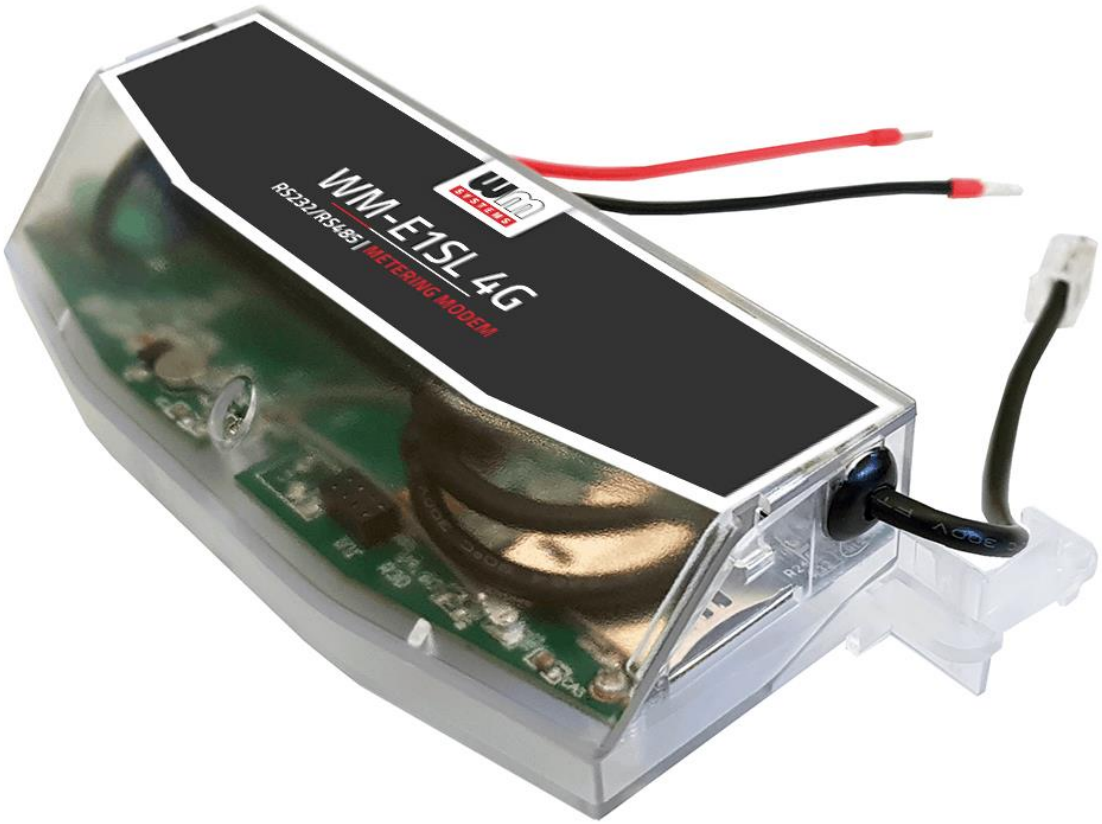
Datasheet and User manual for WM-E1SL® metering modem



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Document specifications

This documentation was made for presenting the installation and configuration steps of the **WM-E 1SL®** energy metering modem.

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Chapter 1. Introduction

The **WM-E1SL**® 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 furthermore there is no need of manual readout of the meter systems.

It can also be used as an external modem - for a universal meter with any standard connector. This solution also means the possibility of future expansion, which is a great help especially in cases where the installation space is scarce.

Using the modem can save you time and money by eliminating the need for on-site manual reading of meters.

Wireless communication

The 4G version has 2G and 3G 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 modem can be configured to GSM-CSD connection also - e.g. when using a 2G module, receive the CSD calls.

The modem is independent of the mobile service provider and includes a removable SIM card.

Your device supports multi-operator SIM cards and roaming.

Design and installation

This modem was especially developed for the **Landis+Gyr® E350 / E450 / E650 electricity meters (ZxD and ZxG type)** energy meters, which can be connected to the meter by its design and its connection interface and can be installed into the meter enclosure's terminal cover.

Design and compatibility

The device can be also installed to the meter as an external modem – due an optional rail-adapter (order option) - which allows to fix/mount the device.

Therefore, the modem is available with several data connectors, so it is suitable for connecting any meter with a standard connection. In addition, it is also compatible with:

- with Itron® meters
- with Saphir® electricity meters
- also can be used as external, universal modem for any standard meter (with DIN rail adapter with optional mounting)

The modem is connected to the meter via the meter's RS232 / RS485 data connector. The device can be installed under the sealed terminal cover of the measuring service provider, without replacing the seal certifying the first verification or the non-destructively sealed measuring housing. For each model, the modem housing can be ordered with a mounting tab compatible with each meter type - for proper mounting. It can also be installed and secured as an external modem, with the help of a DIN-rail adapter unit (which can be ordered as an option), and can be fixed to the underside or back of the modem housing - thus securing it.

Operational characteristics

The device can be accessed remotely via the mobile network and is capable of sending data over the Internet using an APN.

The modem is thus suitable for retrieving current and stored measurement data, reading recorded event log and load curve data, and reading and remotely managing meter parameter files.

The modem is basically prepared for transparent data transmission between the metering server or metering service provider, with CSData call (only for 2G network setting!) And via mobile internet (TCP) connection (“PULL” mode) suitable for electricity meter registers. and remote reading of load curves, use of standard reading commands, remote reading and modification of the meter / parameters, updating of the meter application firmware.
Over the RS232/RS485 compatible data connection, some models have the 2-Inputs option (for sabotage or relay/tariff switch status). In case of input line presence, the device is able to detect the input signal changes and generating and transmitting SMS alert notification.

Data connection

The modem has RJ12 connector (with RS232 and RS485 compatible).

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)

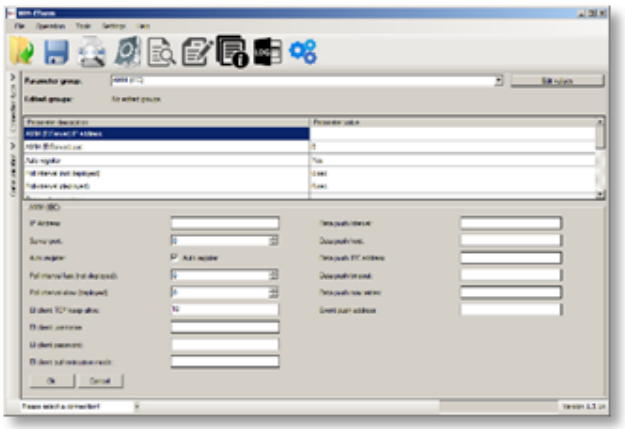
In case of the need of using external DC power, the modem can be orderd in DC-voltage version.

Supercapacitor

The modem is also available with a power outage protection by an optional supercapacitor component, which allows to continue the modem operation in case of minor power outage(s).
In case of a power outage, the supercapacitors will discharge by time, and the modem will shut down. When the power supply returns, the modem restarts and sends data over the cellular network, and the capacitor components will be charged).

Configuration and firmware refresh

The modem can be configured locally via RS232 port, remotely with a CSData call (only if you use a setting that also uses a 2G network!) Or via a mobile internet (TCP) connection, and its firmware can be updated.



The modem is configurable via TCP 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 run. It is available in English and some local languages as well (as French, Spanish, Czech, etc.).

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 control port of the modem is encrypted by AES (by option), or can be ordered with TLS protocol usage.

The external flash- and the internal flash content of the device are encrypted.

All security protocols can be activated/deactivated by authorized client.

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, Last Gasp 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).

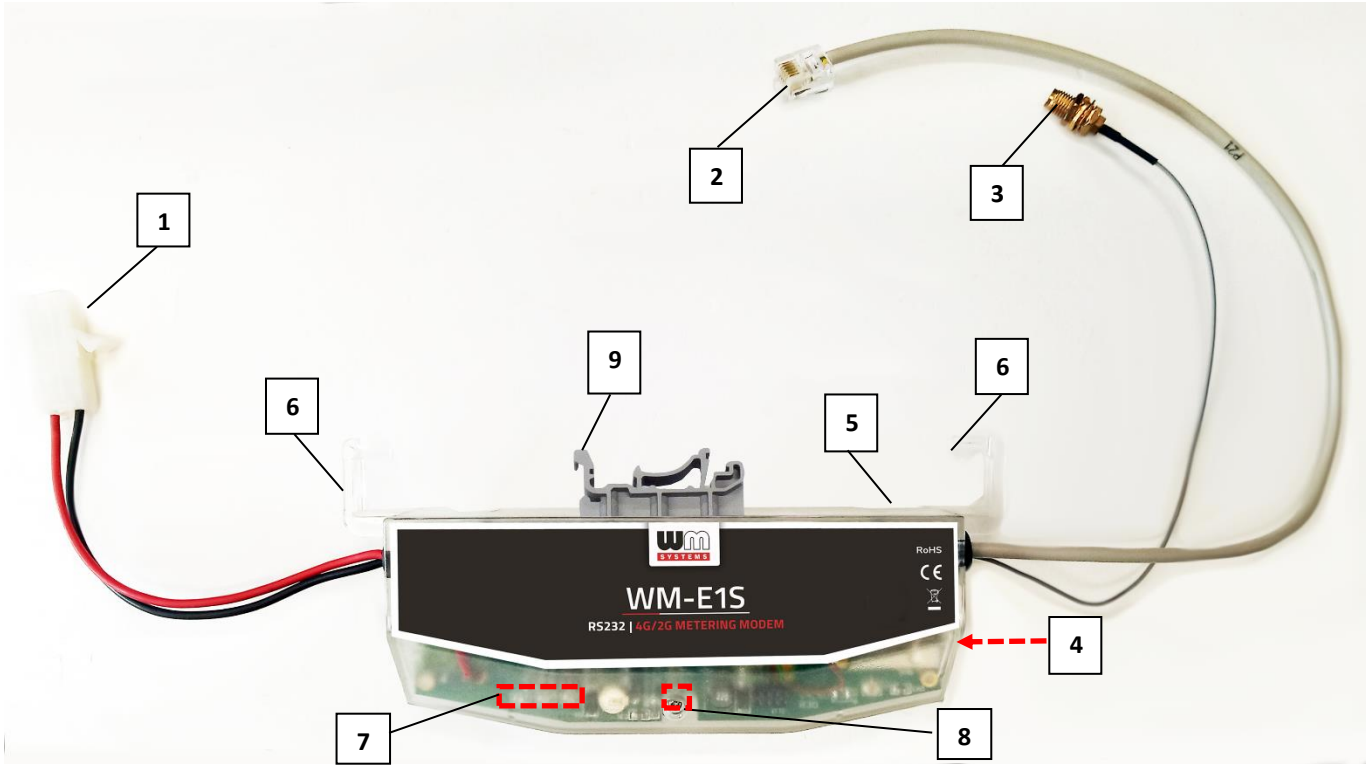
The LastGASP SMS notification feature is available by some models for case of reporting the occurred possible power outages.

Certification

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

Chapter 2. Connectors, interfaces

2.1 Modem with RJ12 connector (RS232)



1 – Mains connector (100V AC - to the meter)

2 – RS232 connector (RJ12 – data connection modem← → meter)

3 – External antenna connector (SMA-M, 50Ω)

4 – SIM card slot (mini SIM, insert-push)

5 – Plastic holder (lower plastic case fixation to the upper plastic case)

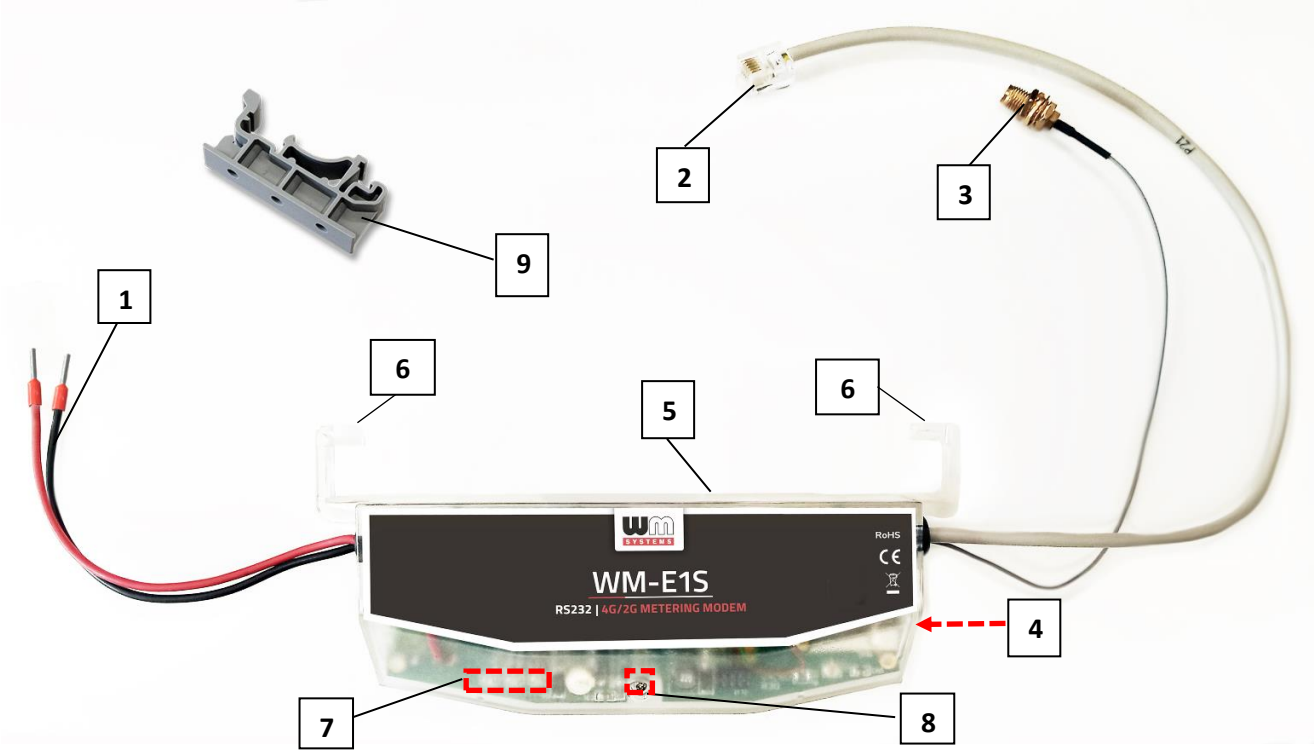
6 – Plastic hooks to fix the modem case into the meter coverage – optional

7 –Status LEDs

8 – Fixation screw of top modem enclosure

9 – DIN-rail adapter (order option) to fixate/mount to wall

2.2 Modem with RJ12 connector (RS232) for Landis + Gyr® meters with DIN-rail adapter option



1 – Mains connector connector (pigtail connector for the AC power of the meter)

2 – RS232 connector (RJ12 – for data connection modem← → meter and for configuration of the modem)

3 – External antenna connector (SMA-M, 50Ω)

4 – SIM card slot (mini SIM, insert-push)

5 – Plastic holder (lower plastic case fixation to the upper plastic case)

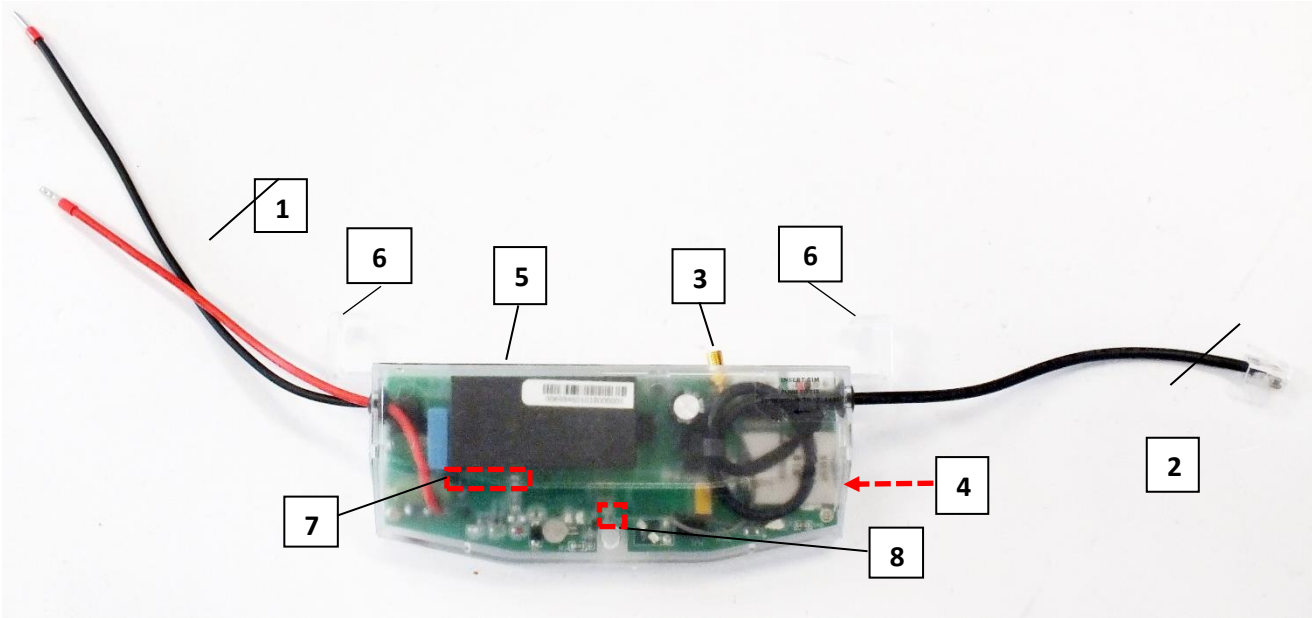
6 – Plastic hooks to fix the modem case into the meter coverage – optional

7 – Status LEDs

8 – Fixation screw of top modem enclosure

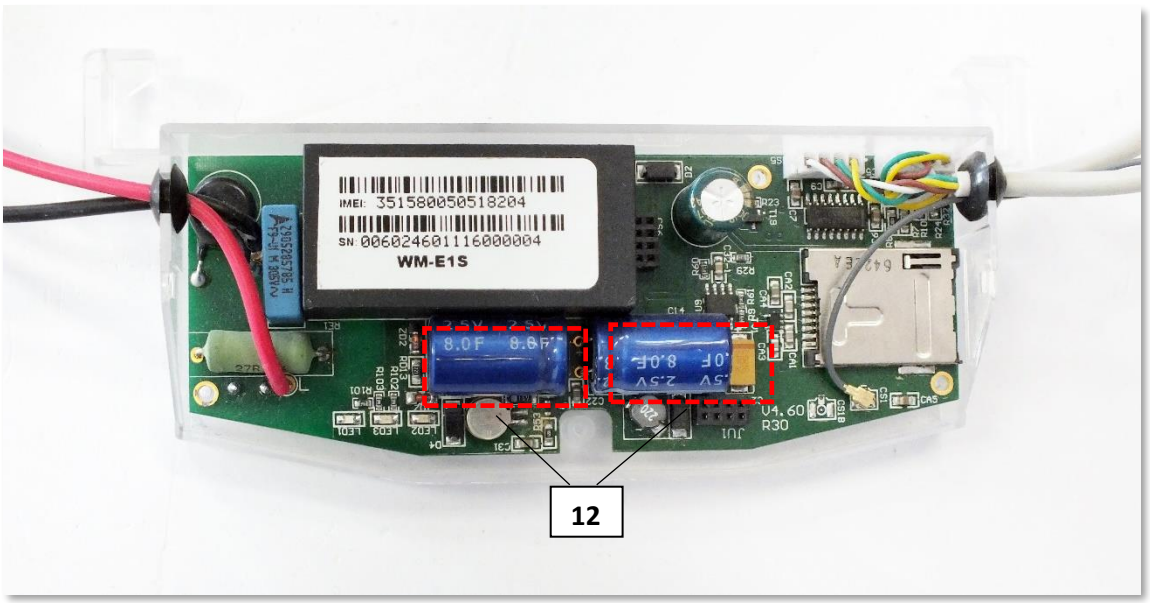
9 – DIN-rail adapter (order option) to fasten/mount to wall

2.3 Modem RJ12 with connection (RS485)



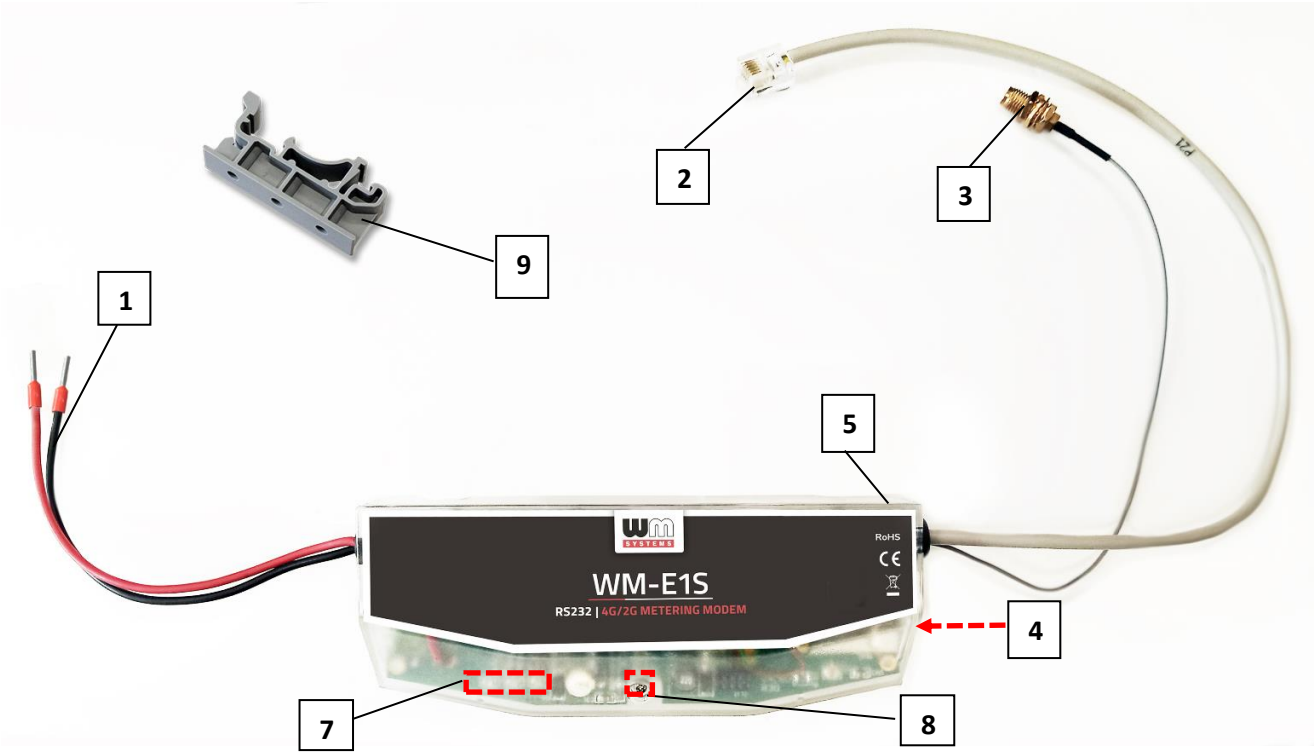
1 – Mains connector connector (pigtail connector for the AC power of the meter)
2 – RS485 connector (RJ12 – for data connection modem← → meter)
3 – External antenna connector (SMA-M, 50Ω)
4 – SIM card slot (mini SIM, insert-push)
5 – Plastic holder (lower plastic case fixation to the upper plastic case)
6 – Plastic hooks to fix the modem case into the meter coverage – optional
7 – Status LEDs
8 – Fixation screw of top modem enclosure

2.4 Supercapacitor option – for any modem version



12 – Supercapacitors (order option)

2.5 Universal metering modem with external mounting (with RJ12 connector and DIN-rail adapter mounting)



1 – Mains connector connector (pigtail connector for the AC power of the meter)

2 – RS232 (gray) or RS485 (black) connector (RJ12 data connection modem← → meter and for the configuration of the modem)

3 – External antenna connector (SMA-M, 50Ω)

4 – SIM card slot (mini SIM, insert-push)

5 – Plastic holder (lower plastic case fixation to the upper plastic case)

6 – Plastic hooks to fix the modem case into the meter coverage – optional

7 – Status LEDs

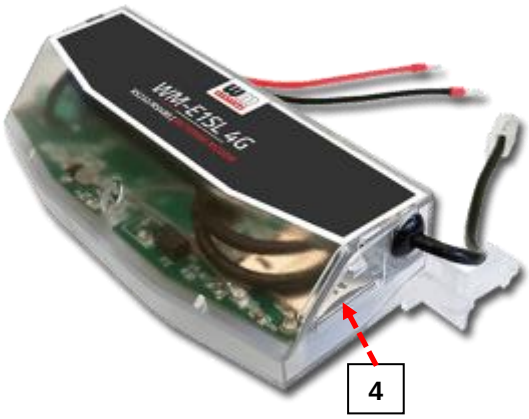
8 – Fixation screw of top modem enclosure

9 – DIN-rail adapter (order option) to fixate/mount to wall – can be glued/fixed to the bottom side of the modem

2.6 Installation steps

Step #1: Remove the meter terminal cover (I), loosen the screws (J).

Step #2: Ensure that the device is not powered on, remove the AC connector (1).



Step #3: Insert a replaceable and active SIM card (with APN) into the SIM-holder (4) - the chip looks down, and the cutted edge of the SIM looks to the modem. Push the SIM until it will b efastened (you will hear a click sound).
(If necessary, the SIM card can be easily removed by pressing the card again, causing the card to be ejected from tray.)

Step #4: Insert the modem into the internal mounting points and on the meter terminal cover (18)
attach it to the meter terminal cover according to the meter user guide.

Step #5: Screw the external magnetic base or breakable antenna (12) corresponding to the communication to the antenna connector (3).

Step #6: Connect the modem to your computer with the RS232 cable (2/2a) and an RS232-USB converter (for RJ12 using the RJ12-USB adapter).

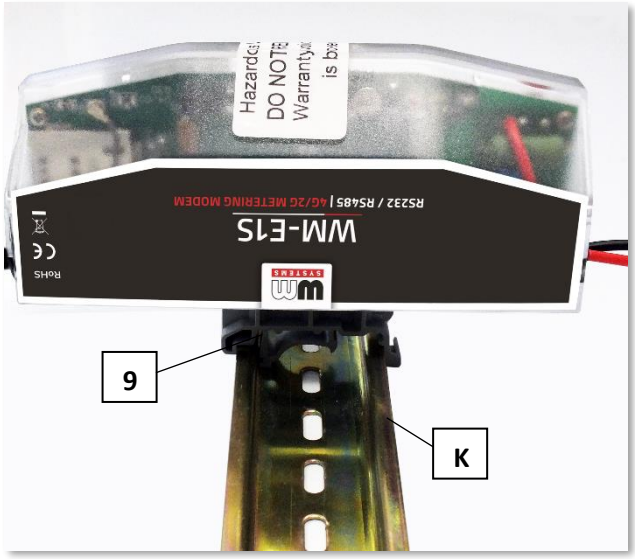
Attention! *The modem can be programmed only through an RS232 cable!*

Step #7: Connect the modem's AC power connector (1) - wire socket connection or "pigtail" connector depending on the version - to the meter power input (for 100-230V AC) or to an external 230V power supply.

Step #8: Configure the modem with the WM-E Term® software.

Step #9: After completing the configuration, remove the R232 cable (or RJ12 cable) - labeled 2/2a - from the USB adapter.
Step #10: Disconnect the modem AC power connector (1) from the meter (or power source). The modem will be shutting down.

Step #11: Make a data connection between the modem and the meter on the interface you want to use (port nr. 2 / 2a - RS232 data connection, data connection 2b to the meter RS232 data connector (G), or via RS485 port, or via the RJ12 connector (2) to the modem's RS485 connector (D)) - according to the meter type and according to the factory instructions.



Step #12: Install the modem according to the meter type – e.g by placing the modem under the the meter's terminal cover.
(For outdoor installation, install the modem on a 35mm DIN rail (K) using a DIN rail adapter (9) by fixing/glue the modem to the bottom or back of the enclosure near the meter.)

Step #13: Connect the modem's AC power connector (1) - wire socket connection or "pigtail" connector depending on the version - to the meter's power input (for 100-230V AC). The modem starts automatically, which is also indicated by LED flashes. You can now set the modem parameters.

Step #14: Replace the terminal cover (I) and secure with the screws (J).
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.

2.7 Connecting the modem to the Landis+Gyr® meter

Step #1: Remove the meter's communication module plastic case by releasing the 2 screws from the top of the housing.
Step #2: Connect to the meter using the data connector.

Step #3: Connect the RJ12 data connector (2) of the modem to the RS232 socket marked “G” on the meter. (The AC power connector here is a ferrule connection).

Wiring to the Landis & Gyr® ZMG/ZMD meter

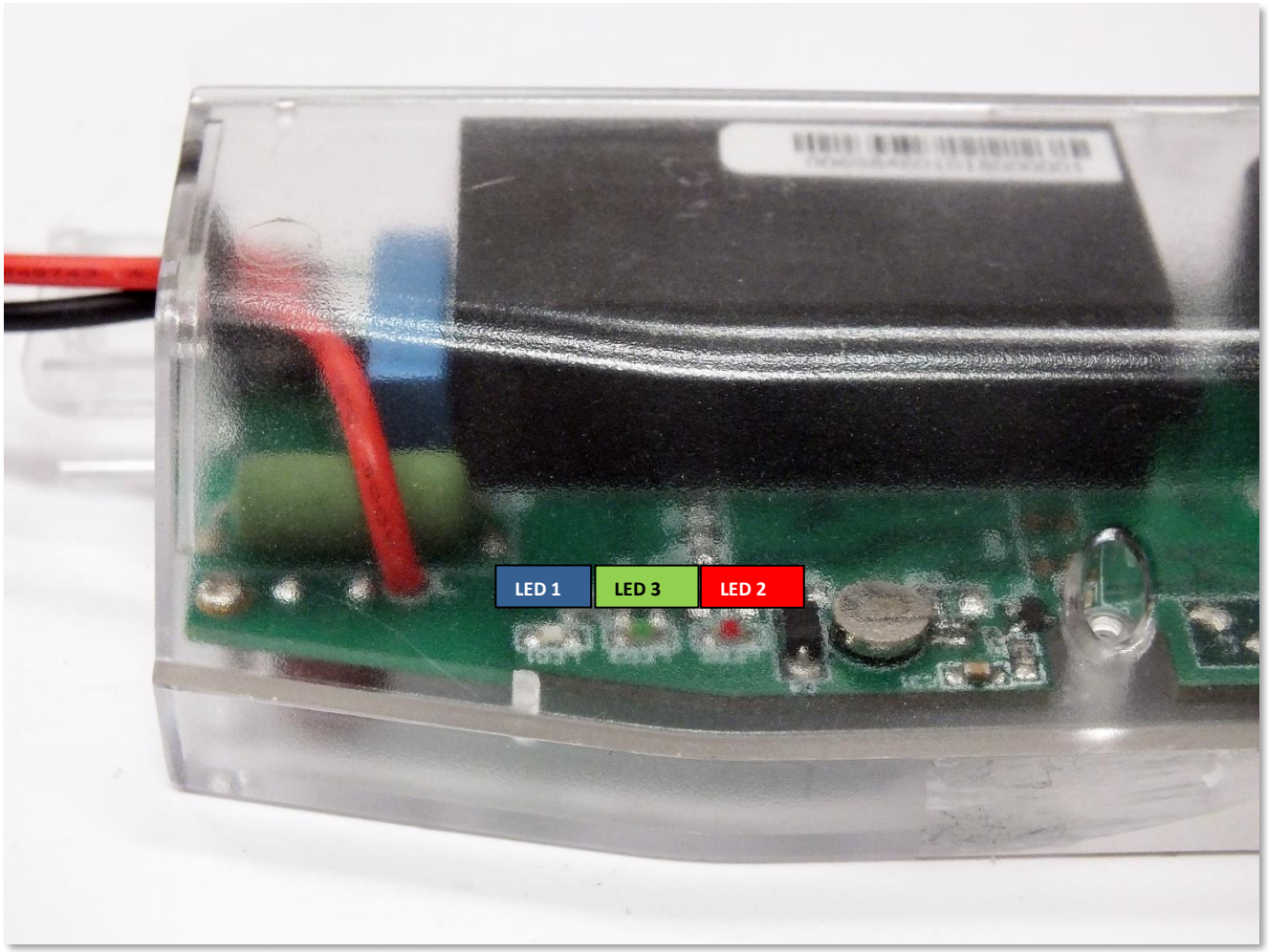
2.8 Antenna connection

The modem requires enough signal strength of the cellular network and LTE or similar antenna for the proper operation and good communication.

Where the signal strength of the cellular network is sufficienty, there an internal antenna may be enough to use.
However, in places where the signal strength is low or poor, you should use an external antenna (50 Ohm, SMA connector), which can be mounted to the modem – you can place it even inside of the top cover of the meter.

2.9 Operation LEDs

*The LED numbering is the same as the LED labels on the modem panel: from left to right in order: LED1 (**blue**, left), LED3 (**green**, center), LED2 (**red**, right).*



Factory default LED signals:

LED identifier	Events

LED 1
GSM / GPRS status
	• **If there is a SIM and PIN code ok, the LED will turn on**
	• **If there is no SIM or the SIM PIN is incorrect, the LED flashes every 1 second.**
	• **If there is no SIM, the LED flashes every 1 second.**
	• **• RSSI flashes the LED according to the field strength value (1 flash lasts for 1 second, followed by a pause)**
	  ○ **RSSI <= -98 → 1 flashing**
	  ○ **RSSI> -98 and <= -83 → 2 flashing**
	  ○ **RSSI> -83 and <= -68 → 3 flashes**
	  ○ **RSSI> -68 → 4 flashes**

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
SIM status / SIM failure or PIN failure
	• **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**

Over the factory defaults, the operation and the sequence of the LED signals 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:

Selectable LED status (in WM-E Term)
Not used
GSM / GPRS status *(see above)*
SIM status *(see above)*
E-meter status *(see above)*
Firmware status
Network status and access technology – Network status and accessible technology information
Meter status with IEC polling – Meter status in case of IEC communication

Further configurable LED status signals:

LED identifier	Events
Firmware status	• When the modem **firmware starts**, the **LED turns on** • When the **connection between the meter ←→ modem** is established, the LED **flashes in every 2 seconds.**
Network status and access technology	• During **network search**: **flashes once per second** • When **connected to the cellular network** and the IP connection is OK: **Blinks twice per second** • If mobile network access has changed: flashes quickly:

	○ ***2G → 2 flashes / sec*** ○ ***3G → 3 flashes / sec*** ○ ***4G → 4 flashes / sec*** • If **no network** is available: the LED is **not active**
Meter status with IEC polling	• When the modem ←→ meter starts communicating, the LED flashes 1x per second. • If the meter responds to the modem during communication, it turns on the LED. • If the modem ←→ meter cannot communicate with each other for a while, the LED will turned off.

** The power supply of the e-meter can be controlled with the relay listed here. Cannot be used for tariff change!*

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

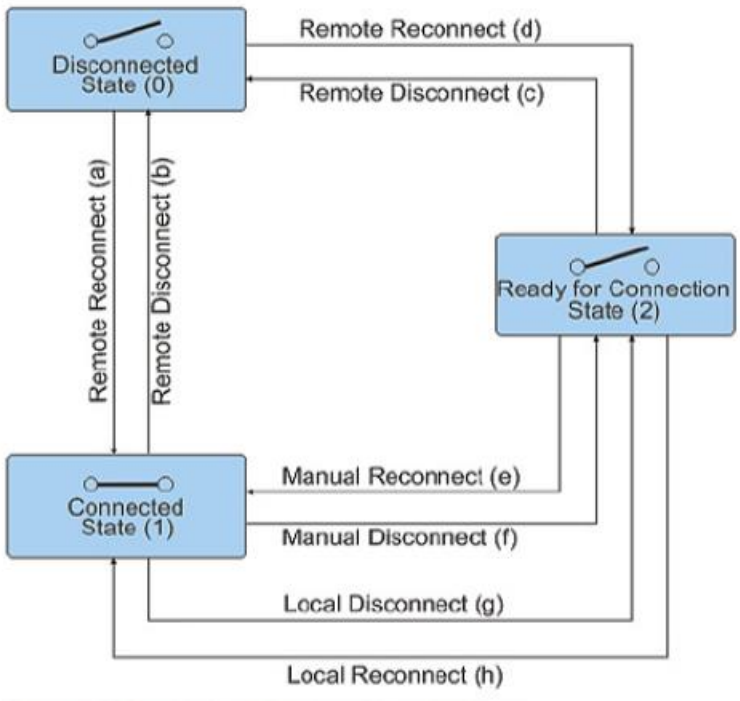
At the relay status, as it is shown in the next figure it is „*Disconnected*", which is the "active" mode (relay retracted, in which case the **LED is turned on**).

The "*Connected*" is in "normal" mode (relay released), the **LED is turned off.**

In case of "*Ready for Connection*", it is in "ready", when the **LED flashes once in every second.**

Control Mode

Control mode defines the mode of operation for disconnect control object. Possible modes are listed in the Table 66.



During firmware upload, the LEDs indicate normal operation - there is no distinct indication during the FW update. After installing the FW, the three LEDs light up for 5 seconds and then all three light up. The modem will then restart and use the new firmware. Then each LED will continue to flash according to the listed states.

2.10 Power outage management

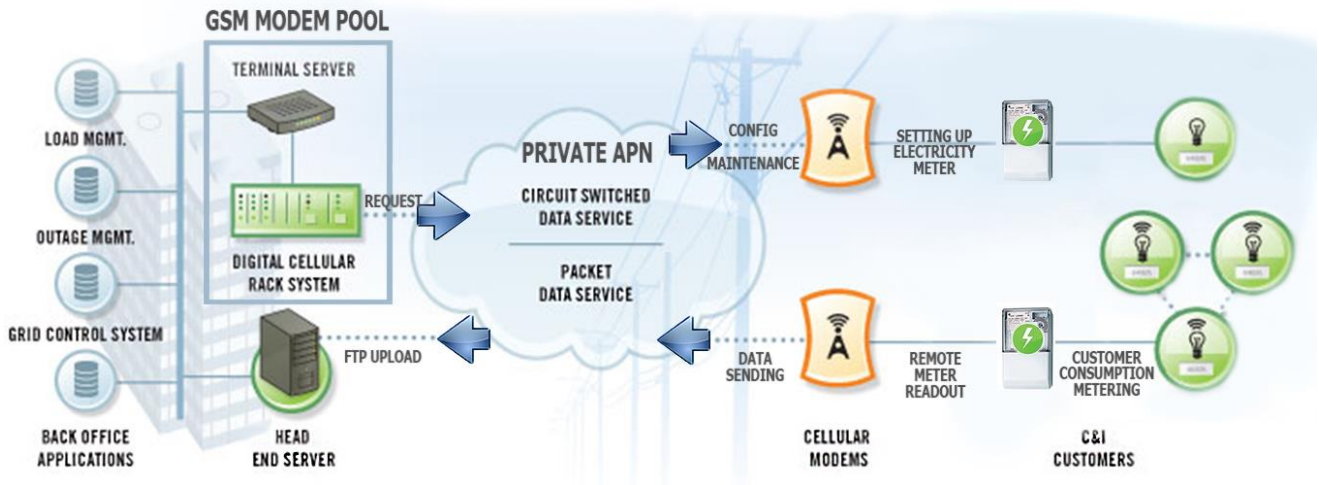
Some firmware versions of the modem support the LastGASP feature, which means that in case of power outage the modem's supercapacitor allows to operating further the modem for a short time (a couple of minutes). In case of detecting the loss of mains/input power source, the modem generates a "POWER LOST" event and the message will be immediately transmitted as 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.

2.11 Push operation method

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.



The modem does not operate continously on the network.

Therefore, 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 GSM network and ready to connect to GPRS, but without active IP connection.

- Data Push - starting at predefined times

- The Data Push method triggers FTP file upload, plain text or encrypted.
- The unique filename and the file is generated automatically.
- The ftp function also requires an ftp server to receive data that is accessible from the currently used mobile network.
- The ftp must be set to passive mode.
- Unique file names are generated automatically.
- The file always consists of two parts, first a standard register read and then an event log (containing the events of the last 31 days).
- The readings shown as standard IEC format, including some ASCII control characters
  like STX ETX, etc. also.

- **Alarm Push (sending alarms)** - starting when new event can be read from meter

- Alarm Push method triggers TCP sending of a DLMS WPDU contains the IP address,
- listening port number for transparent service, and the meter ID.

- Triggering with SMS

- GPRS connection can be activated remotely with a defined SMS from any call number.
- The SMS text must be left empty.

- After the SMS received, the modem will connect to IP network, and will be accessible as a IP server for a time period defined in the config file.
- Example config file will be provided with a 30 minute setting.

2.12 LED operation during the CSD call

The CSD call consists of two parts:

a.) We want to read / configure a meter in transparent mode

b.) We want to perform a modem configuration / firmware update

To read / configure a meter in transparent mode:

- The LED configured for GSM / GPRS status will be lit continuously during the CSD call.

- The LED that is configured for e-meter status will flash according to the CSD call status:

• It will flash every half second from the beginning of the connection to the end of the connection / If the measuring interface is not configured for a baud rate of 9600, the LED will be lit continuously from the beginning to the end of the connection

• After closing the connection, the LED will turn off

IF you want a modem configuration / firmware update:

- The LED configured for GSM / GPRS status will be lit continuously during the CSD call.

- In this case, the other LEDs do not change due to the CSD mode.

2.13 Configuring from CSD connection

If the modem restarts due to an incorrect configuration, it is possible to access it with a CSD call. Its operation can be fine-tuned in the WM-E Term software with a

value that can be specified in the **PDP connection delay** field in the **APN** parameter group.
For more information, see Chapter 3.1 of the *WM-E Term User Manual*.

2.14 Data control direction (DCD) feature

On the WM-E1SL® modem for Landis & Gyr® meters through the RS232 connection, there you can use the **DCD** feature - due to the RS232 data connection – there you can declare the direction of the data control according the following parameter settings as options.

For configuring the **DCD** feature, choose the **RS485 interface settings** parameter group.
Note that it is valid for the RS232 port!

DCD Parameter values:

- **Fix 0** (provides logical 0 value as result for the connected meter)
- **Fix 1** (provides logical 1 value as result for the connected meter)
- **Standard**
- **Inverted** (opposite direction)

Important! *This feature needs of using the 2.49B or later firmware version for the modem.*

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, etc., you can also test the modem communication by the configuration program.

Important! *The modem can be configured throu RS232 connection only!*

During the configuration, you have to remove the meter-modem data connection (2/2a) and you have to connect the modem to your computer by the following hints.

Important!
Note that until the configuration the modem is not connected to the meter, therefore it cannot readout the parameter values through the RJ12 interface.

The modem can be connected with the RS232 cable (2a) - or in case of version C by the RJ12 cable (2) and by using the RJ12-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 externa power source (from 100-230V AC or by the meter 57-100V AC).*

Use the WM-E Term program for the configuration – use the WM-E Term User manual.

For the proper communication of the modem, you have to configure the APN settings of the SIM – as PIN code, APN, username and password. These all can configured by using the WM-E Term® software through the serial link connection.
For the successful operation of the communication module it is necessary to have appropriate signal strength.

In places where the signal strength is strong it is possible to use internal antenna, for areas with poor reception mount an external antenna (50 Ohm SMA connection) to the antenna connector (3) of the device, which you can place inside even inside the meter enclosure (under the plastic housing).

If you want to readout the meter parameter values during the PC-modem connection, after the RJ12-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.

Download WM-E Term® to your computer from the following location using a browser:
https://www.m2mserver.com/m2m-downloads/WM_ETerm_v1_3_80.zip

Then unzip the .zip file to a directory and run WM-ETerm.exe.

The configuration software supports user account management and password change. You can log in to the program with a password! Follow the WM-E Term® Program User's Guide!

Attention! *It is recommended that you use the latest - or later - firmware to use the modem.*

Factory configuration file sample (for WM-E Term):
https://www.m2mserver.com/m2m-downloads/WM-E1SL_STD_default.zip

For the operation of the modem cellular network communication and SIM card settings (such as APN, password, and account) are required.

In addition, be sure to review and save the transparent mode data speed functions in the WM-E Term program for the RS232, RS485 settings. In addition, you must send the configured configuration to the modem using the program - according to the configuration software's User Manual document.

WM-E Term User Manual:
https://www.m2mserver.com/m2m-downloads/WM-E-TERM_User_Manual_V1_94.pdf

3.3 Sending an SMS about the meter

Depending on the meter configuration, by using the modem, the meter can send SMS message corresponding to standard AT commands to the phone number which was configured at the meter side.

It is worth configuring this primarily for alarms and special events, according to the capabilities of the meter.

No other settings are required in WM-E Term®.

3.4 Automatic network reconnection

If the mobile network provider drops the modem from the cellular network due to the device's network inactivity, there are available parameters if these are set, then automatic and periodical connection connection rebuild can be caused.

If the network provider sends a message to the modem that the data connection has been lost, the connection will be restored automatically. If you do not send a message, you can choose from these two workarounds to follow:

a.) Active mode - Use periodical ping, set the ping:

1. For setting this, set the **Watchdog** parameter group's ping parameters as **Ping IP-address**, **Number of ping retries**, **Ping wait-time (for reply)** and **Wait-time (for next).**

2. If there is no ping response, it reconnects to the network after the time interval specified in the **Seconds, gprs connection closed and restored after this time** parameter.

Attention! *In case of frequent ping using, the data traffic will be higher, but the chances are higher that the device will remain on the cellular network.*

b.) Passive mode - If you don't use the ping - set the connection retry:

1. For setting this, use the **Watchdog** parameter group's **Seconds, gprs connection closed and restored after this time** parameter.
2. Here you can define that after the network drops out the modem, how long does the modem wait before trying to reconnect to the mobile network again. Ask your mobile provider about the offered settings.

   Attention! *If there is less data traffic and there is no ping configured, the device may not stay on the network for a long time.*

   If you set this parameter to a low value that can cause frequent network reconnections.
   Therefore under no circumstances should you set this value lower than what your mobile service provider recommends. (e.g. there are mobile network providers that limit the number of times a modem can logon to the network in a given time).

Chapter 4. Support

If you have a technical question regarding the usage You can find us on the following contact possibilities:

Email: support@m2mserver.com

Phone: +36 20 333-1111

4.1 Support

The product has a identification void which has important product related information for the support line.

Warning! *Damaging or removing the void sticker means the loss of product guarantee.*

Online product support available here: http://www.m2mserver.com/en/support/

4.2 Product Support

The documents and information related on the product are available here.
https://www.m2mserver.com/en/product/wm-e1sl/

Chapter 5. Legal notice

The figures in this document are illustrations, those can be different from the real appearance.

The *WM Systems LLC* doesn't take any responsibility for text inaccuracy in this document.

The presented information can be changed without any notice.
The printed information in this document are informative only. For further details contact us.

Warning
Any fault or upcoming error during the software upload/refresh can lead to the device breakdown. When this situation happens call our specialists.

Chapter 6. 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.

3G

Third generation of mobile telecommunications technology. 3G telecommunication networks support services that provide an information transfer rate of at least 200 kbit/s. Later 3G releases, often denoted 3.5G and 3.75G, also provide mobile broadband access of several Mbit/s to smartphones andmobile modems in laptop computers. This ensures it can be applied to wireless voice telephony, mobile Internet access.

The following common standards comply with the 3G standard:

UMTS system, first offered in 2001, standardized by 3GPP, used primarily in Europe, Japan, China (however with a different radio interface) and other regions predominated by GSM 2G system infrastructure. The cell phones are typically UMTS and GSM hybrids. Several radio interfaces are offered, sharing the same infrastructure:

EDGE, a revision by the 3GPP org

W-CDMA is the most common deployment, commonly operated on the 2,100 MHz band. A few others use the 850, 900 and 1,900 MHz bands.

HSPA is an amalgamation of several upgrades to the original W-CDMA standard and offers speeds of 14.4 Mbit/s down and 5.76 Mbit/s up. HSPA is backward-compatible with and uses the same frequencies as W-CDMA.

HSPA+, a further revision and upgrade of HSPA, can provide theoretical peak data rates up to 168 Mbit/s in the downlink and 22 Mbit/s in the uplink, using a combination of air interface improvements as well as multi-carrier HSPA and MIMO. Technically though, MIMO and DC-HSPA can be used.

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.

RS485

RS-485 is a standard defining the electrical characteristics of drivers and receivers for use in serial communications systems. Electrical signaling is balanced, and multipoint systems are supported. The standard is jointly published by the Telecommunications Industry Association and Electronic Industries Alliance (TIA/EIA).

This characteristics make RS-485 useful in industrial control systems and similar applications.

RS-485 supports inexpensive local networks and multidrop communications links, using the same differential signaling over twisted pair as RS-422.

The RS-485 implemented the linear bus topologies using only two wires. The equipment located along a set of RS-485 wires are interchangeably called nodes, stations or devices.[4] The recommended arrangement of the wires is as a connected series of point-to-point (multidropped) nodes, i.e. a line or bus, not a star, ring, or multiply connected network. Star and ring topologies are not recommended because of signal reflections or excessively low or high termination impedance. If a

star configuration is unavoidable, special RS-485 repeaters are available which bidirectionally listen for data on each span and then retransmit the data onto all other spans.