



WIRELESS COMMUNICATION SYSTEM
Wireless M-BUS

WB169-RFE-R
(WB169-RFG-R, WB169-RFW-R)

Revision 1.0

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1 Introduction

This document describes features, parameters and setting possibilities of the WB169-RFE-R communication gateway, which is used for receiving of radio messages from the devices for remote reading of consumption meters working in the communication system Wireless M-BUS (hereinafter referred as WMBUS) in the 169 MHz band and for transmitting of these messages over a standard IP network (Internet) to a central collecting system.

1.1 Wireless M-BUS Communication Protocol

Wireless M-BUS is the communications protocol described by international standards EN 13757-4 (physical and link layer) and EN 13757-3 (application layer), which is intended primarily for radio transmission of remote reading values from consumption meters and sensors. Protocol Wireless M-BUS (hereinafter „WMBUS“) is based on a standard M-BUS definition (uses the same application layer as M-BUS standard), but is adapted for data transfer via radio signals.

Communications via WMBUS protocol works in Master-Slave mode, where „Master“ is a collecting data device, „Slave“ is a providing data device. Slave device could be integrated or external radio module transmitting data from the meter/sensor. The communications protocol WMBUS defines several communication modes (simplex or duplex). If working in simplex mode a „Slave“ device only transmits messages to „Master“ that these messages receives. If working in „bidirectional“ mode, it is possible to use a back channel from „Master“ device to „Slave“ device for „Request“ type of messages, that can contain e.g. request for the change of slave's configuration.

Wireless M-BUS communications protocol partially supports repeating of the messages. If receiving from some „Slave“ device is not possible because of the low level of radio signal, the messages can be re-transmitted (repeated) by appointed element of the radio network (repeater or slave with such functionality). Each repeated message is marked as „repeated message“ so as not to be repeated again.

1.2 Module usage

The WB169-RFE-R module is intended for data transfer from the consumption meters (water meters, gas meters, electricity meters, calorimeters) and a central computer application that receives and processes the data. The module receives radio messages coded according to the Wireless M-BUS EN 13757-3 and EN 13757-4 standard for the 169 MHz band, checks their correctness, encodes („repacks“) them into IP/UDP frames and sends them to the configured IP address and a central application port number. Inside the IP/UDP frames the data are coded by using of Softlink's proprietary „NEP“ protocol, so that the WB169-RFE-R module can be used for those central applications only, which use „NEP“ coding system.

If the WB169-RFE-R module is setup for working in the **N2 bidirectional communication mode**, it could transmit Wireless M-BUS messages of „**Request**“ type addressed to any subordinate module supporting N2 mode. These messages can be used for remote changing of parameters of the subordinate „Slave“ device. Broadcasting of the back-channel message for a particular „Slave“ device is under way during 500 ms long back-channel communication window that opens immediately after transmitting of „User Data“ message from the device. During this time period the „Slave“ activates its receiver so as to be able to receive a „Request“ message (if transmitted). Receiving of the back-channel message is confirmed by „Acknowledgment“ type of message.

Management of „Request“ type of messages must be implemented into the central application software. These messages addressed to the particular „Slave“ are transferred to the WB169-RFE-R module through the IP/UDP protocol with using of „NEP“ coding. WB169-RFE-R module stores the „Request“ messages (that contain also the lifetime period of each message) into its memory tables and after receiving of next „User Data“ message from the „Slave“ device transmits the back-channel message within the communication window. If the message is confirmed by receiving of „ACK“ message from the „Slave“, the message is removed from the WB169-RFE-R memory table. If „ACK“ message does not come, „Request“ is sent again during next window until its lifetime period is elapsed. WB169-RFE-R module can keep just one message in the memory table, so if the module receives another „Request“ message from the central application, stored message is replaced by new one so that only the last message is transferred to the „Slave“. „Request“ messages are coded by using of common M-Bus principles and the coding system must be implemented in the central application as well as in the „Slave“ device in a specular manner. The WB169-RFE-R module performs just transferring of the messages.

The basis of the module is a microcomputer with the Linux operating system, which is equipped with one **10/100 Mb/s Ethernet** communication port, four **USB (Universal Serial Bus)** ports and one **COM/CMOS** configuration port. Communication ports are used for the following purposes:

- 10/100 Mb/s Ethernet port – the main communication port intended for communication with the central application over IP-network;

- COM/CMOS port 115 kHz – the module configuration port;
- 4 ports of USB 2.0 type – for connecting of external GSM or WiFi communication adapters (see paragraph 1.3)

The module is equipped with a slot for inserting of the external **memory card of SD type**, which is always included in a delivery and it is an essential part of the device. The module radio receiver is equipped with the **coaxial connector** of SMA (Female) type designated for interconnection of an external antenna (directly or via coaxial cable). The module is enclosed in a plastic casing adapted for mounting on a DIN-rail. The box has a standard „circuit breaker” profile and width of six standard DIN-modules. The module needs an external power supply 12V to 24V DC. For connecting of the power supply there is a screw terminal with marked voltage polarity.

Note: The manufacturer strictly recommends not removing the memory card from the module or to change or replace it. The module is fully non-functional without the original SD card with the module's firmware.

View of the WB169-RFE-R module is shown in Figure 1.

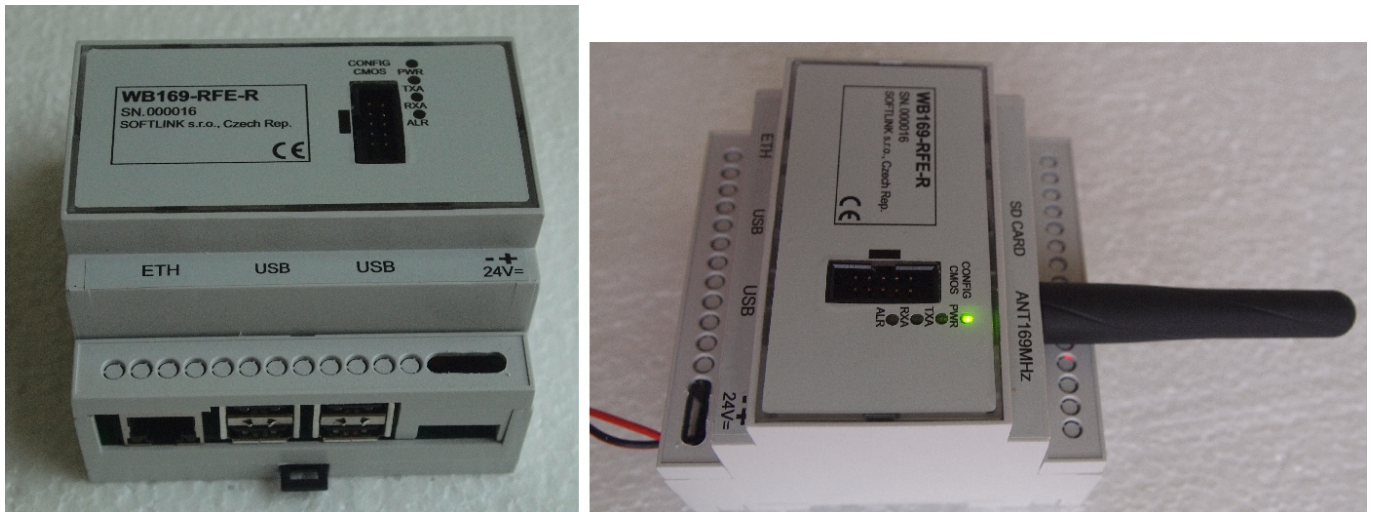


Figure 1: View of the WB169-RFE-R module

1.3 Variants and ordering codes

The WB169-RFE-R module can use three methods of local connection to the IP-network:

- direct connection to a local area network (LAN) of Ethernet type via the integrated 10/100 Mbps Ethernet port;
- connection via a local wireless network (WLAN) WiFi 802.11 b/g/n with using an external adapter connected to the USB port;
- connection via the mobile network GSM/GPRS/3G/4G (hereinafter referred as "GSM") using the external adapter connected to the USB port.

The manufacturer supplies the WB169-RFE-R module based on customer requirements, either in a basic version without external adapters, or with one of the above mentioned communication adapters. The module is always equipped with complete software support for connecting of WiFi and GSM adapters, and it is always labelled as WB169-RFE-R on the manufacturer's label regardless whether and which adapters it is actually equipped with.

To order desired configurations of the WB169-RFE-R module use following ordering codes:

- **WB169-RFE-R** - is the ordering code for the module basic version **without external adapters**;
- **WB169-RFW-R** - is the ordering code for the version with the **WiFi external adapter** of Edimax EW-7811Un type (or similar);
- **WB169-RFG-R** – is the ordering code for the version with the **external GSM module** of **WG-LTE** type.

The change of module's hardware configuration can be performed additionally by adding the desired external communication module/adapter. However, the manufacturer recommends ordering the required module configuration (including appropriate adapter) so that the full equipment functionality (including adapter functionality) could be completely tested before the delivery.

Note: The manufacturer does not recommend using other types of external modules/adapters, than those the manufacturer currently delivers and whose functionality is properly tested. Types of currently supported adapters can be checked at manufacturer by query.

2 Technical parameters overview

Overview of all WB169-RFE-R module technical parameters is shown in the Table 1.

Table 1: Overview of WB169-RFE-R technical parameters

Transmitter and receiver parameters		
Frequency band	169,400 ÷ 169,475	MHz
Modulation type	2GFSK, 4GFSK	
No of channels in band	10	
Transmission rate	2400, 4800, 19200	Baud
Receiver sensitivity	-109	dBm
Back cghannel transmitting power	500	mW (*)
Antenna connector	SMA female	
Communication protocol	Wireless M-BUS	
Communication mode (by EN 13757-4)	N1, N2	(*)
Communication interfaces		
Ethernet	1 port 10/100	Mbps
USB	4 ports USB 2.0	
Configuration interface RS232		
Transmission speed	115 200	Baud
Operation mode	asynchronous	
Transmission rate	8 data bits, 1 stop bit, none parity	
Signal level	TTL/CMOS	
Power supplying		
External power supply	(12 ÷ 24)	V
Input power	4	W
Dimensions		
Width	108	mm
Height	90	mm
Depth	58	mm
Weight	cca 200	g
DIN case	6 modules	
Storing and installation conditions		
Installation environment (CSN 33 2000-3)	normal AA6, AB4, A4	
Operating temperatures range	(-10 ÷ 50)	°C
Storage temperatures range	(0 ÷ 70)	°C
Relative humidity	90	% (no condensation)
Degree of protection	IP20	

(*) Modules WB169-RFE-R with serial numbers 000001 to 000090 are not equipped with back channel transmitter so they do not support N2 communication mode.

3 Configuration of the WB169-RFE-R module

Configuration parameters of the WB169-RFE-R module can be displayed and changed from a common computer (PC) equipped with USB port. This port can be interconnected with the WB169-RFE-R module configuration port with using of the **"USB-CMOS"** converter and configuration cable. Technique of interconnection of the module with configuration computer and general rules of configuration are described in detail in the section 3.1. The description and meaning of all configuration parameters can be found in the section 3.3 „Setting of WB169-RFE-R parameters via configuration cable”.

3.1 Configuration via the configuration cable

Configuration of the module can be performed by using of any PC with MS Windows or Linux operating systems interconnected by configuration data cable. The module's communication interface is of RS-232 (COM) type with CMOS signal level. The **"CONFIG CMOS"** configuration connector is placed on the module's front panel.

3.1.1 Connecting of module to computer

For the interconnection with a USB port of computer it is necessary to use an manufacturer's original configuration cable with „USB-CMOS” converter (see Figure 3). This converter creates a virtual serial port through the USB interface and adapts voltage levels of the module's configuration port to the standard USB port of common PC. So as to be able to create a virtual serial connection via USB interface, there must be a relevant driver installed in the computer operation system. After the „USB-CMOS” converter is connected to computer for the first time, operating system will find and install appropriate generic driver of „USB Serial Device” category automatically. After driver installation is completed, the device will appear in the „Ports (COM and LPT)” section of the „Device Manager” window as „USB Serial Device (COMx)” (see figure 2).

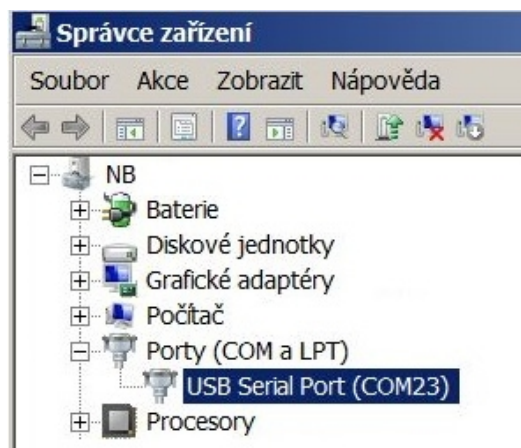


Figure 2: Appearance of the USB-CMOS converter in Windows „Device Manager”

As some of the older MS Windows versions do not support a generic driver for USB serial ports, the automatic installation of the driver could fail (system reports „Driver software installation failure”, or „driver not found”). In this case there is necessary to install the driver manually, following the steps in paragraph 3.2 „Installation of USB-CMOS converter driver”.

Insert USB-CMOS converter to the USB port of computer. Connect configuration cable to the „CONFIG CMOS” port on the module's front panel. Thus the computer is connected with the module and ready for performing any changes in configuration (see figure 3 „Configuration via USB port of computer”).

3.1.2 Using of „PuTTY” freeware program for configuration

The module configuration can be done with using of any suitable program for the serial line communication. The description bellow is relevant for the open-source software „PuTTY” that is available for free on www.putty.org.

„PuTTY” software runs after clicking on the downloaded file „putty.exe”. There will open a window of the terminal communication (see Figure 4). For switching the program into the serial line communication, choose „Serial” option of the connection type in the „Session” tab.



Figure 3: Configuration via USB port of computer

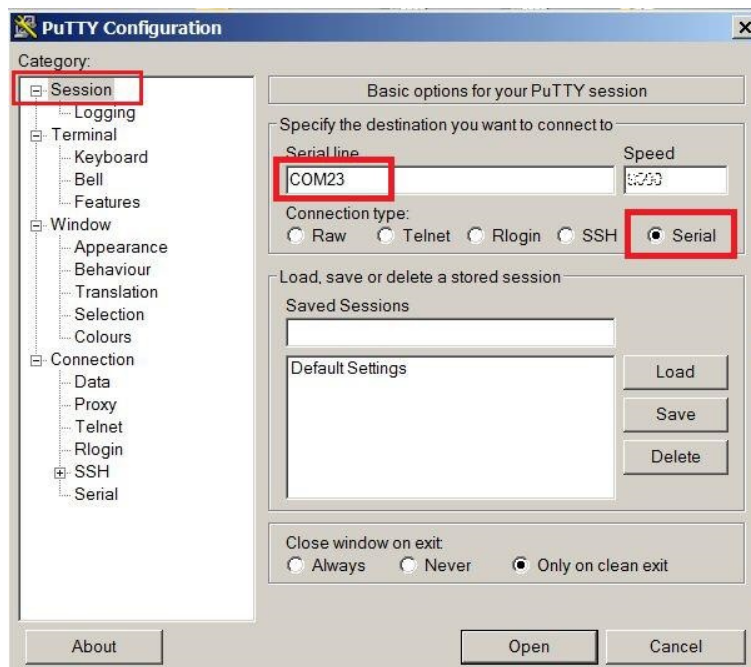


Figure 4: Terminal setting for serial line communication

Check (or set up) the communication speed („Speed”) to 115200 bits/s and then enter into the „Serial line“ tab the number of the serial port that the system automatically assigned to the virtual port at the moment of interconnection module to the computer. The number of the serial port can be found in OS Windows by using of „Device Manager” (Control Panel/System and Maintenance/Device manager) by clicking on „Ports (COM a LPT)” where the numbers of ports appear (e.g. „COM23” - see figure 2).

Click on „Open” button in „PuTTY” program and open the terminal window. After pressing of „ENTER” key there will appear a command prompt „root@pi169-AAA:/#” which announces that the module is ready to be configured (see figure 5).

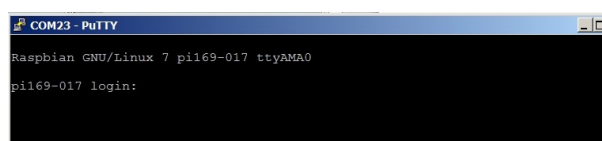


Figure 5: Open terminal window for module configuration via serial line

3.1.3 Basic commands of the Linux operating system

Activate a terminal window for configuration via configuration cable according to the instructions above. The module WB169-RFE-R is equipped with the Linux operating system (OS). When configuring the module it is necessary to know some basic OS commands and common procedures when working with OS Linux.

1. Login to the system

After connecting power supply to the module (or after completing a rebooting procedure) the system requires a login and a password to enter. After booting of the operating system user is prompted for a login. Enter the universal “**root**” login for the system administration and after the password is required enter initial password „**sladmin**” for the WB169-RFE-R module administration. After entering login and password the module’s command prompt “**root@pi169-AAA:/#**” appears, where “**AAA**” series is a module serial number.

An example of login:

```
Raspbian GNU/Linux 7 pi169-016 ttyAMA0

pi169-016 login: root
Password:
Linux pi169-016 4.1.6+ #810 PREEMPT Tue Aug 18 15:19:58 BST 2015 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@pi169-016:~#
```

2. Movement in OS Linux directories

In OS Linux the directory can be changed either by direct entry of entire “path” from the root directory („root”), or by gradual movement in the directory up/down. For the change of directory the general command in the form “**cd [path]**” is used. If the path to the directory is entered „from the root”, it always begins with “/” (slash). The command for transition from the current directory towards “down” to the lower level directory (subdirectory) can be made by entry the subdirectory name after the command “**cd**”. The command for transition to the upper directory has the form of “**cd ..**”.

An example of direct input of the directory:

```
root@pi169-016:/etc# cd /opt/gw/bin
root@pi169-016:/opt/gw/bin#
```

An example of gradual movement in a directory „tree”:

```
root@pi169-016:/# cd opt
root@pi169-016:/opt# cd gw
root@pi169-016:/opt/gw# cd bin
root@pi169-016:/opt/gw/bin# cd ..
root@pi169-016:/opt/gw# cd ..
root@pi169-016:/opt# cd ..
root@pi169-016:/#
```

3. List of files in the directory

List of the current directory content can be displayed in OS Linux with using of the “**ls**” command. After entering the command the names of all the directories and files located in the current directory will display. To display a list with more details of each subdirectory/file use “**ls -l**” command (i.e. „a long list”), In this case subdirectories/files will be displayed in separate lines (the file line always begins with “-”).

An example of a simple („short”) directory list:

```
root@pi169-016:/opt/gw/bin# ls
nepgw  setfreq  setserial  wmbus.xml
```


An example of a detailed („long”) directory list:

```
root@pi169-016:/opt/gw/bin# ls -l
total 156
-rwxr-xr-x 1 root root 143475 Sep 10 11:59 nepgw
-rwxr-xr-x 1 root root   451 Sep 10 12:00 setfreq
-rwxr-xr-x 1 root root   431 Sep 10 12:00 setserial
-rw----- 1 root root  1156 Sep 17 12:38 wmbus.xml
root@pi169-016:/opt/gw/bin#
```

4. Viewing of a file

To view the file in OS Linux use "**cat** [name]" or "**less** [name]" commands. Commands have a similar meaning, the command "less" makes possible a cursor movement in the list up and down. When enter one of mentioned commands a text preview of the file is displayed.

An example of viewing a file „wmbus.xml”:

```
root@pi169-016:/opt/gw/bin# less wmbus.xml
<?xml version="1.0" encoding="UTF-8"?>
<gw>
  <xxx
  <xxx
wmbus.xml
```

Viewing will be ended by entering of "q" key .

5. Mounting disk (volume) in the read/write mode

After each start-up (or reboot) of the operating system memory disks/volumes are always mounted to the system in the „**read only**” mode. To edit a file on the disk it is necessary to mount the disk (volume) to the „**read/write**” mode. Mounting the volume in the „read only” mode is performed by using of the "**mount -o remount,ro** [volume]" command. Mounting of the volume in the „read/write” mode is performed by using of the "**mount -o remount,rw** [volume]" command. Commands can be entered from any directory.

An example of mounting of the main („/") volume to „read only” and „read/write” mode:

```
root@pi169-016:~# mount -o remount,ro /
root@pi169-016:~# mount -o remount,rw /
```

An example of mounting of the „/opt” volume to „read only” and „read/write” mode:

```
root@pi169-016:/opt/gw/bin# mount -o remount,ro /opt
root@pi169-016:/opt/gw/bin# mount -o remount,rw /opt
```

6. File editing by using of „vi” program

Change of some configuration parameters of the module WB169-RFE-R is performed by editing of a file, in which the parameter is set-up. Editing can be performed with a commonly used „vi” editor. Before editing of the file it is necessary to remount the volume to the „read/write” mode as it is described in the „Mounting disk (volume) in the read/write mode” article.

Editing of the file is run with using a command in a form of "**vi** [filename]" as it is shown in the example of editing of the „wpa_supplicant.conf” file:

```
root@pi169-016:/etc/wpa_supplicant# vi wpa_supplicant.conf
```

When entering the command the "name" file opens in the browse mode. The file viewing is similar as under entering the command "cat" or "less". In the bottom line the file name displays; if the „[readonly]" information displays after the file name, the volume is in „read only” mode and the file cannot be edited – see example:

```
~
"wpa_supplicant.conf" [readonly] 13L, 191C          1,1          All
```

Switch the editor to editing mode by entering the "i" command. In the bottom line information „INSERT" appears instead of the file name – see example:

```
~
-- INSERT --                                1,1      All
```

Editing is performed with the inserting of characters from the keyboard (they are always inserted in a place before the cursor) or deletion of characters by pressing of "Backspace" key. After editing is finished use "Esc" and "colon" (**Esc:**) keys to move back to the command mode (last line of file's dump is replaced by colon and cursor). When in command mode, use "wq" command to save all changes and to exit the editor. If using the "q!" command the editor is closed without saving of changes.

7. Starting the program (executive file)

In OS Linux a program can be started either from any directory by input of whole „path" from the root down to the executive file name (the command begins with a slash "/"), or from the current directory (the command begins with a dot and a slash "./").

An example of starting the „nepgw" program by entering the entire path from the root:

```
root@pi169-016:/opt/vc# /opt/gw/bin/nepgw
```

An example of starting the „nepgw" program from the current directory

```
root@pi169-016:/opt/gw/bin# ./nepgw
```

8. The system rebooting

The system rebooting is performed with the "reboot" command entering from any directory. The command can be used in specific cases, for example if the system does not respond to entered commands. The operating system will pass the reboot process, connect disks in the „read only" mode and after the entire process completion requires to enter login and password.

An example of the system rebooting:

```
root@pi169-016:/# reboot

Broadcast message from root@pi169-016 (ttyAMA0) (Thu Oct  1 13:14:14 2015):
The system is going down for reboot NOW!
root@pi169-016:/#
xxx
[ 17.382493] EXT4-fs (mmcblk0p3): mounted filesystem with ordered data mode. Opts: (null)
Raspbian GNU/Linux 7 pi169-016 ttyAMA0

pi169-016 login:
```

9. Password change

The change of main directory ("root") password can be performed by using of Linux standard "passwd" command entered from any directory. Before the change there is necessary to mount the main volume ("/") to the "read/write" mode as described in the "Mounting of the disk (volume) in the read/write mode" article.

An example of the change of password including mounting of the disk in read/write mode:

```
root@pi169-016:~# mount -o remount,rw /
root@pi169-016:~# passwd
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
root@pi169-016:~#
```

10. The system shutdown

In normal operation the system is proof against sudden disconnection of power supply and it is possible to shutdown it without risks simply by disconnecting power supply only. But if the configuration takes place and

some directories are mounted in „read/write” mode, the manufacturer recommends carrying out controlled shutdown using the **poweroff** command entered from any directory. The operating system stores data and shutdown safely. The shutdown process is completed by displaying a „Power down” message, after which power supply can be disconnected without risks.

An example of the system controlled shutdown:

```
root@pi169-016:/opt/gw/bin# poweroff

Broadcast message from root@pi169-017 (ttyAMA0) (Thu Sep 17 18:34:14 2015):
The system is going down for system halt NOW!
root@pi169-016:/opt/gw/bin#

[ 476.116539] reboot: Power down
```

3.2 USB-CMOS converter driver installation

If the computer operation system failed in automatic installing of the driver for the „USB-CMOS”, it is necessary to install the driver manually. The relevant current driver can be found on a chip manufacturer’s (FTDI) webpages, namely in the „VCP Drivers” (Virtual COM Ports) section.

www.ftdichip.com/Drivers/VCP.htm

In the „Currently Supported VCP Drivers” table find a link to a driver relevant to your operating system. To download the file, click on a link in the table. After downloading the file (in .ZIP format) into any directory in your computer, unzip the file. It will create a new folder (directory) with a set of files (e.g. „CDM 2.08.24 WHQL Certified”).

Connect the converter „USB-CMOS” to your computer and open a „Device Manager” tool. The converter with the disabled driver will be displayed in the top right corner of the window as „Other Devices” (see figure 6 left).

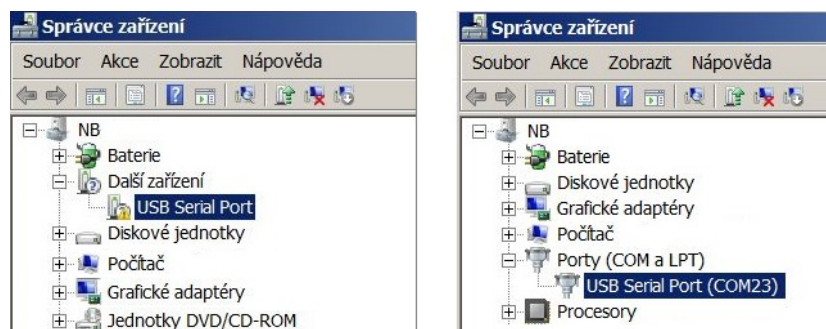


Figure 6: Appearance of converter without driver in the Windows „Device Manager” table

Click by right mouse button on „USB Serial Port” and choose „Update Driver Software” option in the context menu. Choose „Find Driver in this computer” option in the „Update Driver Software” window. Use „Browse” button to set up the path to the driver’s folder (directory) and then click on the „Next” button. The driver installation process will launch. After the driver installation is completed, the standard „Installation Completed” message will appear. After the installation the converter will appear in the „Ports (COM and LPT)” section of the „Device Manager” window (see figure 6 right).

3.3 Configuration of the module individual parameters via cable

In this part of the document there are described the parameters of WB169-RFE-R module that can be checked (read) and configured (changed) with using of „USB-CMOS” configuration cable and PuTTY program as described in the paragraph 3.1 of this document. Each part of the configuration is described in a separate paragraph.

Configuration of the WB169-RFE-R module parameters can be performed in three configuration files, where each of them can be used for setting of specific group of parameters:

- in the „wmbus.xml” file the basic parameters of the gateway are set (the module parameters, Wireless M-BUS parameters and communications settings with the parent over IP-network);
- in the „wvdial.conf” file parameters for the GSM communication adapter are set;
- in the „wpa_supplicant.conf” file parameters for the WiFi communication adapter are set.

3.3.1 Configuration of the GateWay basic parameters

In this part of configuration the basic parameters of gateway and Wireless M-BUS subsystem are set-up. The module is factory-set to communicate with the central system "CEM". The configuration is stored in the „wmbus.xml” configuration file that is located in the „/opt/gw/bin” directory. The current setting of the configuration can be found out by the following method:

Go to the directory „/opt/gw/bin”:

```
root@pi169-017:/etc# cd /opt/gw/bin
root@pi169-017:/opt/gw/bin#
```

View the configuration file „wmbus.xml” by the command „less”:

```
root@pi169-017:/opt/gw/bin# less wmbus.xml
<?xml version="1.0" encoding="UTF-8"?>
<gw>
  <ip port="1141"></ip>
  <radio index="1" freqcorr="-11" protocol="wmbus" defstandart="n1" defchann="3" ></radio>
  <defaults cemip="ns1.softlink.cz" cemport="1141" cemtimeout="300" cemhb="30"></defaults>
  <nep>
    <tree oid="1" name="Device name" type="0" value="WMBUS Gateway R" ro="true"></tree>
    <tree oid="2" name="Type" type="2" value="169" ro="true"></tree>
    <tree oid="3" name="SubType" type="2" value="78" ro="true"></tree>
    <tree oid="4" name="Vyrobní číslo" type="0" value="00000017" ro="true"></tree>
    <tree oid="5" name="HW version" type="2" value="1" ro="true"></tree>
    <tree oid="6" name="HW revision" type="2" value="1" ro="true"></tree>
    <tree oid="7" name="SW version" type="2" value="1" ro="true"></tree>
    <tree oid="8" name="SW revision" type="2" value="1" ro="true"></tree>
  </nep>
</gw>
wmbus.xml
```

In the first three lines of the configuration file there are set basic parameters („defaults”) of the Wireless M-BUS subsystem, which have the following meanings:

ip port="1141"	<i>communication port of IP protocol</i>
radio index="1"	<i>index (order number) of radio-subsystem (don't change!)</i>
freqcorr="-11"	<i>receiver frequency tuning (don't change!)</i>
protocol="wmbus"	<i>communication protocol setting (don't change!)</i>
defstandart="n1"	<i>communication mode setting</i>
defchann="3"	<i>frequency channel setting</i>
cemip="ns1.softlink.cz"	<i>default server name or IP address</i>
cemport="1141"	<i>IP communication port of default server</i>
cemtimeout="300"	<i>timeout for rerouting to default server (sec)</i>
cemhb="30"	<i>heartbeat period for default server (sec)</i>

Default server is a default superior system (master), which is preset to collect data from the gateway. The gateway may be connected temporary to another system (for example to radio traffic analyzer), but if the connection is broken, the gateway after expiring of preset „cemtimeout” automatically redirects to communication with the default superior system.

Heartbeat message is the brief message without data content, which is sent by the module to the default superior system. It is used for continual monitoring of the gateway functionality.

Frequency channel setting can be used for change of module's receiver frequency channel. There are seven frequency channels within the 169 MHz frequency band defined by Wireless M-BUS standard. WB169-RFE-R gateway has only one receiver so that all the devices which will be connected to superior system through the gateway have to transmit on the same frequency channel as it is configured on the gateway's receiver. Change of channel can be performed by editing the numeral after "defchann" parameter.

Parameters of the individual frequency channels are as follows:

- "1" - channel 1a (169.40625 Mhz), transmission rate 4.8 kbps
- "2" - channel 1b (169.41875 Mhz), transmission rate 4.8 kbps
- "3" - channel 2a (169.43125 Mhz), transmission rate 2.4 kbps

- "4" - channel 2b (169.44375 Mhz), transmission rate 2.4 kbps
- "5" - channel 3a (169.45625 Mhz), transmission rate 4.8 kbps
- "6" - channel 3b (169.46875 Mhz), transmission rate 4.8 kbps
- "7" - channel 3g (169.43750 Mhz), transmission rate 19.2 kbps

In other lines of the configuration file (oid = 1 to 8) there is a set of **identification data** of the module when communicate with the superior system with using of NEP-protocol (see "Quick test of the gateway availability" in paragraph 5 "Troubleshooting". These IDs are a part of every message that the module sends to the superior system. All data are factory-set and are of „read only" character.

Viewing the file will be ended by the "q" command (quit).

Editing of the parameters can be done by mounting the „/opt" disk to „rw" mode and editing „wmbus.xml" file by using of Linux „vi" editor:

```
root@pi169-017:/opt/gw/bin# mount -o remount,rw /opt
root@pi169-017:/opt/gw/bin# vi wmbus.xml
```

After opening the file in „vi" editor switch the editor to editing mode with using of „i" command and perform the desired change of the file (for example the change of the server IP address, frequency channel etc...). The editing is performed under the procedure described in the paragraph 3.1.3 (File editing in program "vi"). After editing switch the editor to the command mode with using of "Esc" + "colon" keys (**Esc:**) and save changes and exit editor by using of the „wq" command.

3.3.2 Configuration of GSM communication parameters

In this section the configuration of GSM/GPRS communication parameters over GSM adapter is set up. Configuration is stored in the „wvdial.conf" configuration file, which is placed in the „/etc" directory. The actual setting can be browsed as follows:

Go to the „/etc" directory;

```
root@pi169-017:/opt/gw/bin# cd /etc
root@pi169-017:/etc#
```

Browse the „wvdial.conf" configuration file by using of "less" command:

```
root@pi169-318:/etc# less wvdial.conf
[Dialer 3g]
Init1 = ATZ
Init2 = AT+CFUN=1
Init3 = AT+CGATT?
Init4 = AT+CGDCONT=1,"IP","Internet"
Stupid Mode = 1
Phone = "*99***1#"
Modem = /dev/ttyUSB0
Username = " "
Password = " "

[Dialer lte]
Init1 = ATZ
Init2 = AT+CFUN=1
Init3 = AT+CGATT?
Init4 = AT+CGDCONT=1,"IP","Internet"
Stupid Mode = 1
Phone = "*99***1#"
Modem = /dev/ttyUSB1
Username = " "
Password = " "
wvdial.conf
```

Quit viewing of the file by using of "q" command (quit).

The „wvdial” file is a Point-to-Point dialler, which is currently used in Linux systems for the modem communication settings. Description of the function and setting possibilities can be obtained from public sources in Internet, for example under this reference: wiki.archlinux.org/index.php/Wvdial

The only parameter that must be set-up in the „wvdial.conf” file is setting of **APN** (Access Point Name) in „**Init4**” section. The parameter is factory-set for communication over public Internet (“**Internet**”). If the gateway is connected to non-public APN, then original setting is necessary to rewrite to corresponding APN name (for example „cms.softlink”).

Editing of APN setup can be done by mounting of the main volume „/” to „rw” mode and editing of the the „wvdial.conf” file by using of „vi” editor as follows:

```
root@pi169-017:/etc# mount -o remount,rw /
root@pi169-017:/etc# vi wvdial.conf
```

Switch editor to editing mode by „i” command and change the “Init 4” parameter in the file (for example rewrite string “Internet” to “cms.softlink”). Editing is performed according to a procedure described in the paragraph 3.1.3 (File editing in program „vi”). Switch editor to command mode by using of “Esc” + “colon” keys (**Esc:**), save changes and quit editor by using of the „wq” command.

The manufacturer strictly discourages from making any changes in the „wvdial.conf” file, other than the APN name.

Note: Older series of WB169-RFE-R module can be equipped with a set of software that does not support the newest LTE (4G) GSM data services. Their configuration file „wvdial.conf” does not include „[Dialer lte]” section. The modules with such configuration of software cannot be used for communication through the GSM/LTE network. Software set with LTE support can be obtained from producer free of charge.

Important note: When communicating by GSM/GPRS network with using of GSM-adapter use only **SIM-card with PIN input function turned off!** Otherwise it would be necessary to input PIN code after each reset of the module.

3.3.3 Configuration of WiFi communication parameters

In this section the configuration of Internet access via the local wireless network with using of WiFi-adapter is set up. The configuration is stored in the „wpa_supplicant.conf” configuration file which is placed in the „/etc/wpa_supplicant” directory. The actual setting can be browsed as follows:

Go to the „/etc/wpa_supplicant” directory

```
root@pi169-017:/opt/gw/bin# cd /etc
root@pi169-017:/etc#
root@pi169-017:/etc# cd wpa_supplicant/
root@pi169-017:/etc/wpa_supplicant#
```

View the „wpa_supplicant.conf” configuration file by using of „less” command:

```
root@pi169-017:/etc/wpa_supplicant# less wpa_supplicant.conf
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
#
network={
    ssid="softlinkWifi"
    psk="abc12def"
    proto=RSN
    key_mgmt=WPA-PSK
    pairwise=CCMP
    auth_alg=OPEN
}
#
wpa_supplicant.conf (END)
```

Quit viewing of the file by using of “q” command (quit).

The „wpa_supplicant” file is freely available universal program for Linux, FreeBSD, NetBSD and Microsoft Windows, which provides authentication and secure communication within the Wi-Fi wireless network under WPA and WPA2 standards. The program is located on the end user’s (i. e. authentication applicant’s) computer running as daemon. Description of the function and setting possibilities can be obtained from public Internet resources, for example, under this reference: [wiki.archlinux/WPA_supplicant](http://wiki.archlinux.org/WPA_supplicant)

The file is factory pre-set to the most commonly used authentication WPA (2)-PSK. When configuring the module for working within the WiFi-network which uses this kind of authentication it is necessary to set-up in the file these two parameters:

<code>ssid="softlinkWifi"</code>	<i>WiFi local network "name" (Service Set Identifier)</i>
<code>psk="abc12def"</code>	<i>WiFi local network „password” (PreShared Key)</i>

Editing of SSID and PSK parameters can be done by mounting of the main volume „/” to „rw” mode and editing of the the „WPA_supplicant.conf” file by using of „vi” editor as follows:

```
root@pi169-017:/etc/wpa_supplicant# mount -o remount,rw /
root@pi169-017:/etc/wpa_supplicant#
root@pi169-017:/etc/wpa_supplicant# vi wpa_supplicant.conf
```

Switch editor to editing mode by „i” command and change the „ssid” and „psk” parameters in the file. Editing is performed according to a procedure described in the section 3.1.3 (File editing by using of „vi” program) section. After making required changes in the file switch the editor to command mode by using of „Esc” + „colon” keys (**Esc:**), save changes and quit editor by using of the „wq” command.

When working in the WiFi network with WPA-PSK authentication the manufacturer does not recommend to perform any changes in the „wpa_supplicant.conf” configuration file than setting of SSID and PSK. Settings for WiFi network with other authentication method than WPA-PSK can be provided only by a person with appropriate knowledge and experience.

4 Operational conditions

This section of the document describes basic recommendations for transportation, storing, installation and operation of WB169-RFE-R radio modules.

4.1 General operational risks

Radio modules WB169-RFE-R are electronic devices powered from the external power source that receive radio messages from surrounding radio modules and forward these messages to the superior server over the Internet. They can be connected to the local network either via the LAN Ethernet cable, or with using of wireless WiFi-adapters or GSM/GPRS communication adapters. During the operation of the modules there are following potential risks:

4.1.1 Risk of mechanical damage

The devices are covered in plastic boxes, so electronic components are not accessible for a direct mechanical damage. When installing it is necessary to ensure a sufficient space for connecting cables (including the configuration cable) and also that the cables are as short as possible (especially power and antenna cables). It is necessary to ensure the proper fastening of the module to DIN-rail with a plastic lock. In normal operation no special precautions are needed, besides avoiding of the mechanical damage from strong pressure or shocks.

Special attention is required for power, communication/signaling and antenna cables. In operation it is necessary to ensure that the cables are not stressed by mechanical tension or bending. In the case of damage of any cable isolation it is recommended to replace the cable immediately. If the module is equipped with a remote antenna on a coaxial cable, much attention should be paid for the antenna and the antenna cable as well. The minimum bending radius of the antenna cable with 6 mm diameter is 4 cm, for the antenna cable with the 2,5 mm diameter the bending radius is 2 cm. Violation of these bending parameters can lead to breach of homogeneity of the coaxial cable that could cause reducing of radio range of the device. Further it is necessary to ensure that the connected antenna cable will not stress the antenna connector of the device by tension or twist. Excessive loads can damage or destroy antenna connectors.

The module is specified for installation in normal internal premises with the temperature range of $(-10 \div +50)^{\circ}\text{C}$, with humidity up to 90% without condensation. Direct installation of the equipment in outdoor areas is not possible.

4.1.2 Risk of electrical damage

Electrical installation of the module can be performed only by a person with necessary qualification in electrical engineering and at the same time trained for this device installation. The device is powered by DC power with safe voltage up to 24 V and current consumption up to 200 mA.

The power supply must meet the requirements for the safety protective transformer ČSN-EN61558-2-6. The module has an integrated protection against reversing the polarity of the supply voltage. Reversing the polarity is indicated so that after switching on the supply voltage to the module a green LED „PWR” on the front panel does not shine. Unwanted reversing the polarity of the supply voltage does not lead to damage or destruction of the device. In addition, the module is on the supply inlet equipped with an irreversible fuse (polyswitch) with the actuating current of 300 mA and over-voltage protection with 30 V switching level.

The module is not equipped by any disconnecting component – switch. It is suitable to place in installation a disconnecting component, for example a circuit breaker, which can be inserted into 24V/DC lateral of the supply or into the 230V/AC side of the supply. The primary side of the power source must be protected by automatically irreversible fuse.

For the connection to the local Ethernet network it is necessary to use standardized good quality shielded cables and lead them (just as the antenna cable) as far from the 230V/50Hz power lines as possible.

4.2 The condition of modules on delivery

Modules are delivered in standard cardboard boxes. At standard term of delivery the module does not include the antenna, the power supply and cables, if required these components must be ordered separately.

4.3 Modules storage

Modules should be stored in dry rooms with a temperature range $(0 \div 30)^{\circ}\text{C}$.

4.4 Safety precautions

Warning! Mechanical and electrical installation of the WB169-RFE-R module can be provided only by a person with necessary qualification in electrical engineering.

4.5 Environmental protection and recycling

The equipment does not contain exchangeable components, which require compliance with specific rules in terms of environmental protection for their replacing, storage and disposal. Damaged, destroyed or discarded devices cannot be disposed as household waste. Equipment must be disposed of in the waste collection yards, which dispose electronic waste. Information about the nearest collection yard can be provided by the relevant local (municipal) authority.

4.6 WB169-RFE-R module installation

WB169-RFE-R radio modules are enclosed in plastic casings with an IP20 degree of protection equipped by plastic locks for mounting on the DIN-rail. Casings should not be open under mounting, dismantling and normal operation. Detailed view of the WB169-RFE-R module from the front side and the rear side is shown in Figure 7.

Installation of the module should be performed by the following procedure:

- installation of the module can be performed only by a person with necessary qualification in electrical engineering and at the same time trained for this device installation;
- when selecting an installation site pay attention to secure sufficient space for connection of antenna, power and signaling cables to the module (see paragraph 4.1.1 „Risk of mechanical damage”). It is necessary to keep the sufficient space for the connecting of configuration cable as well;

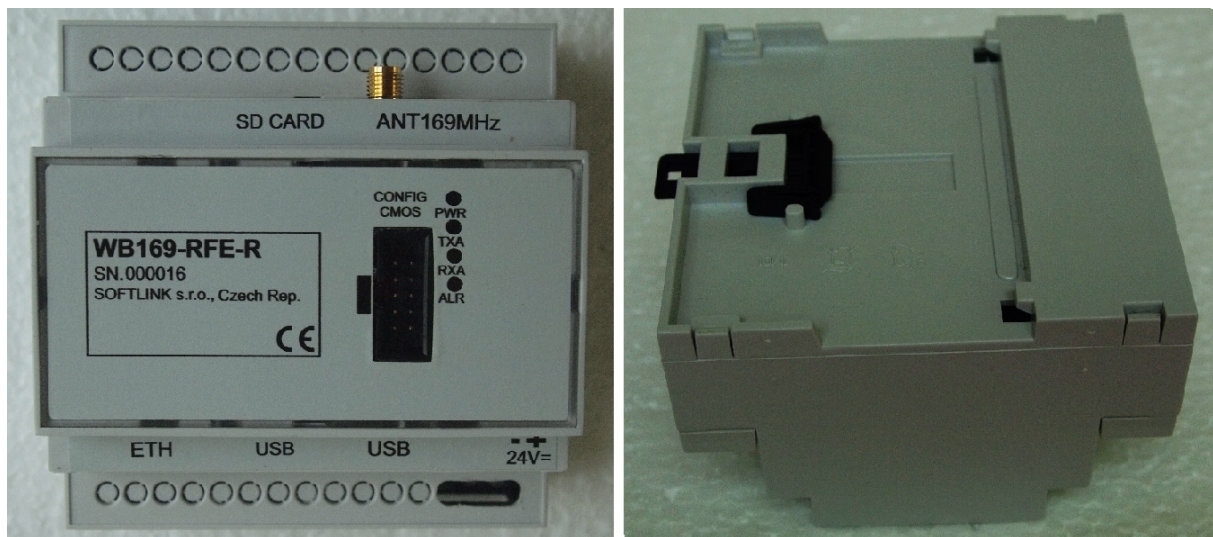


Figure 7: Detailed view of WB169-RFE-R module

- when selecting a site for the module installation it is necessary to choose a place with availability of power supply. The power supply should be placed close to the module so that the feed of 24 voltage is as short as possible. Further it is necessary to consider the method of the module switching off and location of an appropriate disconnecting element (see paragraph 4.1.2 „Risk of electrical damage”).
- mount the module to the selected place on the DIN-rail. Pull down black plastic lock in the bottom side of the module (outward of the module), attach the module to the DIN-rail so that the rail fits into the slot on the rear side of the module and push the black plastic lock up (inward the module);
- connect the antenna and signal cables to the module;
- make sure that the power supply is turned off and connect the power cable to the module. Verify that the polarity of power supply corresponds with the marking on the module terminals;
- check whether everything is properly connected and fasted and turn on the power supply. Green LED „Power” will shine on the module and the operation system will start up;
- perform the basic diagnostic of the module in compliance with the procedure mentioned in the paragraph 4.9 „Functional check of the module” and possibly (if the module was not pre-configured during the preparatory stage of installation) its configuration with using of the configuration cable according to the procedure described in the paragraph 3 „Configuration of the module individual parameters”;
- record information about the module installation (serial number, position, picture of installation...) to the operational documentation under internal rules.

When locating installation site, selecting antenna type and antenna position it is necessary to take into account conditions for radio signal propagation in the area of installation. The conditions is possible either estimate empirically on the base of previous experience, or accomplish a measurement of the signal strength by the signal analyzer.

4.7 Module replacement

When there is necessary to replace the module due to the module failure follow this procedure:

- switch off the power supply and disconnect the power cable wires from the module;
- disconnect the signal cable and the antenna cable;
- release the module from DIN-rail by pulling down of the black plastic lock on the bottom side of the module down (outward of the module) and remove the module from the rail;
- attach the new module at the place of the original module and proceed further according to the procedure mentioned in the paragraph 4.6. Especially pay attention to the correct connection of the power cable;
- after switching power on perform the diagnostics and set-up parameters;
- label the original module as „defective” and fill in the appropriate documentation prescribed by internal rules for this case.

4.8 The module dismantling

When dismantling module turn the power supply off and disconnect the power supply cables from the module. Disconnect the signal cable and the antenna cable from the module. Release the module from DIN-rail by pulling down of the black plastic lock on the bottom side of the module (outward of the module). If there is no further use for the antenna, remove the antenna cable and the antenna. If there is no further use for the power supply, remove the power supply and the power cable. If the power supply is used for other purposes, secure power cables against short circuit (by insulation of live ends of wires or by removal of useless power branches) and connect the power supply again. After dismantling label the module properly as „dismounted” and fill in the appropriate documentation prescribed by internal rules for this case.

4.9 Functional check of the module

After putting the module into operation (or after each repair and replacing of the module) it is recommended to check its functionality by connecting to the local Internet network and testing of the receiver functionality in the „Radar” mode.

Checking of connection to the local Internet can be performed immediately after the module turning on. Connect the module with a PC with using of the configuration cable and launch the program for communication over a serial line (for example „Putty”) as it is described in the paragraph 3.1 „Configuration of the module with using of the configuration cable”. Login to the operating system as it is described in paragraph 3.1.3, section „Login to the system”.

Enter a standard **”ifconfig”** command into the command line (from any directory) after which the system displays a listing with the configuration status of system’s communication ports:

```
root@pi169-017:/# ifconfig
eth0      Link encap:Ethernet  HWaddr b8:27:eb:58:87:14
          inet addr:172.16.16.183  Bcast:172.16.16.255  Mask:255.255.255.0
          inet6 addr: fe80::ba27:ebff:fe58:8714/64 Scope:Link
          inet6 addr: 2001:470:26:6b5:ba27:ebff:fe58:8714/64 Scope:Global
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:37076 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8342 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2547458 (2.4 MiB)  TX bytes:860689 (840.5 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:8 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:652 (652.0 B)  TX bytes:652 (652.0 B)
```

In the „**eth0**” section (the first section of the listing) there is displayed the current setup of Ethernet port and its operating statistics. The second and third lines display the **current IP-address** assigned the module by DHCP-server of the local network. If the IP-address is loaded, the module apparently communicates with the local network. A **”lo”** section is an internal virtual port of the computer, the port displays when operating WiFi and GSM as described in the section 4.11 „Particularities of WiFi and GSM operation”.

Check presence of radio signal from the neighboring modules in the „**Radar**” mode by using of WEB browser. Open any browser and enter WB169-RFE-R module’s IP-address in the form of „**http://ip_address/**” and start searching. If an IP-connectivity between the computer and the module is available, website „Radar” of the module displays (see Figure 8), where there are the last reports from all devices broadcasting in the area of the module radio receiving (on the same frequency 169 MHz and with the same communication mode N1 (unidirectional), or N2 (bidirectional)).

The record of each device is displayed in a separate line where the following data can be seen:

- equipment identification
- receiving time of the last report from the equipment

IoT WB169 gateway - Internet Explorer

http://172.16.16.183/ IoT WB169 gateway

Soubor Úpravy Zobrazit Oblíbené položky Nástroje nápověda

SOFTLINK IoT & WMBus
SW & HW Solutions

Gateway WB169

Modules online

On-line modules during last 2 hours

Refresh Num. of modules : 9

Device ID	Manuf.	Med.	Ver.	Time	RSSI
22334455	SFT	7	1	před 3 minutami (14-10-15 09:01:18)	-82
81854209	TCH	98	112	před 6 minutami (14-10-15 08:57:33)	-65
63406583	KAM	22	27	před 13 minutami (14-10-15 08:50:52)	-81
81853992	TCH	98	112	před 16 minutami (14-10-15 08:47:30)	-77
12345678	SFT	7	1	před 20 minutami (14-10-15 08:44:19)	-94
81506372	TCH	114	112	před 23 minutami (14-10-15 08:41:13)	-39
11000060	ITR	7	30	před 32 minutami (14-10-15 08:32:12)	-63
12345678	SFT	8	1	před hodinou (14-10-15 08:17:56)	-55
31600904	EFE	7	0	před 2 hodinami (14-10-15 07:04:42)	-89

Figure 8: Example of WB169-RFE-R module "Radar" table

- indication of radio signal quality of received message (RSSI = Received Signal Strength Indicator)

If the „Radar” table is displayed in a sufficiently long time since the WB169-RFE-R module was putting into operation (or since its rebooting), the table contents all the devices in the radio reach of the module including the evaluation of the receiving quality – see Figure 8. The „Radar” table displays only records received during last 2 hours.

When installing the local collecting Wireless M-BUS network it is recommended to put into operating the WB169-RFE-R gateway first and the broadcasting equipment after that. Then it is possible to check the successfulness of individual devices installation in the „Radar” mode, including quality of the connection between broadcast devices and the gateway.

4.10 Operation of the WB169-RFE-R module

Receiving radio messages from surrounding radio modules and forwarding of the messages to the superior system via Internet the WB169-RFE-R module performs fully automatically. Take into consideration that the broadcasting systems according to the Wireless M-BUS standard has no protection against interference during transmission (a signal collision, which occurs when two modules broadcast at the same time), so that temporary loss of data from some modules can commonly occur in case of operating of a large number of modules in one radio network. These losses can last for several hours or days.

The greatest risks of the signal losses from surrounding radio modules are commonly caused by human activities within the installation. It is mainly about the following risks:

- turning off the module power (e.g. circuit breaker failure or unintentional shutdown);
- malfunction of Internet connection (e.g. line drop, or change of IP-address);
- temporary or permanent shading of the antenna (e.g. due to building operations);
- mechanical damage of the module, the antenna cable or the antenna when handling things at the installation site.

To eliminate these risks, it is recommended to pay close attention to selection of the installation site and choice of antenna and antenna location so that to find appropriate compromise between qualities of signal and the level of risk of mechanical damage of the module or antenna. It is necessary to carry out the installation carefully with using of high-quality cables and mounting components. In case of loss of income data from large number (or all) reading modules, it is recommended to contact the installation site caretaker and ask for the potential cause of the anomaly or perform the physical check on the installation site.

4.11 Particularities of WiFi and GSM operation of the WB169-RFE-R module

When operating the WB169-RFE-R module with local connection to the Internet via the WiFi local wireless network or via the GSM/GPRS/3G mobile data network, the principle of the operation does not change, only data transfer between the module and the superior system passes via the local wireless or mobile network. There are following recommendations and features that are relevant for using of WiFi or GSM connection:

- only one type of local connection can be in used. When operating over LAN remove communications adapters. When operating over the communication adapter disconnect the cable to the Ethernet and use only one communication adapter;
- when operating over the WiFi wireless network, it is necessary to control whether the WiFi network is in compliance with the 802.11 b/g/n standard and make settings according to the paragraph 3.3.3 „Configuration of WiFi communication parameters”;
- when operating over the GSM mobile network, it is possible to use GPRS, EDGE or 3G services. The adapter does not support LTE (4G) service. During operation over the GSM mobile network it is necessary to make settings according to the paragraph 3.3.2 „Configuration of GSM communication parameters”;
- when operating over the GSM mobile network, it is necessary to set up with the SIM-card operator correct setting of tariffs and services, and especially **switch off the PIN-control procedure**.

When displaying of ports status via the **“ifconfig”** command (see paragraph 4.9) the list of ports appears as follows:

- if operation with the WiFi adapter an additional section **“wlan0”** appears under **“lo”** – see example:

```
wlan0      Link encap:Ethernet  HWaddr 80:1f:02:f3:0d:1d
            inet addr:172.16.16.180  Bcast:172.16.16.255  Mask:255.255.255.0
            inet6 addr: fe80::821f:2ff:fe3:d1d/64 Scope:Link
            inet6 addr: 2001:470:26:6b5:821f:2ff:fe3:d1d/64 Scope:Global
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:90 errors:0 dropped:1 overruns:0 frame:0
            TX packets:91 errors:0 dropped:1 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:11249 (10.9 KiB)  TX bytes:16457 (16.0 KiB)
```

- if operation with the GSM adapter the new **“ppp0”** section will appear under **“lo”** (and - for some types of adapters - also **“wwan0”** section) - see example:

```
ppp0       Link encap:Point-to-Point Protocol
            inet addr:10.1.0.25  P-t-P:10.64.64.64  Mask:255.255.255.255
            UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
            RX packets:28 errors:0 dropped:0 overruns:0 frame:0
            TX packets:29 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:3
            RX bytes:160 (160.0 B)  TX bytes:595 (595.0 B)

wwan0      Link encap:Ethernet  HWaddr 22:92:37:5b:e4:e7
            inet6 addr: fe80::2092:37ff:fe5b:e4e7/64 Scope:Link
            UP BROADCAST RUNNING NOARP MULTICAST  MTU:1500  Metric:1
            RX packets:0 errors:0 dropped:0 overruns:0 frame:0
            TX packets:1 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:0 (0.0 B)  TX bytes:56 (56.0 B)
```

While using WiFi the current IP-address displays in the second line of the section **“wlan0”**, while operating of GSM the current IP-address appears in the second line of the section **“ppp0”**.

An external communication module/adaptor for WiFi or GSM communication can be connected through any of module USB ports. Simple USB adapters of „dongle” type can be put directly on the USB port, or (if it is not sufficient signal in the spot) connected through the extension USB cable.

It is strongly recommended to use **an external GSM module** with independent power supplying for GSM communication (e.g. producer’s original WG-LTE module). Transmitting power of this module will not be limited by peak power of USB internal source.

The original external GSM communicator of **WG-LTE** type, that is a part of original „WB169-RFG” package, supports 3G as well as 4G (LTE) mobile services. It is designed for installation to DIN-bar, uses same power voltage as WB169-RFE-R module and can be equipped by external GSM antenna. Set of WB169-RFE-R device with external communication module of WG-LTE type is depicted in the figure 9.

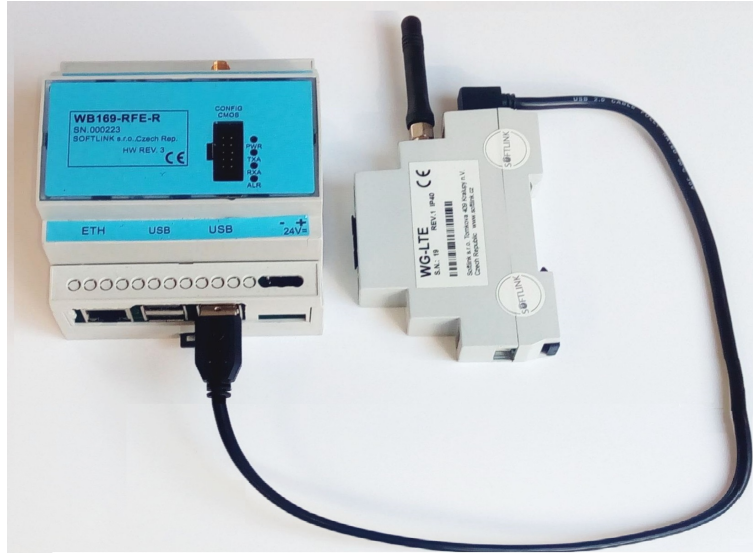


Figure 9: Set of WB169-RFE-R module with external GSM communicator WG-LTE

5 Troubleshooting

If during installation or operation anomaly or malfunctions are detected, the probable cause of the failure can be found in the following manner:

1. No data come from the gateway; no data are available from the devices which communicate via the gateway (hereinafter as „reading modules”). In this case try to find the cause of the failure as follows:
 - (a) Find out whether there is an IP-connection between the gateway and the superior system by using of the standard ”ping” test commonly used in the IP-network:
 - if the gateway is connected directly to the public network (it has a public IP-address), it should respond to ”ping” test from any computer with an access to the public Internet;
 - if the gateway is connected to a private network (it has a private IP-address) and there is an access to the edge router of the private network available, try to use ”ping” test from the edge router;
 - if the gateway is connected through a VPN/APN, ”ping” test can be performed from the computer which has access to the VPN/APN.
 - (b) Availability of the gateway and its functionality can be tested by using of „Quick test of the gateway availability” application accessible at the address:

[unimonitor.eu/Quick test of gateway availability](http://unimonitor.eu/Quick%20test%20of%20gateway%20availability)

By entering of the address a „Quick test of gateway availability” Web form opens (see Figure 10), where it is necessary to fill in the gateway IP-address and the port number. The application requests basic diagnostic data from the gateway and displays them in the „Test results” window.

If the test result is „OK”, the gateway is accessible and functional. In this case try to find out the reason why the gateway does not receive the signals from reading modules under the proceeding described in the paragraph 2;

- (c) If the gateway is not accessible examine its power supplying, especially:
 - whether there has been a power failure in the object,
 - whether the power supply is on,
 - whether the gateway is really under power supplying (the „Power” LED should be shining).
- (d) If the power supplying of the gateway is not working, repair wiring, power supply or A/C power input.

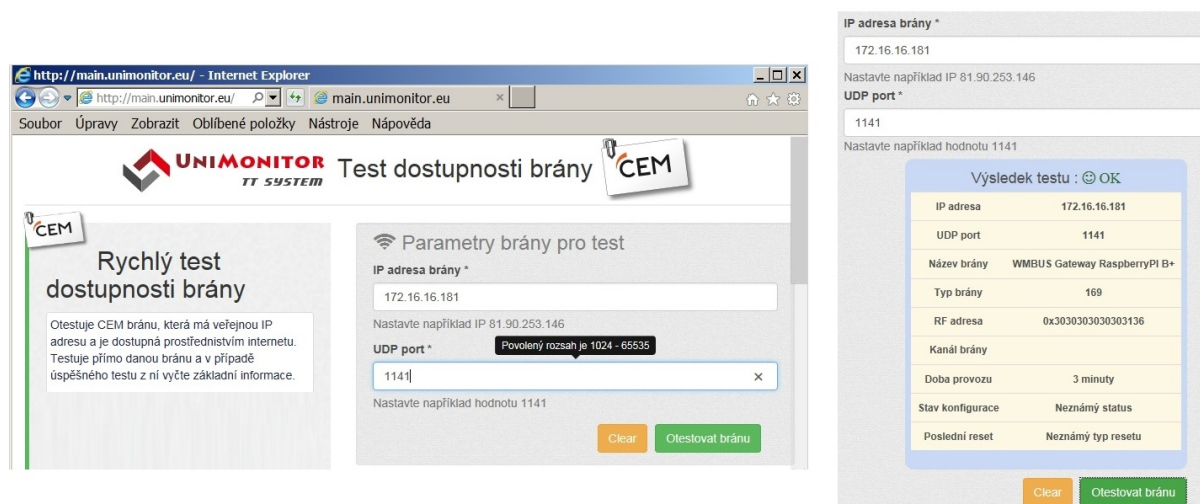


Figure 10: Quick test of gateway availability

- (e) If the power supplying is correct and the gateway is not accessible, search for any circumstances which may affect the IP-connectivity, especially if the local Internet access in the installation site is currently available or if there are any changes in routing or in IP-addressing;
 - (f) If the IP-connectivity is most likely available and the power supply is correct (LED „Power” on the module shines), perform a quick check of connection to the local network according to the paragraph 4.9. In case that the gateway has no IP-address assigned, check functionality of the local IP network and reset the module by disconnecting and connecting of the power supply (the source off/on). If this intervention does not restore communication, replace the gateway according to the paragraph 4.7. If after replacing the new module works correctly, label the dismantled module as ”defective”. If there is no apparent physical damage on the module and it is still under warranty, follow the warranty claim procedure;
 - (g) If the neither restart nor replacing of the module do not lead to restoration of the connection between the gate and the parent system, solve the problem of IP-connectivity with experts in routing within IP-network.
2. The module evidently communicates, answers to ”ping”, the result of the quick test of the gateway availability is „OK”, but data does not come from all (or most) reading modules which communicate via the gateway. In this case try to find the cause of trouble following way:
 - (a) Check receiving functionality of the module in ”Radar” mode as described in the paragraph 4.9. If there is no device in the „Radar” table even after a long time, the module probably does not receive any messages;
 - (b) Ensure that there are no changes in the object, which could have the fatal effect on receiving quality;
 - (c) Check the module visually for any damage of the antenna, antenna cable or connector. If there are any doubts about functionality of any of these components, replace it;
 - (d) Check the module settings according to the paragraph 3.3.1, particularly settings of the communication mode and frequency channel parameters;
 - (e) If the module is configured correctly perform measuring of the signal strength from reading modules by using of the analyzer (or other receiving device);
 - (f) If the signal from reading modules in the place of the WB169-RFE-R module installation is sufficiently strong and the module is set correctly, replace the module according to paragraph 4.7. If after the replacing a new module works correctly, label the dismantled module as ”defective”. If there is no apparent physical damage on the module and it is still under warranty, follow the warranty claim procedure;
 - (g) If even after replacing the new module does not work correctly, the possible cause of trouble could be the local radio interference or wrong settings that has not been discovered by examination. Check functionality of the exchanged module in different location (in area where other gateway is evidently working) and if the module works properly in another location, search for a source of interference or request a company with an expertise in the radio signal transmission to determine the cause of trouble.
 - (h) If the module does not work even at another location, go through its configuration again or try to set-up the spare module to the same configuration. If even spare module with the same configuration does

not work, the trouble is probably in configuration details related to given purpose. Ask for support the manufacturer or other knowledgeable person.

3. The module evidently communicates, responds to "ping" tests, result of quick test of the gate availability is "OK", but the data from some reading modules are not received. In this case the problem may be caused by weakening of the signal in the area of the gateway antenna position, failure of the gateway receiver or radio interference at the installation site. Execute the similar examination as described in the point 2:

- check the antenna, the antenna cable and the connector,
- inspection of the gateway installation site,
- inspection of reading modules installation sites.

If all the results are correct and signals from reading modules measured by signal analyzer or referential receiver are sufficiently strong, replace gateway and proceed further as described in the point 2.

6 Additional information

This manual is focused on description, parameters and configuration options of radio modules WB169-RFE-R, operating according to the Wireless M-BUS standard (EN 13757-3 / EN 13757-4 recommendation) for the 169 MHz band, that are a part of the Softlink's **wacoSystem** product family. More information about all WB169 (Wireless M-BUS), WM868 (WACO), WS868 (Sigfox) or NB (NB-IoT) series of the modules can be found on the manufacturer website:

www.wacosystem.com
www.softlink.cz

If interested in any additional information related to application of radio modules of WB169, WM868, WS868, NB series or other manufacturer's equipment for telemetry and remote reading of consumption meters, feel free to contact the manufacturer:

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