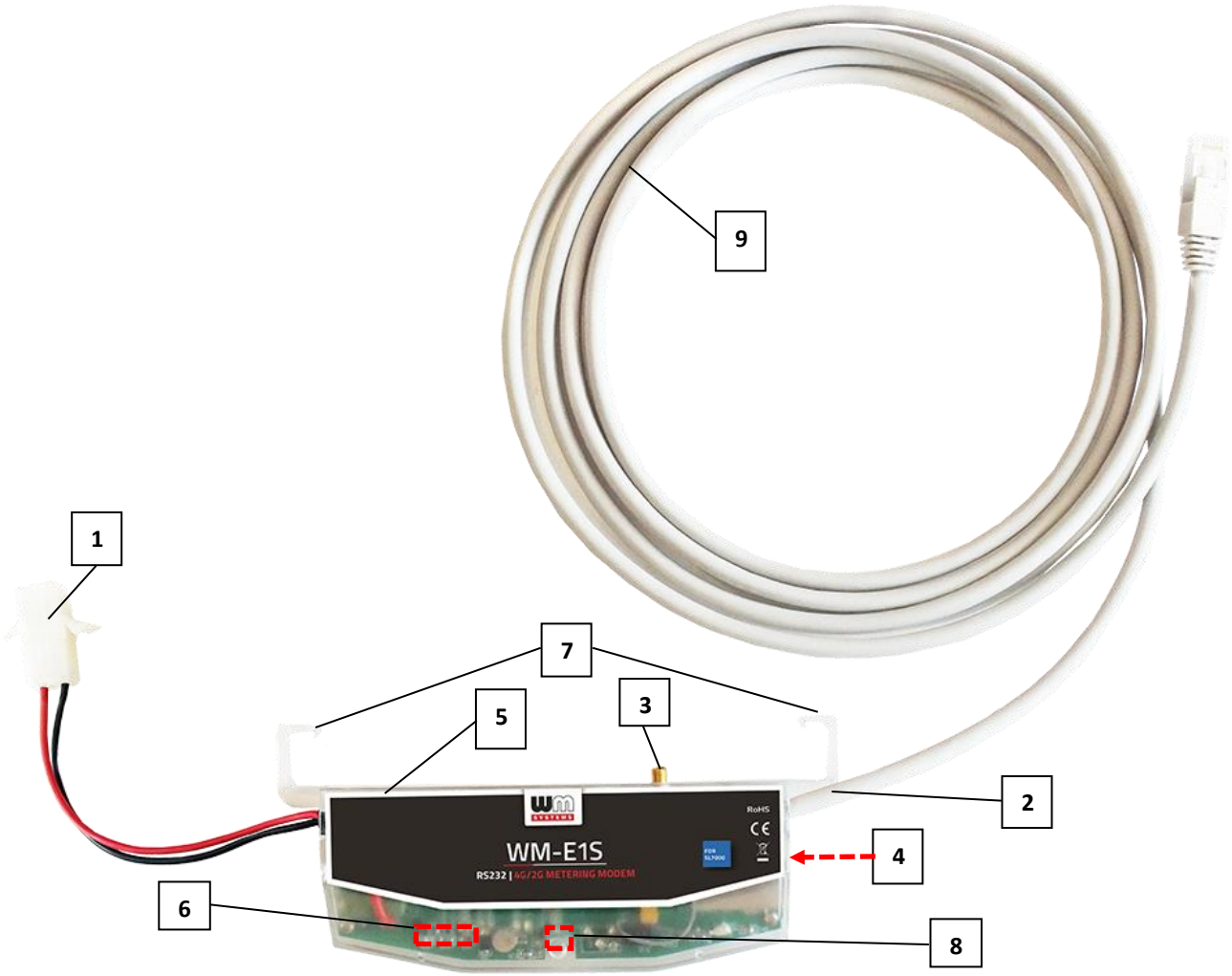
By the configured features, the device is able to send SMS alarm notification (depending on the used cellular network and mobile operators - if the SMS notification is not disallowed on the network, then it can be used) and optional Last Gasp notification (power outage alert sending).

Certification

The modem is accomplishing with the CE standard and the Radio Equipment Directive (2014/53/EU), safety directives (EN 60950-1).

Chapter 2. Connections

2.1 Connectors, interfaces



1 – Mains pigtail connector* (100-240V AC - to the meter's AC connector)
2 – RS232 connector (for RJ45 – data connection between the modem← → meter)
3 – External antenna connector (SMA-M, 50Ω)
4 – SIM card slot (mini SIM, insert-push, type 2FF – at right side of modem)
5 – Modem enclosure (transparent, plastic)
6 – 3pcs Status LEDs
7 – Hooks to fix the modem case into meter enclosure (optional)
8 – Fixation screw of top modem enclosure
9 – Meter data cable (for the RJ45 – data connection between the modem← → meter)
10 – DIN rail adapter (backside)

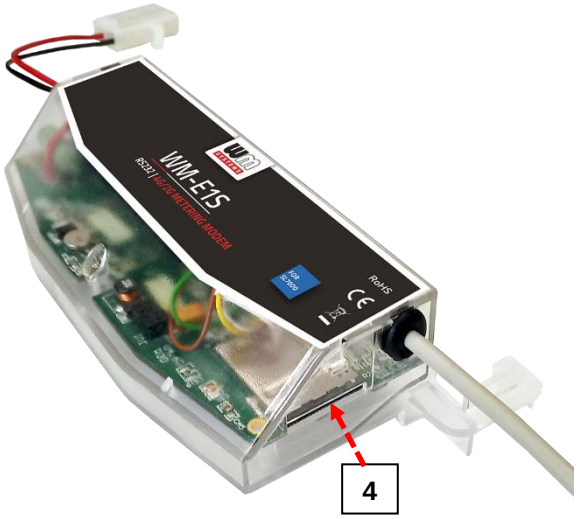
**Note that the modem power plug can be connected through the following modes:*

*a.) the meter is connected to the 57.7/100V AC power network: the modem's AC power plug must be connected to **phase** voltage (100V, L1..L2 or L2..L3 or L1..L3)*

*b.) the meter is connected to the 230/400V AC power network: the modem's AC power plug must be connected to the **line** voltage (230V, L1..N or L2..N or L3..N)*

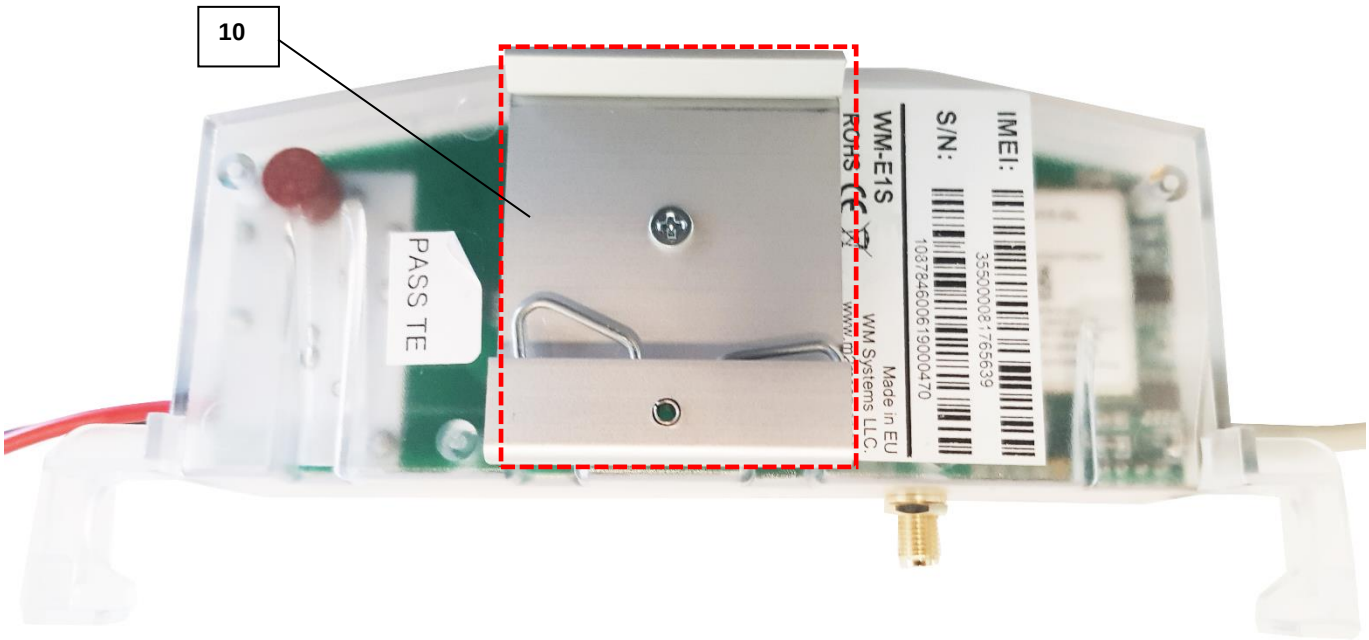
2.2 Installation steps

Step #1: Ensure that the device is not powered on or remove the AC connector (1) from the meter.



Step #2: Insert a replaceable and active SIM card (which uses APN) into the SIM-holder (4). The SIM chip looks down, the cutted edge of the SIM is oriented to inside of the modem. Then push the SIM until it is fastened (you will hear a click sound) to the SIM slot.

Step #3: Make the RS232 data connection between the modem and the Itrón® SL7000 meter by the RJ45 interface (2) using the provided and integrated data cable of the modem.



Step #4: Install the modem enclosure (5) by using the 35mm DIN-rail adapter (10) to fixate on rail (which can be seen on the figure). Therefore the modem position can be fixed.

Step #5: Mount a 4G antenna (SMA, 50 Ohm) to the SMA antenna connector (3) of the modem. ***Important!*** *For the successful communication of the modem you need to use a 4G antenna!*

Step #6: Remove the Itrón® SL7000 meter's communication module plastic enclosure by releasing the screw from the top of the plastic middle part of the cover interface – according to the meter's installation manual.

Step #7: Connect the modem's RJ45 data cable (9) to the modem's RJ45 port (2) to the meter's RS232 port.

Step #8: Connect the modem's AC Power plug (1) to the meter's Power input line (in case of using 100V AC) or connect to **2-phase** (in case of using 57.7V voltage as power source).

Step #9: Then the modem will be power supplied by the meter and the modem will start its operation and the LED signals are signing the current activity.
Now you can use or configure the modem.

2.3 Description of the RJ45 connector

Connect the provided RJ45-type RS232 cable (9) to the modem's RJ45 communication interface (2).
The Itrón® SL7000 meter's RJ45 connection pinout can be seen in the following table.
Please note, that the modem side of the connector pinout is the opposite / counterpart to the meter's side.

Pin # (RJ45)	Legend
1	**VMDM Approx +10V DC at 100mA (0.9W max.)**
2	**No connection**
3	**No connection**
4	**RX (Data request)**
5	**TX (Data transmit line)**
6	**0V – Ground**
7	**DTR**
8	**No connection**

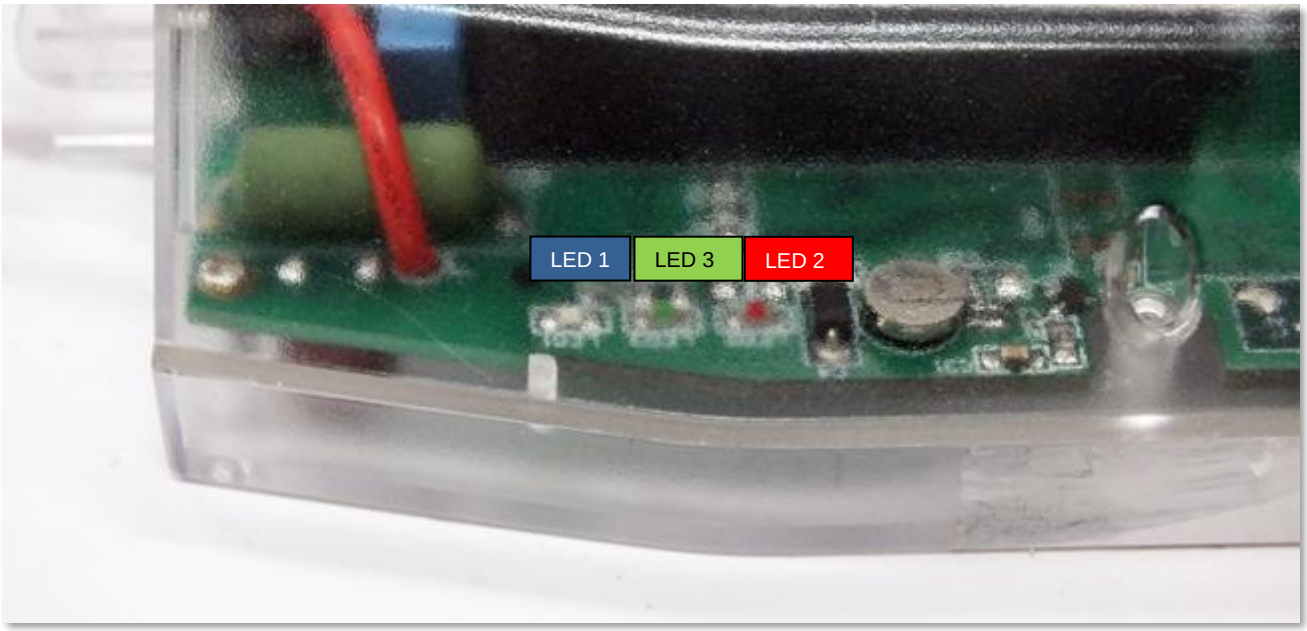
2.4 Status LED signals

Factory default LED signals:

LED identifier	Events

LED 1
GSM / GPRS status
	• **During** network **registration**: led is ***active***
	• **During** network **search**: ***blinking once per second***
	• When **connected to the network** and the **IP connection** is okay: ***blinking twice per second***
	• When the mobile **network** access technology was **changed**: ***quick flashing will be relied:***
	  ○ 2G → ***2 flashing per second***
	  ○ 3G → ***3 flashing per second***
	  ○ 4G → ***4 flashing per second***
	• If no network is detected: the led will be **blank**
	• The LED is **lighting** continuously during CSD call the IP data transmission

LED 3 **E-meter status**	• During the **transparent meter communication**: ***twice per second***. • At finish of the transparent communication: led is ***blank***. • According the **IEC meter status**: the LED will be ***active***. • In case of configuring the **Multi Utility mode**: led will be ***active*** or ***blank***.
LED 2 **Firmware status**	• When the **modem has been initialized**: ***led is active*** • **Firmware refresh**: ***no led change*** • When the **modem** has been **started**: ***flashing in every 2 seconds***



The LED number we listed here is the same as can be found on the PCB – from left to right the sequence is the following: LED title **LED1** (**blue**, left), **LED3** (**green**, middle), **LED2** (**red**, right)).

Over the factory default settings, the operation of the LED signals and its sequence can be changed by the **WM-E Term®** configuration tool, at the **Standard Meter Interface** parameter group, where you can define one of the following functions of the leds (LED1..LED3) according the next list:

Further configurable LED status signals:

LED status	Event
E-meter relay status – Relay* output status (not available on this modem)	• Default: "Ready" / stand-by – the LED is **flashing once per second** • "Active" mode – **at *relay switching turns on the LED** • "Normal" mode – **at *relay release turns off the LED**
M-Bus status	• Not used
Firmware statusz	• If the modem firmware starts the **LED will be active** • If the meter←→modem connection was built up, the **LED is flashing twice per second**

Network status and access technology	• Network registration: the **LED is active**
	• During the network searching: **flashing once per second**
	• When connected to the network and the IP connection is fine: **flashing twice per second**
	• If the cellular network access technology was changed: **signed by quick flashing** *according the technology by the following:*
	  ○ 2G → *2 flashing / second*
	  ○ 3G → *3 flashing / second*

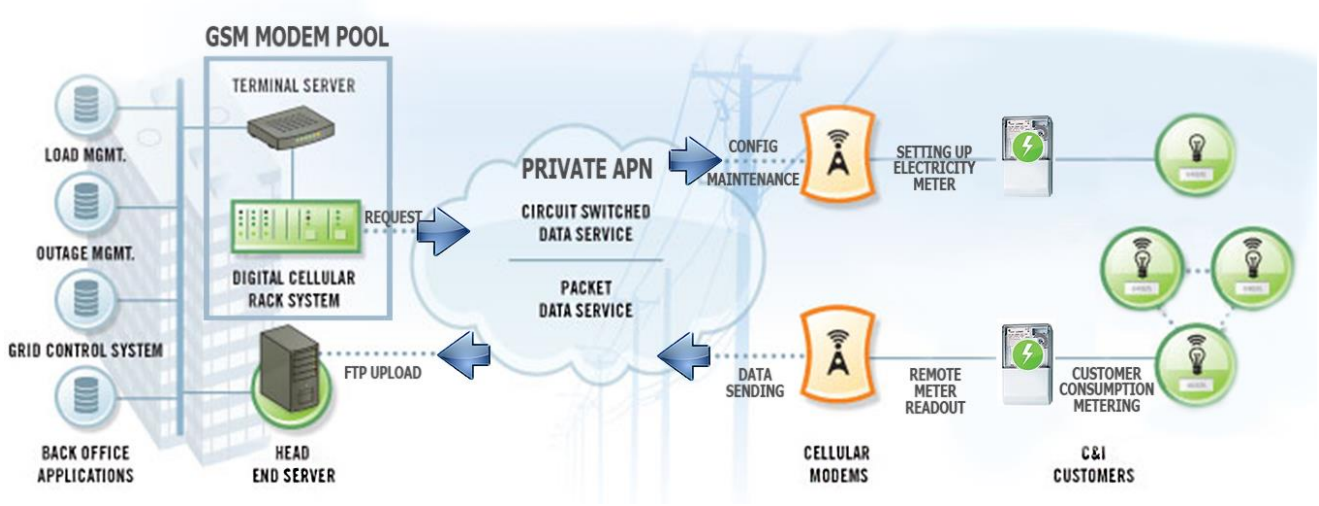
	○ 4G → *4 flashing / second* • If there is no available network: the **LED is inactive**
Meter status with IEC polling	• When the modem←→meter starts the communication, the **LED is flashing once per second.** • When the meter answers to the modem during the communication, the **LED will be turned on.** • When the modem cannot communicate with the meter permanently, the **LED will be turned off.**
AMM (IEC) client state	• By default, or in case of finishing the communication of the modem←→EI client the **LED is turned off** • During the modem←→ EI client ** connection build-up the LED **flashing shortly once in every second** • The EI client** at login requrest **– flashing once per second** • The EI client**←→modem communication was built– **the LED is active**

**The listed relay can be used for control the power supply of the e-meter. This is not used for tariff change!*

***The EI client is the transparent TCP channel from the modem to the EI server*

2.5. Operation of the modem

The complete readout and data sending mechanism to the centre and the other direction for the configuration and maintenance tasks can be realized on the defined paths.



There is an another option and meter data sending mode to initiate a remote readout automatically in the pre-defined intervals. Anyway, it is also possible to start the data sending in case of different events (e.g. removal of meter cover, incoming SMS message from the centre).

In this situation the modem is connected to the mobile data network only during the time of the data transmission.

The devices needs to be connected to 4G or 2G network for its proper operation.

2.6 Power outage management

The modem supports the LastGASP feature, which means that in case of power outage the modem's supercapacitor allows to operating further the modem for a short time (a couple of minutes).

In case of presence of the super-capacitor parts, the modem is the detecting the loss of mains/input power source, and it generates a "POWER LOST" event, when the message will be immediately transmitted b an SMS text to the configured phone number.

In case of recovering the mains/power source the modem generates the "POWER RETURN" message and sending by SMS text.

The LastGASP message settings can be enabled by the WM-E Term® application – in the AMM (IEC) parameter group part.

Chapter 3. Modem Configuration

3.1 Configuration

The modem must be configured by the WM-E Term® software by configuring its parameters which must be performed before the normal operation and usage.

Over the parameter settings of meter, modem and communication, you can also test the modem communication by the configuration program.

Important!

During the configuration, you have to remove the meter-modem RJ45 connection (2) and you have to connect the modem's connector to your computer by the following hints.
Until the configuration the modem is not connected to the meter, therefore it cannot readout the parameter values through the RJ45 interface.

The modem can be connected with the RJ45 cable (2) and by using the RJ45-to--USB converter by directly to your computer.

Important!

During the configuration, the power supply of the modem must be assured by its AC plug from an external power source (from 100-240V AC or by the meter 57-100V AC).

Use the WM-E Term® configuration software to perform the settings according its user manual – check the manual for settings.

For the proper communication of the modem, you have to configure at least the APN settings of the SIM – as PIN code, APN, username and password. These all can be configured by using the WM-E Term® software through the RJ45 connection.
For the successful operation of the communication module it is necessary to have appropriate signal strength.
If you want to readout the meter parameter values during the PC-modem connection, after the RJ45-configuration you made, then you should select a different configuration port to the meter as TCP/IP or Optical, etc.

3.2 Configuring the modem by WM-E Term®

The Microsoft .NET framework runtime environment is required on your computer.
For modem configuration and testing you will need an APN/data package enabled, active SIM-card with.
Sure, the configuration is possible without a SIM card, but in this case the modem is performing restart periodically, and some modem features will be not available until the SIM card is inserted (e.g. remote access).

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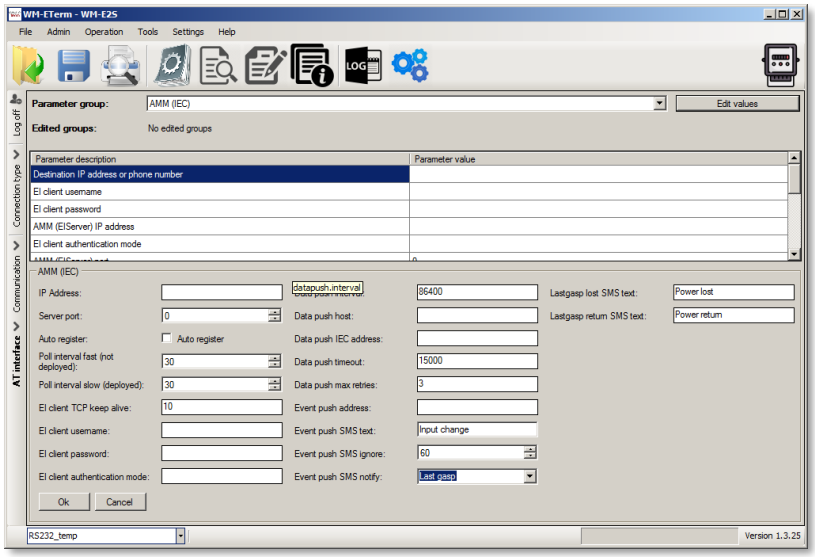


If the modem was not supplied by power for a long time, it needs to be charged before usage. It takes about ~2 minutes to charge if it the supercapacitor was exhausted / discharged. *See: LED signals part*

Download the WM-E Term® software by this link from your browser:
https://www.m2mserver.com/m2m-downloads/WM_ETerm_v1_3_78.zip

Unzip the .zip file and start the software by the *WM-ETerm.exe* file.

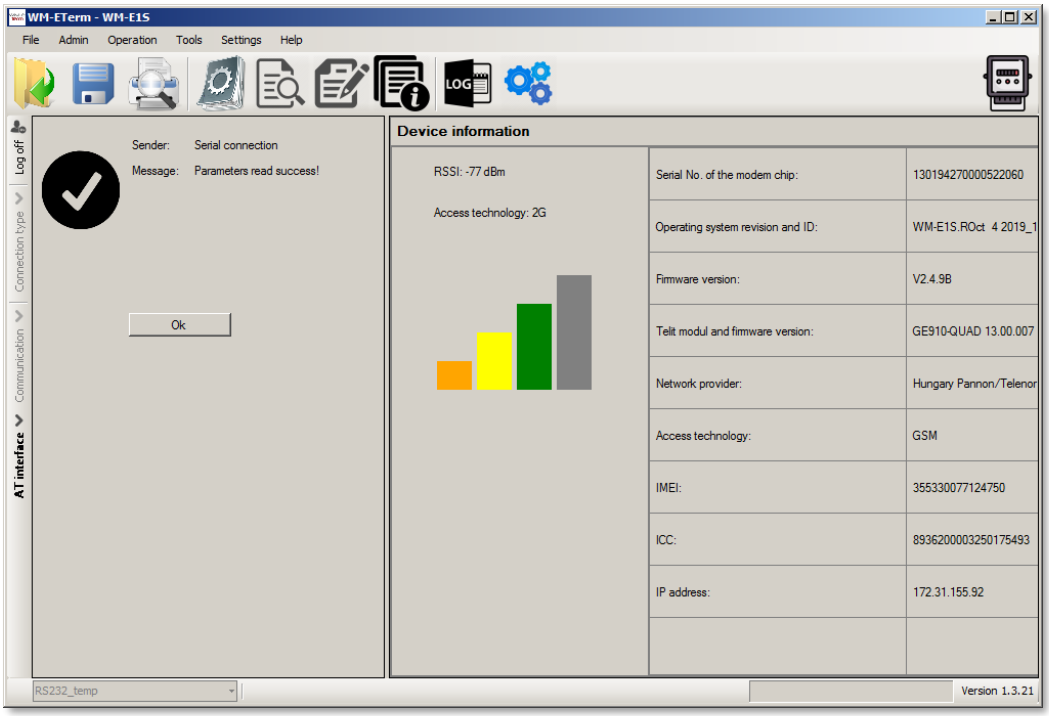
You can login into the configuration software by the default password. You can change the password for the configuration anytime you want. Check the WM-E Term® *User Manual* for more!

WM-E term description:

https://www.m2mserver.com/m2m-downloads/WM-E-TERM_for_SAPHIR_User_Manual_V1_64.pdf

3.4 Signal strength

Check the *WM-E Term*® program's *Device information* menu item – or simply use the  icon. Check the RSSI value that the available signal strength is enough (yellow means average signal quality and the green means the good). When you get poor signal quality, change the antenna position or direction until you will receive better dBm value (the status must be read again bedfore recheck).



3.5 Parameter configuration

The general operation requires to make the cellular communication settings and SIM settings of the modem (APN, APN username, password and PIN code, network usage method).

The meter communication requires to define the communication port, the RS232 settings (transparent mode, baudrate, data format, transmitting speed), LEDs settings and to save the settings by the WM-E Term® software then upload/send to the modem by the *User Manual* of the software.

Main settings:

1. Choose the **Parameter read**  icon to connect to readout the current settings of the modem.

2. Choose the **APN** *Parameter group*, and push to the **Edit settings** button. Add the *APN server name* value, if necessary give the *APN username* and *APN password* values and push to the **OK** button.

3. Then choose the **M2M** *Parameter group,* and push to the **Edit settings** button. At the *Transparent (IEC) meter readout port,* give the *PORT number*, which you are attempted to readout the meter. Add this *PORT number* to the *Configuration and firmware download*, which you want to use for remote paraterization of the modem / for the further firmare exhange.

4. If you have to use *SIM PIN* then choose the **Mobil network** *Parameter group*, and add the *SIM PIN* to the field. Here you can change a *Frequency band* 4G only, LTE to 2G (for fallback feature), etc). You also can select here a dedicated mobile network provider (auto or manual). Then push to the **OK** button.

5. The RS232 serial data port transparent settings can be made at the **Trans. / NTA** *Parameter group*. The default settings: Multi utility mode: *transparent mode*, Meter port baud rate*: 9600, Fix 8N1 data forma tat meter* – enable the checkbox). Ny Then push to the **OK** button.

6. At the RS485 settings change the *RS485 mode* to *disable* value. Then push to the **OK** button.

7. When you have finished, choose the **Parameter write**  icon to send the changed settings to the modem. The status of the configuration process can be seen at the bottom of the screen. At the end of the upload, the modem will be restarted and operating according to the new settings.

Further options

- To refine the modem handling choose a **Watchdog** *parameter group*.
- Save the current last good configuration at the File/Save menu item. Later you can distribute this setting (file) to another modem devices by one click.
- Firmware refresh: choose the **Devices** menu, **Single Firmware refresh** item by choosing the appropriate firmware file (with .DWL file extension).

Attention! Ask our sales about the available newest firmware!

Chapter 5. Legend

GSM

GSM (Global System for Mobile Communications) is the most popular standard for mobile telephony systems in the world. GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity.

GPRS

General Packet Radio Service (GPRS) provides more efficient packet-based data transmission directly from the mobile phone at speeds similar to HSCSD.

GPRS extends the GSM circuit switched data capabilities and makes some additional services possible.

4G LTE

LTE, an abbreviation for Long-Term Evolution, commonly marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is based on the GSM/EDGE and UMTS/HSPA network technologies, increasing the capacity and speed using a different radio interface together with core network improvements. The standard is developed by the 3GPP (3rd Generation Partnership Project) and is specified in its Release 8 document series, with minor enhancements described in Release 9.

LTE is the natural upgrade path for carriers with both GSM/UMTS networks and CDMA2000 networks. The different LTE frequencies and bands used in different countries will mean that only multi-band phones will be able to use LTE in all countries where it is supported.

RS232

In telecommunications, RS-232 (Recommended Standard 232) is a standard for serial binary single-ended data and control signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pinout of connectors.