![WM SYSTEMS logo]

Datasheet and User manual for WM-E2SL® electricity metering modems

Document specifications

This documentation was made for presenting the installation and configuration steps of the **WM-E2SL®** (Landis+Gyr® meter compatible) energy metering modem.

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Hardware Type/Version:	**WM-E2SL® modem** **for electricity metering with DC power supply** **for LANDIS+GYR® ZxG3xx, ZxG4xx electricity meters**
Hardware Version:	**V2.xx / V3.xx / V5.xx**
Firmware Version:	**V2.4.43.11 / V2.5.60 TLS**
WM-E Term® config. software version:	V 1.3.79
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Chapter 1. Introduction

The **WM-E2SL**® is a modem, which is suitable for automated remote reading of electricity meters remotely, on 4G LTE-based and the 2G cellular networks.

You can save money by using our modem, because there is no further need of manual readout of the meter systems.

Wireless communication

The 4G version 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.

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 3-phase **Landis+Gyr® ZxG3xx** and **ZxG4xx** 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.

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.

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

The device can be powered by DC power of the meter's RJ45 connection.

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 WM-E Term® administration software. 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 English and local (French) language 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 control port of the modem is encrypted by AES - optional.

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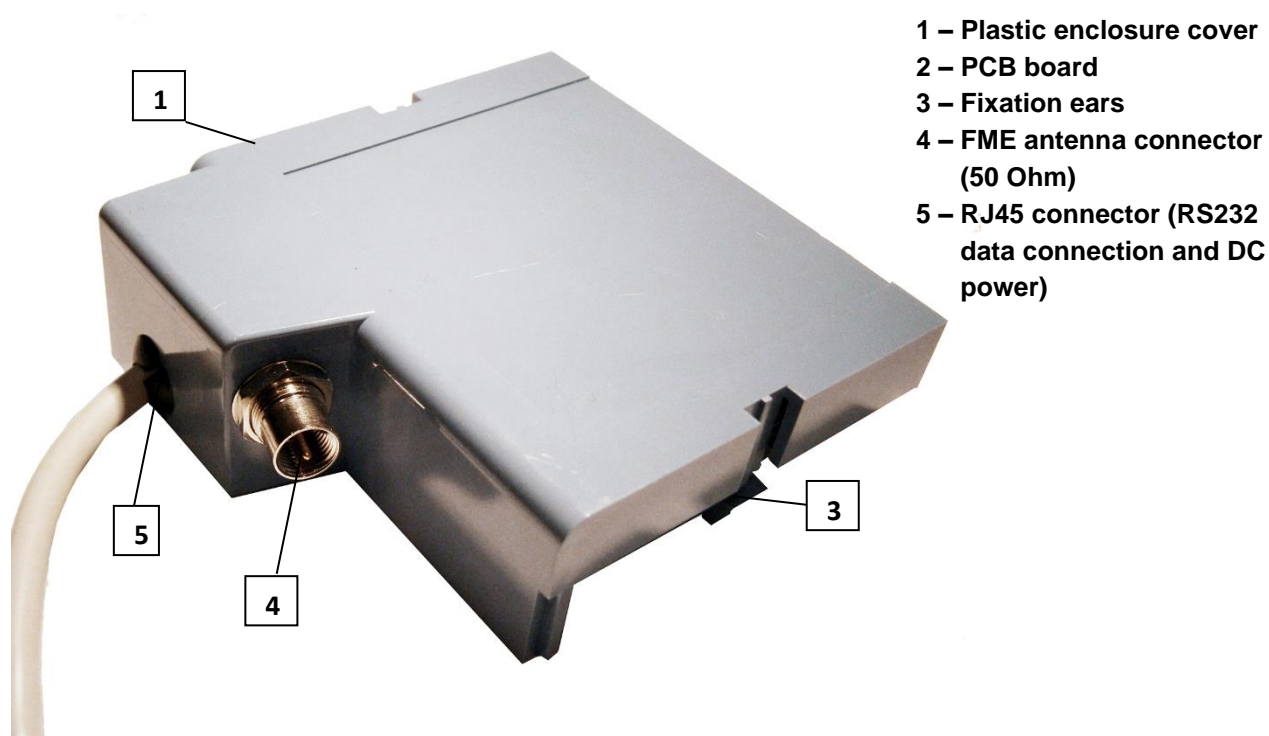
Status and notification

The modem is continuously monitoring the mobile network and device communication health, and can send status information (signal strength, QoS).
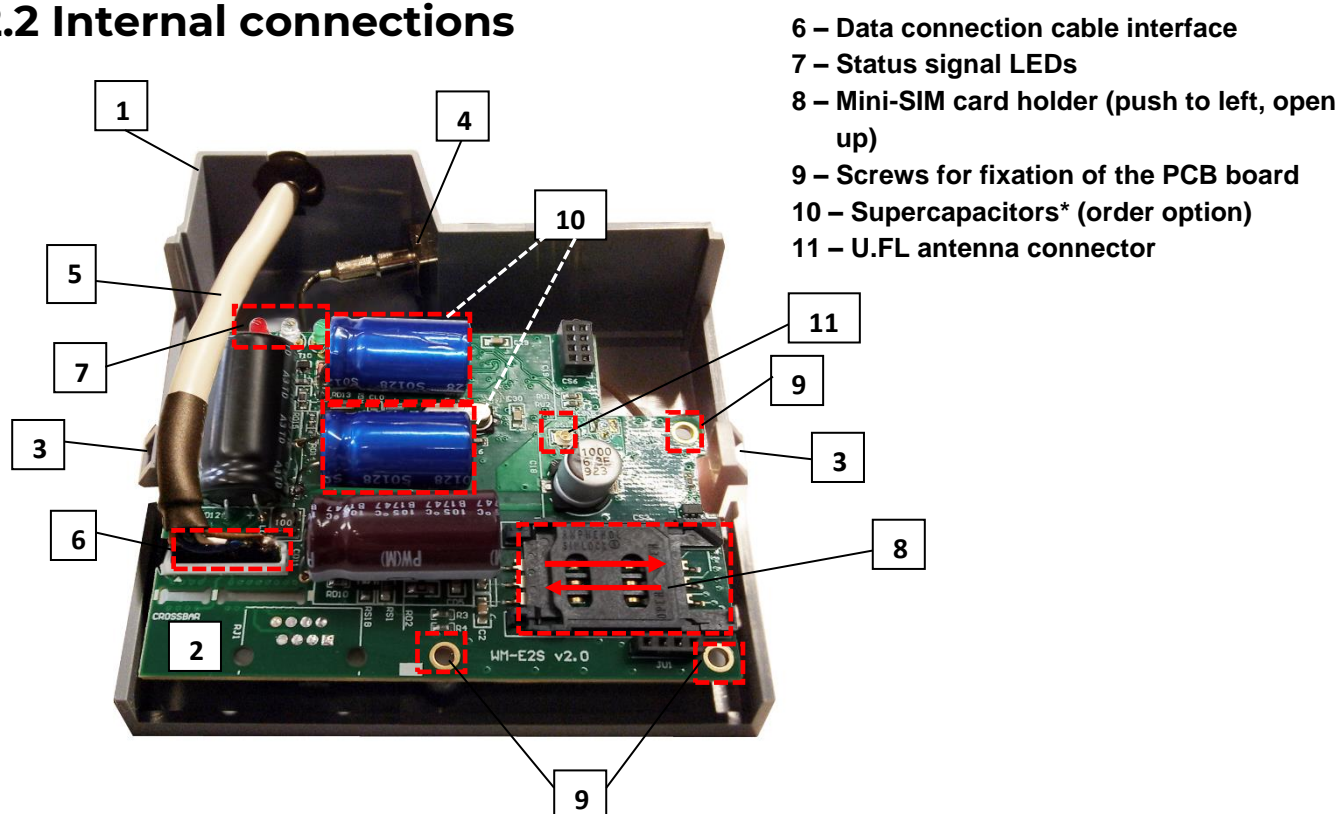
By the configured features, the device is able to send SMS alarm notification, SNMP trap – depending on the used cellular network and mobile operators (if the SMS notification is not disallowed on the network, then it can be used).

Chapter 2. Connections

2.1 External outfit

1 – Plastic enclosure cover
2 – PCB board
3 – Fixation ears
4 – FME antenna connector (50 Ohm)
5 – RJ45 connector (RS232 data connection and DC power)

2.2 Internal connections

6 – Data connection cable interface
7 – Status signal LEDs
8 – Mini-SIM card holder (push to left, open up)
9 – Screws for fixation of the PCB board
10 – Supercapacitors* (order option)
11 – U.FL antenna connector

We deliver the modem without supercapacitor by default, but it can be ordered with that part.
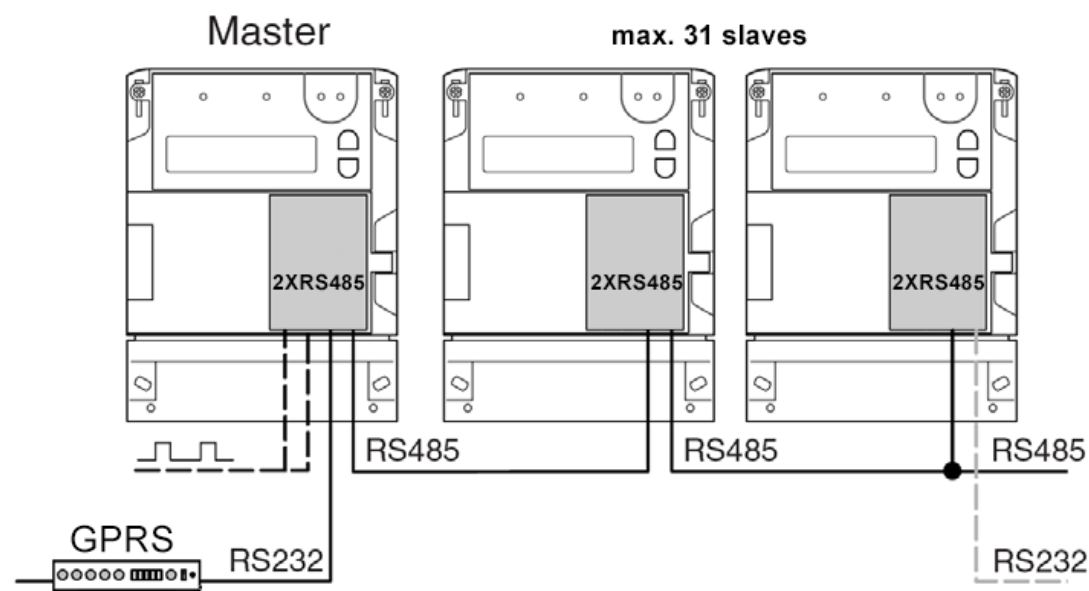
2.3 RS232 connection

The modem RS232 data connection can be assured by using an RJ45 cable (5). The further settings can be made by software with the WM-E Term application.

The modem should be disconnected during the configuration from the meter and the RJ45 connector (5) must be connected to the PC. During the configuration the modem cannot receive the meter data.

Landis+Gyr meter - RS232 Connector pinout

RJ45	Pin 1	+ 10 V		Pin 5	TX-RS232
	Pin 2	RTS-RS232		Pin 6	GND
	Pin 3	CTS-RS232		Pin 7	DTR-RS232
	Pin 4	RX-RS232		Pin 8	DSR-RS232
Power Supply	10 Volt Power Supply		+ —◄●— -		

2.4 Installation steps

Step #1: Remove the top cover or the meter (18) by loosing its screws (17).

Step #2: Ensure that the modem is not powered – remote the RJ45 connection cable (5) from the meter.

Step #3: By turning up the modem plastic enclosure, the the PCB will be free to touch.

Step #4: Slide and open up the plastic SIM card holder (8) - push from right to left, and spin it up until release.

Step #5: Insert a replaceable and active SIM card (with APN) into the SIM-holder (8) - the chip looks down, cutted edge of the SIM is oriented to outside.

Step #6: Close down the SIM holder (8) and push it from right to left until it is fastened.

Step #7: Ensure that the internal antenna U.FL - black - cable is connected to the U.FL connector (11)!

Step #8: Check the data cable (5) that it is ensurely connected to the PCB board (2) directly to the data connection interface (6). The modem gets its DC power from the meter and it is also used for data connection between the meter-modem.

Step #8: Mount the FME antenna to the antenna connector (4). (If you are using an SMA antenna, then you can use a SMA-FME converter adapter to mount the SMA antenna to the FME connector).

Step #9: Install the modem by inserting the modem enclosure (1) into the meter enclosure's terminal cover – according the user manual of the meter – by taking care to the ears (3) of the enclosure for the proper fixation (you will hear a click sound when it is closed).

Step #10: Place and insert the modem into the meter (under the meter's terminal cover) (18) and fix the device to the meter – according to the meter's installation manual.

Step #11: Mount the FME antenna (13) to the antenna connector (4). (If you are using an SMA antenna, then you can use a SMA-FME converter adapter (12) to mount the SMA antenna to the FME connector).

Step #12: For configuring the modem, connect the device to the computer by an RJ45 cable (5) and the USB/RS232 DONGLE converter with a cable converter (for further details, see later in the Chapter 3).
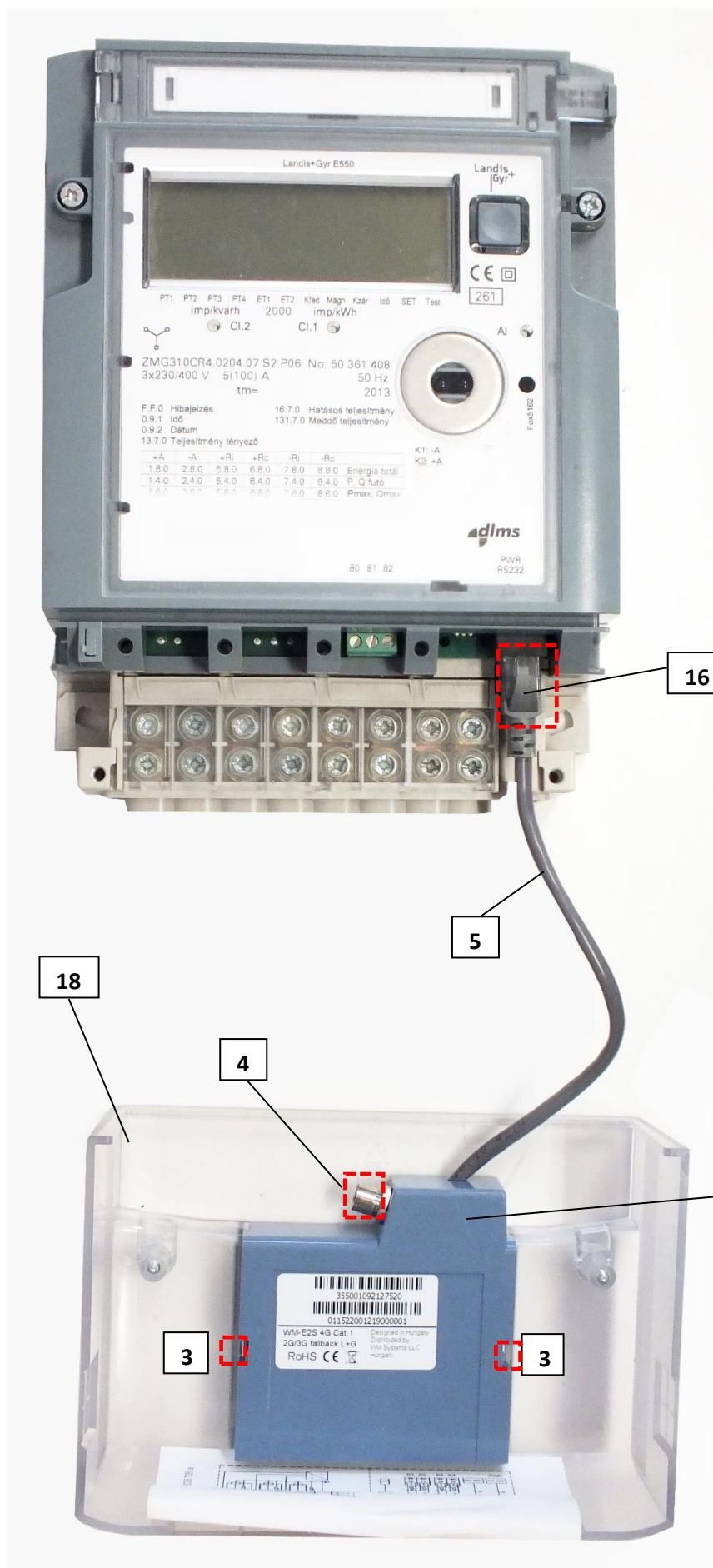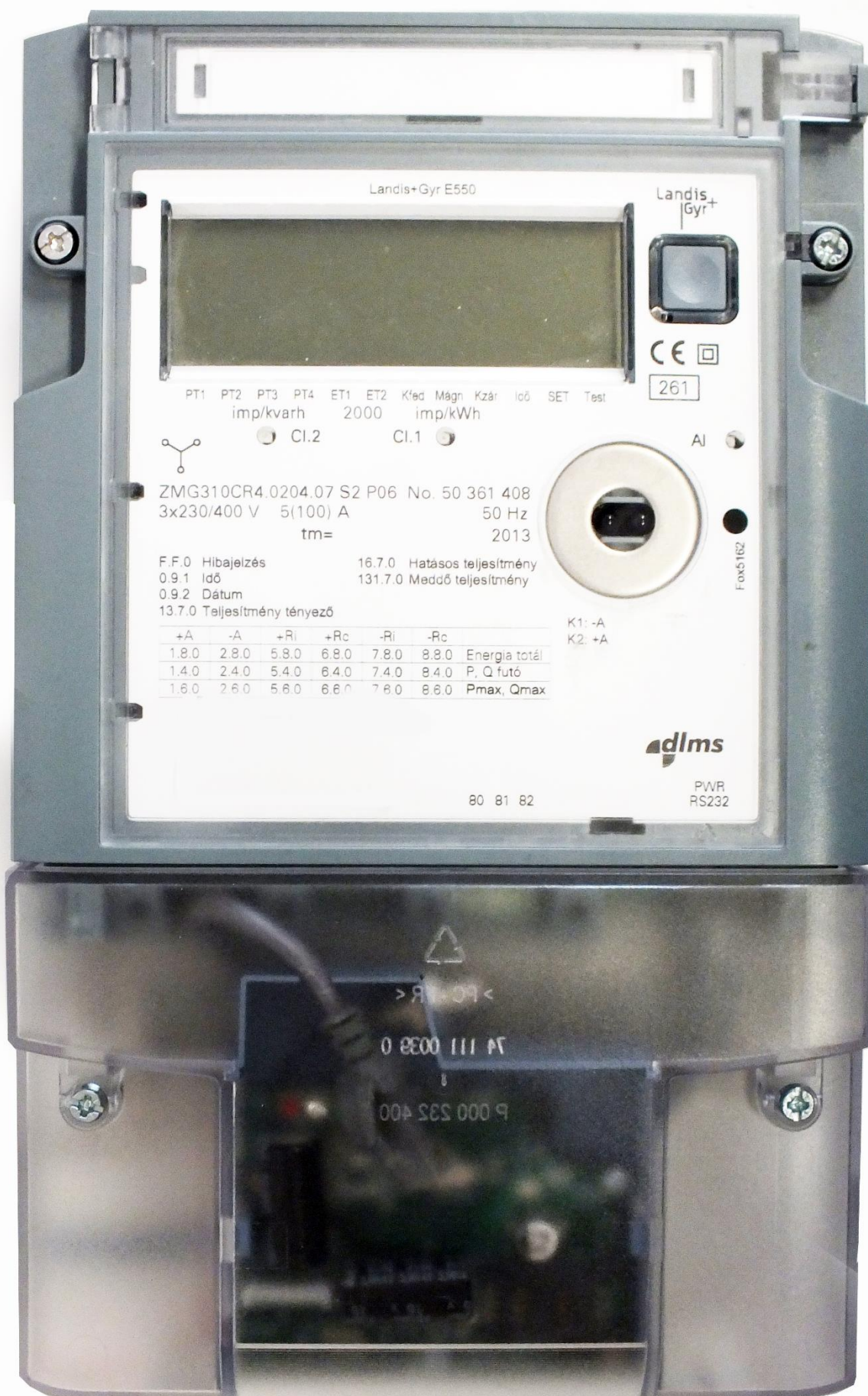

Step #13: Configure the modem with the WM-E Term® software.

Step #14: After the configuration remove the RJ45 cable from the USB/RS232 DONGLE adapter. The modem powering will be off.

Step #15: The data connection between the modem and the Landis+Gyr® meter can be initiated on the RS232 interface by using 1:1 cable connection, which can be made by using the grey RJ45 cable (5) of the modem – connect it to the RJ45 port (16). Then the modem will be powered – if the meter was under power – and the device will be starting its normal operation, which can be followed by checking the LED signals.
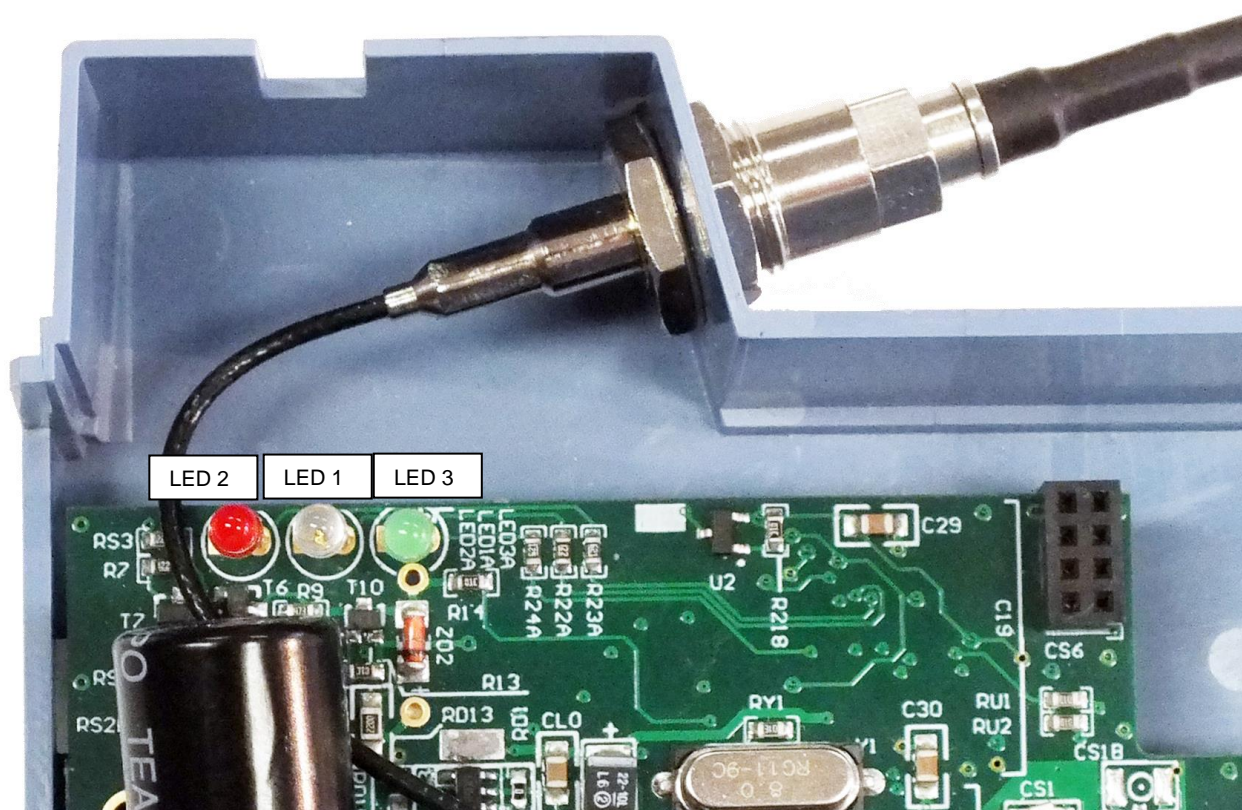
Step #16: Place back the meter's terminal cover (18) and fix it by the screws (17).

2.5 Status LED signals

If the WM-E2SL® modem was not supplied by power source since a long time, it needs to be charged before the usage/installation. The charge takes about ~2-5 minutes if the supercapacitor was exhausted / discharged.

Important!
The LED number we've listed here are the same as can be found on the PCB LED title (as LED3 (green, right), LED1 (blue, middle), LED2 (red, left).

At the first power on - during the charge – the green LED is flashing quickly, than after a couple of minutes it will be blank, then qill be flashing quickly again. When the green LED will be flashing slowly and the other LEDs will be be lighting according the NORMAL operation, then the modem will be charged completely and it will be ready for congfiuring and to operate.

OPERATION LED SIGNALS - <u>IN CASE OF CHARGING</u>

LED	Signal	Description
Green	●	During the charging of the exhausted supercapacitors, only **green** LED will flashing quickly. Only this LED is active during the charge. Wait until the device will be fully charged.

OPERATION LED SIGNALS – <u>IN CASE OF NORMAL OPERATION</u>

Factory default LED signals:

LED identifier	Events

LED 3
SIM status / SIM or PIN failure)
	• Continuously lighting, until the device is not on the cellular network and RSSI cannot be detected (SIM okay)
	• When the **SIM PIN is** okay: led is **active**
	• If there is **no SIM** detected or **SIM PIN is wrong**: *blinking once per second* (slow flashing)
	• **The RSSI (signal strength) value is signed also by this led. Flashing by "N" times in every 10-15 seconds, depending on t he RSSI refresh period. The RSSI value can be 1,2,3 or 4 on the current cellular network.**
	   The numbers of RSSI flashing is different on every available network technology, by the following:
	   ○ **on 2G network:**
	     ○ **1 flashing: RSSI >= -98**
	     ○ **2 flashings: RSSI between -97 and -91**
	     ○ **3 flashings: RSSI - between 90 and -65**
	     ○ **4 flashings: RSSI > -64**
	   ○ **on 3G network:**
	     ○ **1 flashing: RSSI >= -103**
	     ○ **2 flashings: RSSI between -102 and -92**
	     ○ **3 flashings: RSSI - between 91 and -65**
	     ○ **4 flashings: RSSI > -64**
	   ○ **on 4G LTE network:**
	     ○ **1 flashing: RSSI >= -122**
	     ○ **2 flashings: RSSI between -121 and -107**
	     ○ **3 flashings: RSSI between -106 and -85**
	     ○ **4 flashings: RSSI > -84**
	   ○ **on LTE Cat.M1 network:**
	     ○ **1 flashing: RSSI >= -126**
	     ○ **2 flashings: RSSI between -125 and -116**
	     ○ **3 flashings: RSSI between -115 and -85**
	     ○ **4 flashings: RSSI > -84**
	   ○ **on LTE Cat. NB-IoT (Narrow Band) network:**
	     ○ **1 flashing: RSSI >= -122**
	     ○ **2 flashings: RSSI between -121 and -107**
	     ○ **3 flashings: RSSI between -106 and -85**
	     ○ **4 flashings: RSSI > -84**

LED 1
GSM / GPRS status
	• **During** network **registration**: led is *active*
	• **During** network **searching**: *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 **there is no available cellular network** detected: the led will be **blank**
	• **During the CSD call and IP data forwarding, the LED is ligthing continuously**

LED 2 **E-meter status**	• **By general**: the *led is inactive* • **During communiaction**: the *led is active (flashing)*

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 the WM-E Term program)
Not used
GSM / GPRS status
SIM status (wrong PIN flashing slow or without SIM)
E-meter status
E-meter relay status (Only in case of using WM-E3S CIR modem)
M-Bus status
Firmware status
Network status and access technology
Meter status with IEC polling
AMM (IEC) client state

LED status	Events
E-meter relay status – Status of the E-meter relay output (available only in case of WM-E3S CIR modem type)	• General: "Ready" / stand-by – the *led is flashing 1x per seconds.* • In "Active" mode – at *relay switching it turns on the *led (ligthing).* In "Normal" mode – by releasing the *relay it turns off the *led (blank).*
M-Bus status	• Not in use
Firmware status	• When the modem firmware was started, the led will be turned on (ligthing). • When the meter ←→modem connection was built up then the led will be flashing 2x per seconds.

Network status and access technology	• Network registration: *the led is active (lighting).*
	• During network searching: *the led is flashing 1x per seconds.*
	• When it was connected to the network and the IP connection is okay: *the led is flashing 2x per seconds.*
	• If the mobile access technology was changed – it will be signed by quick flashing:
	  o 2G → *2 flashing / seconds*
	  o 3G → *3 flashing / seconds*
	  o 4G → *4 flashing / seconds*
	• If there is no available network: *the led is inactive (blank)*

Meter status with IEC polling – Meter status during the IEC communication	• When the modem←→meter starting the communication, *the led will be flashing 1x per seconds.* • When the meter is answering to the modem during the communication, it will *turns on the led.* • When the modem←→ meter cannot communicate with each other, the *led will be turned off.*
AMM (IEC) client state	• By general or in case of closing the modem←→EI client communication the *LED is turned off.* • In case of building up the modem←→ EI client** connection the *led is flashing shorty 1x per seconds (*then 1 second of pause will be progressed between the flashings)* • In case of EI client** login request attempt– *the led is flashung 1x per seconds.* • When the connection was built up successfully between the EI client**←→modem– *the led is active (ligthing).*

The listed relay can switch the power source of the e-meter. it cannot be used for tarrif switch!

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

In *Connected "normal" mode (when the relay is released),* **the led is turned off**.

In *Ready for Connection "ready" (stand-by) mode,* **the led is flashing once per seconds**.

During the firmware uploading the LEDs are operating as it is normal – there is no significal LED signal for the FW refresh progress. After the Firmware installation, the three LEDS will be lighting for 5 seconds and all will blank, then the modem restarting by the new firmware. Then all LED signals will be used as it was listed here above.

2.6 LED operation during CSD call

During the CSD call two operation option types can be used:

a.) When the meter would be read out / configured in transparent mode

b.) When modem configuration / firmware refresh is attempted to make

When the meter would be read out / configured in transparent mode:

- The GSM / GPRS status configured LED will be continously lighting during the CSD call.

- The e-Meter status configured LED will be operating according the CSD call status by the following:

- Will be flashing twice per seconds from the connection attempt until closing the connection
- If the meter interface is not configured to 9600 baudrate, then it will be ligthing continuously from the connection attempt until closing the connection
- After the connection close the LED will be switched off

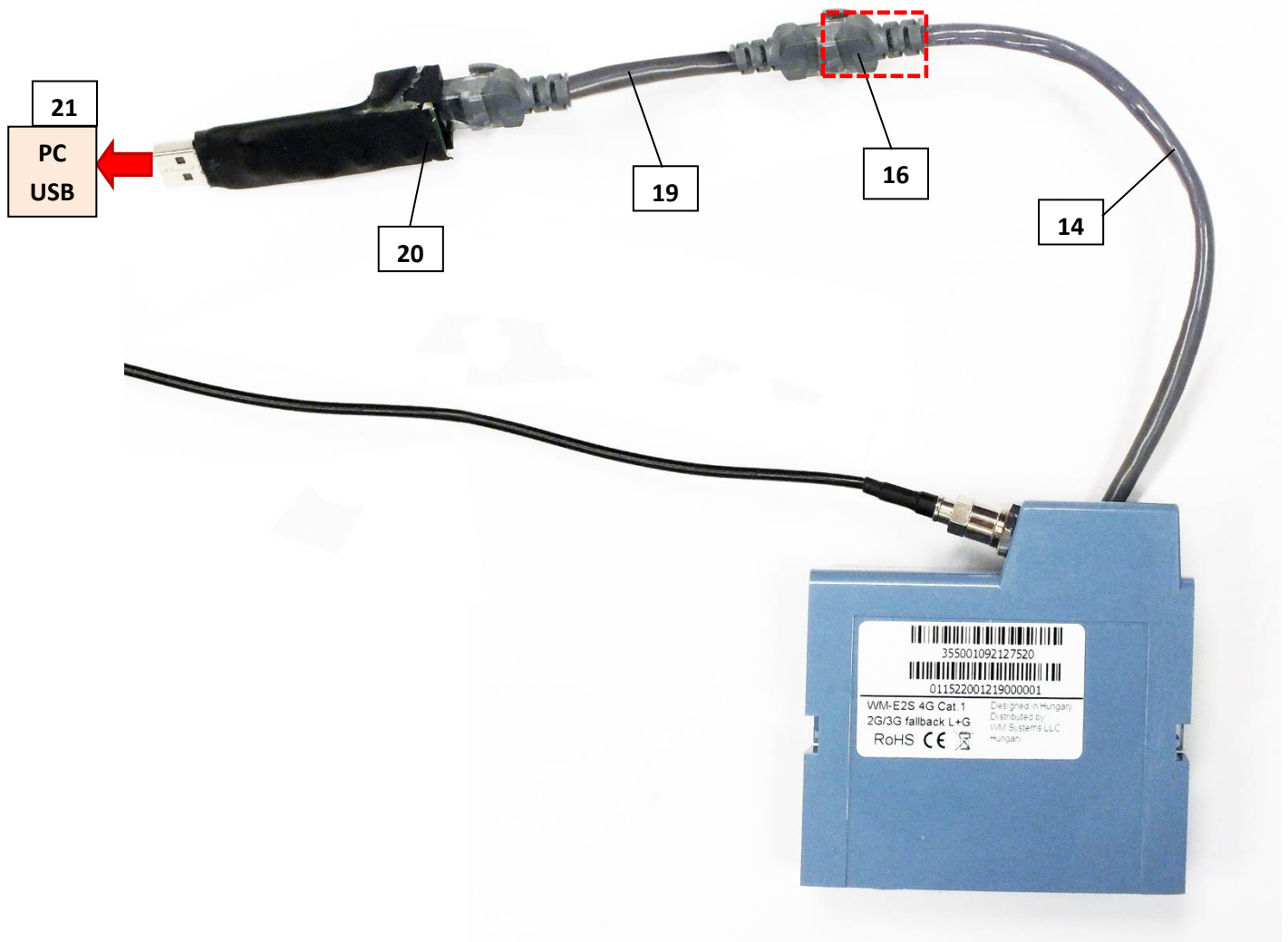When modem configuration / firmware refresh is attempted to make

- The GSM / GPRS status configured LED will be continously lighting during the CSD call.

- The other LEDs will not change their operation because of the CSD mode

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 and execute AT-commands on the modem by the configuration program - see *AT commands* description for the description useful commands.

During the configuration remove the RJ45 connection cable's (14) opposite part of RJ45 connector (16) from the meter's RS232 port.

Then connect the RJ45 converter cable (19) – included in the package - to the RJ45 cable of the modem (16), and connect the converter cable (19) to the USB/RS232

DONGLE® adapter (20), which will must be connected to your computer's USB port (21).

Important! *Note that until the configuration the modem is not connecting to the meter, therefore it cannot readout parameter values through the RJ45 interface during the configuration.*

The configuration can be made by CSData call (by selecting a mobile access technology which uses 2G network). Or you can do it through mobile internet (TCP) connection – therefore you don't need to connect the modem to your PC.

Important! *During the configuration, the power supply of the modem is assured by this converter board, on USB connection. Some computers can sensitive for USB current changes. In this case you should use an external power supply with special connection.*

For the serial cable connection configure COM port settings of the connected computer according to the modem serial port properties.

In the Windows it can be found in the Start / Control Panel / Device Manager / Ports (COM and LTP) menu Properties:

- o *Baud: 9600*
- o *Databits: 8*
- o *Parity: No*
- o *Stopbits: 1*
- o *Bandwith control: no*

Warning!

If the COM port will not visible after connecting the device to the computer, and you cannot found the COM port number in the Windows Device Manager, then you need to install the proper driver - *FTDI VPC* – to your computer, which can be downloaded from here:

http://www.ftdichip.com/Drivers/VCP.htm

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 RJ45 connection.

For the successful operation of the communication module it is necessary to have appropriate signal strength.
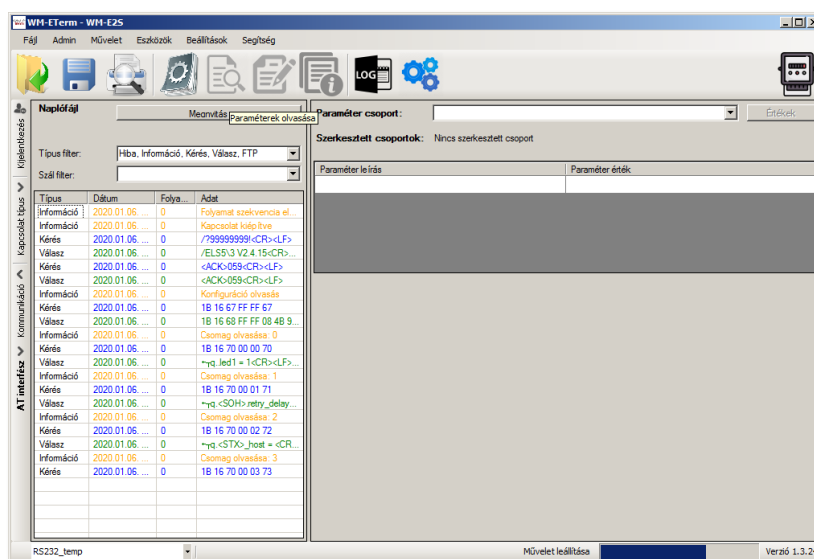
If you want to readout the meter parameter values during the PC-modem connection, after the RJ45-configuration you made, then you should select a different configuration port to the meter as TCP/IP or Optical, etc.

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).

If the modem was not supplied by power for a long time, it needs to be charged before usage. It takes about ~2-5 minutes to charge if it the supercapacitor was exhausted / discharged.
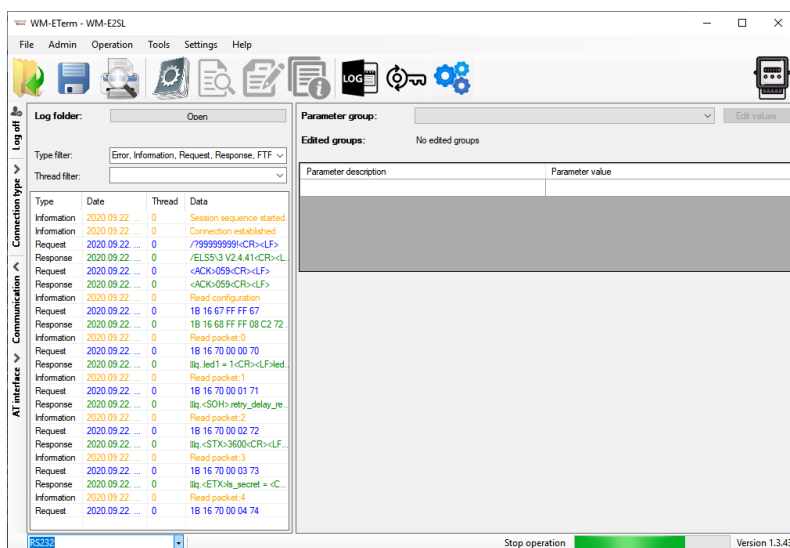
Download the WM-E Term® software to your computer by a browser from the following link: https://www.m2mserver.com/m2m-downloads/WM_ETerm_v1_3_80.zip

Extract the .zip file to e directory and execute the **WM-ETerm.exe** file.

The configuration software is supporting the usage of user accounts and the password change feature.

The configuration software is supporting the usage of user accounts and the password change feature.

You can login to the software by a password. Check the WM-E Term® User Manual for further details!

WM-E term User Manual:

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

The modem firmware v2.4.43.11 can be downloaded from the next link:
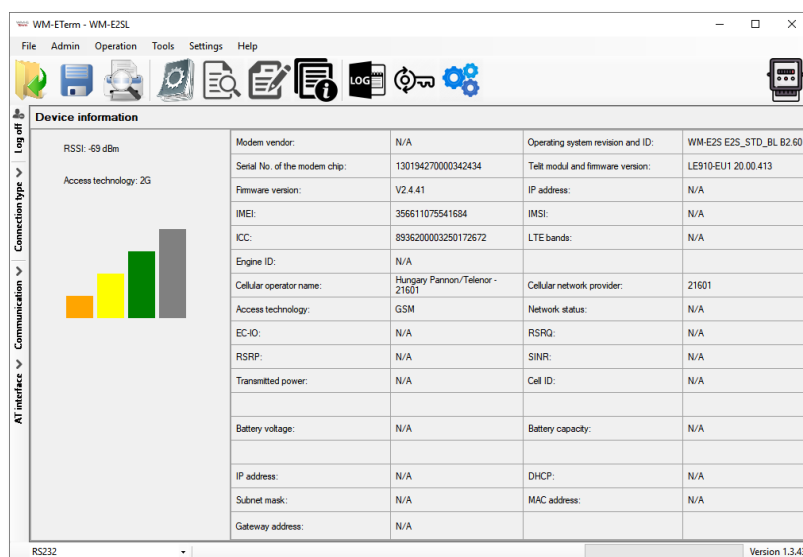
https:/m2mserver.com/m2m-downloads/E2STD_FW_244311.dwl

Basic configuration file for Landis+Gyr meters with RS232/ RS485 support:

https://m2mserver.com/m2m-downloads/WM-E2SL-STD-DEFAULT-CONFIG.zip

3.3 Signal strength

Check signal strength of the cellular network in the *WM-E Term*® software *Device Information* menu or by using the 🖥 icon.

Check RSSI value (at least it should be yellow – which means average signal strength – or better if it is green). You can

change the antenna position while yuo will not receive better dBm values (the status must be readout again for refresh).

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.) <u>Active mode - Use periodical ping, set the ping:</u>
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.) <u>Passive mode - If you don't use the ping - set the connection retry:</u>
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. AT command settings - description (Configuring the Modem by AT commands)

4.1 General information about the commands

In this part of the documentation we have collected the standard Hayes™ AT commands which you can use for programming the modem manually with any terminal application.

During the configuration the modem accepts commands with upper or lower case characters. The modem accepting commands in N81 or E71 format.

When you are attempted to use AT commands for the modem, first you have to declare the modem interface and GPRS settings.

For the GPRS communication settings you can use the AT command syntax at table – Chapter 3. The AT commands and parameter values must be divided with semicomma: e.g. Command;answer;timeout(msec)

The minimal modem configuration settings for connectiong an Itrón® meter:

- AT+0   enabling the 9600,8,n,1 operation for the modem
- AT&W   saving the settings

4.2 AT command set

The AT+ command can be used individually, these cannot be chained!

AT+ command	Description
ATA	The modem is receiving the incoming call – *local interface only* The modem answers for the call after ther third ringing.
ATD	Dial command – *local interface only* The modem connects to the network and performing a call to the defined phone number, e.g.: ATDT 12345 123456^m "D" = dial, "T" = tone (compatible mode), ^m = carrier return.

ATE		Commmand local Echo
	ATE0	Local Echo off
	ATE1	Local Echo on (echo)
ATH		Hang up command – *local interface only*
		The modem is disconnecting the dial connection.
ATI		Module identification (example for the answer: WM-E2 2G V2.44)
ATO		Return to online state command - *local interface only*
		The modem switches back from command mode to data mode
ATQ		Silent mode
		You can allow to the modem that it doesn't send the results
	ATQ0	Silent mode off – it does NOT send the results
	ATQ1	Silent modem on – it sends the results
ATV		Verbose mode (Turned off) means a number
		Text or numeric format.
	ATV0	Verbose mode disabled: number
	ATV1	Verbose mode enabled: text
ATX		Connection (CONNECT) result codes
		Generated code by the modem when connecting or
	ATX0	hanging up the connection.
	ATX1	Selects the basic code set
	ATX2.3.4	Selects the extended code set
		Same as ATX1
ATZ		Modem Reset
		Resets the modem without changing any parameters.
AT&C		Carrier control
		This parameter defines the operation of pin 1 (DCD) of the 9-pin RS232C interface.
	AT&C0	Always ON
	AT&C1	Fixed to this settings – DCD turning on, when online
	AT&C2	in command mode is OFF – DCD is turned on only when the modem is online
AT&D		Determines how the ME responds if the pin 4 (DTR) is changed from ON to OFF state during data connection (the firmware is supporting, but it is not wired by default)
	AT&D0	Ignores the status of the DTR line – eg. not connected
	AT&D1	DTR ON→OFF: Change to command mode while retaining the data connection. (like +++ escape sequence)
	AT&D2	DTR ON→OFF: Disconnect the data connection (only for CSD)

AT&K	Flow-control selection (hardware configuration must
AT&K0	match with settings)
AT&K3	DCD and DTR line can be used for signaling
	RTS and CTS line can be used
AT+I	Reports modem type, firmware version number, local settings
	E.g. WM-E2S v2.48
AT+IP?	Reports current GPRS Listen mode address and port
	E.g. IP: 192.168.0.100:6001
AT+R	Resets modem and causes the modem to execute a 10 second power cycle
AT+S	Displays Signal Strength
	Toggles on / off (default off).
Remote AT+S	Reports the last known signal strength

4.3 Commands which can be used only for the local interface

AT+ parancs	Leírás
AT+CBST?	Signaling format
	This command gives information regarding the cellular network bearer channel.
	Response: 7,0,1 (9600 bps rate, Asynchronous, Non transparent).
AT+CBST=n,0,1	CBST change
n=0	analog auto baud (automatic baud rate selection)
n=4	V.22bis
n=6	V.32
n=7	V.32
n=70	V.110 or X.31
n=71	V.110 or X.31
AT+CPIN?	SIM card PIN-code status report
AT+CLCC	Reports the current CSD call list
AT+COPS	Reports the mobile operator and network registration status
AT+CIMI	Delivers the International Mobile Subscriber Identity (IMS)
AT+CGSN	Delivers the International Mobile Equipment Identity (IMEI)

4.4 Modem result codes

Number (VO)	Answer (V1)	Legend
1	OK	Command line executed without errors.
2	CONNECT	Connection.
3	RING	Ringing signal detected.
4	NO CARRIER	Carrier lost or never present.
5	ERROR	Invalid Command.
6	NO DIAL TONE	No dial tone detected.
7	BUSY	Busy signal detected.
8	NO ANSWER	No answer from remote modem.

4.5 Configure the TCP/IP (GPRS) connection

Check the modem answer by executing the AT+I command and listen for the answer!

The execution of the following commands are necessary for the TCP/IP (GPRS) connection settings:

AT+ command	Legend
AT+CGDCONT=1,"IP","APNNAME"	Change the APNNAME part to the APN name you are attempted to use
AT+CGDCONT?	Checking the current APN settings

Chapter 5. 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

5.1 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: https://www.m2mserver.com/en/support/

5.2 Product Support

The documents and information related on the product are available here.

https://www.m2mserver.com/en/product/wm-e2sl/

Chapter 6. Legal notice

Warning

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