WIRELESS COMMUNICATION SYSTEM
Wireless M-BUS

WB169-MM

Revision 2.0

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1 Introduction

This document describes features, parameters and setting possibilities of the WB169-MM module, which is used for reading of consumption meters (e.g. water meters, electrometers, gas-meters...) and sensors with M-Bus data bus output and for radio-broadcasting of the data from connected meters/sensors to the superior remote reading system in form of Wireless M-BUS standard messages. The WB169-MM module works either in unidirectional communication mode N1, or in the bidirectional N2 mode. In both modes the module regularly broadcasts information messages of „User Data" type intended for superior „master" device. In bidirectional N2 mode it is possible to use a back channel from master device, that can be used for transfer of „Request" type of messages with remote configuration demands.

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-MM module can be used for remote reading of electronic consumption meters (electro-meters, water meters, gasmeters) that are equipped with M-Bus physical data output with either M-Bus, or Modbus, or IEC 62056 type of data coding. The module is equipped with one M-Bus data bus input that can be used for connection up to 20 meters/sensors of various kinds. The module regularly pulls down actual data from connected devices through the M-Bus bus and broadcasts these data as regular Wireless M-BUS „User Data" information messages. Each regular information message contains following entries:

- identification of the meter
- current values of meter counters (e.g. „high tariff", „low tariff")
- operational entries of the module (internal voltage, processor temperature...)

Detailed information about the content and format of information messages can be found in paragraph 3.4.

Information messages are transmitted either in open mode (without encryption), or encrypted by AES-128 encryption key. The messages are transmitted on the 169.4 MHz frequency with data rate from 2.4 kbps to 19.2 kbps (according to used frequency channel). Messages can be received either by WB169-RFE communication gateway (WMBUS Ethernet GateWay produced by SOFTLINK), or any other „Master" device that complies with the Wireless M-BUS EN 13757-3 / EN 13757-4 standard for 169 MHz frequency band.

Modbus protocol support is available only in newer WB169-MM module modifications with software version of 1.06 and higher.

1.2.1 Repeating function

The module can be also used as a repeater of radio-messages from other modules of WB169 product series, that are out of range of data receiving device. If the repeating function is switched on, the module repeats all received messages of „Slave-to-Master type, that are not assigned by „already repeated" sign. Before transmission the module marks the message by „already repeated' sign so as not to be repeated again.

Repeating function is available only in newer WB169-MM module modifications with software version of 1.06 and higher.

1.2.2 Bi-directional communication mode

If the WB169-MM module is preset for working in **bi-directional communication mode N2**, it could receive the **„Request" type of messages** according to the Wireless M-BUS standard. These messages can be originated by superior system or by superior „Master" device and can contain commands for remote configuration of following parameters:

- setting of transmitting power;
- setting of info-messages broadcasting period;

The module is able to receive messages of „Request" type permanently and to confirm receiving of each „Request" by sending of „Acknowledgment" type of message.

Management of „Request" type of messages must be implemented into the central application software or into the superior „Master" device. The messages are coded by M-Bus standard principles with short Wireless M-BUS header with special indication of „Request" type messages (C-byte ="53", CI-byte = "5A"). The message contains one data block (with appropriate DIFE/VIFE code and required value) for each parameter, that should be remotely changed. More detailed description of „Request" type of message can be provided by producer of the WB169-MM module on request.

Bi-directional communication mode support is available only in newer WB169-MM module modifications with software version of 1.06 and higher.

1.3 Hardware features and power supplying

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 three standard DIN-modules. The module is equipped with a **WB169-MM data bus screw-on terminal** with two clamps.

The module needs an external power supply 12V - 24V DC. For connecting of the power supply there is a screw-on terminal with marked voltage polarity. Power supplying must follow all the safety requirements according to the appropriate standards. Maximum current consumption of the module (for voltage of 24 V) is 150 mA, the module is protected by reversible fuse with release current of 300 mA.

The module cannot be used in exteriors without additional covering.

External appearance of the WB169-MM module is shown in the Figure 1.

Figure 1: View of the WB169-MM module

2 Technical parameters overview

Overview of WB169-MM module technical parameters is shown in the Table1 below.

Table 1: Overview of WB169-MM module technical parameters

RF subsystem parameters		
Frequency band	169.40625 - 169.46875	MHz
Modulation *	2-GFSK, 4-GFSK	
Bandwidth *	12.5 or 50	kHz
Transmitting power	500	mW
Sensitivity of back-channel receiver	-109	dBm
Communication protocol	Wireless M-BUS	
Communication mode (by EN 13757-4)	N1 or N2	
Repeating function	yes	
Transmission speed *	2400, 4800, or 19200	Baud
Configuration interface RS232		
Transmission speed	19200	Baud
Operation mode	asynchronous	
Transmission parameters	8 data bits, 1 stop bit, none parity	
Signal level	TTL/CMOS	
Data bus interface		
Bus interface type	M-Bus	two clamps
Transmission speed	300 ÷ 19200	Baud
Supported data protocols	M-Bus, IEC 62056, Modbus	
Supported number of meters/sensors	up to 20	
Power supplying		
External power supply	(12 ÷ 24)	V
Power input	4	W
Weight and dimensions		
Width	54	mm
Height	90	mm
Depth	58	mm
Weight	cca 150	g
DIN case size	3 modules	
Storage and installation conditions		
Installation environment (by ČSN 33 2000-3)	normal AA6, AB4, A4	
Operation temperature range	(-10 ÷ 50)	°C
Storage temperature range	(0 ÷ 70)	°C
Relative humidity	90	% (w/o condensation)
Degree of protection	IP20	
Signalling and control		
Power signalling	”PWR”	green LED
Signalling of RF transmission	”TXA”	yellow LED
Signalling of RF reception	”RXA”	yellow LED
Signalling of bus transmission l	”TXR”	yellow LED
Signalling of bus reception	”RXR”	yellow LED
Signalling of signal collision	”ALR”	red LED
System restart button	”RES”	

* in reliance on selected frequency channel - see EN 13757-4, Mode N, Physical link parameters (Table 18).

3 Configuration of the WB169-MM module

Configuration parameters of the WB169-MM module can be displayed and changed from a common computer (PC) equipped with USB port. This port can be interconnected with the WB169-MM 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-MM parameters via configuration cable".

3.1 Configuration of the module with using of 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

Configuration can be performed by using of common USB port of the 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 Manger" window as „USB Serial Device (COMx)" (see figure 2).

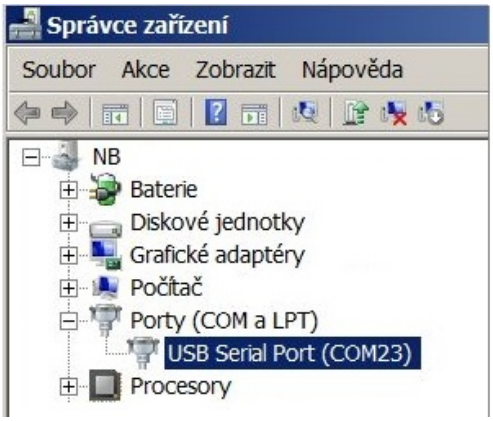


Figure 2: Appearance of the USB-CMOS converter in Windows „Device Manager"

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

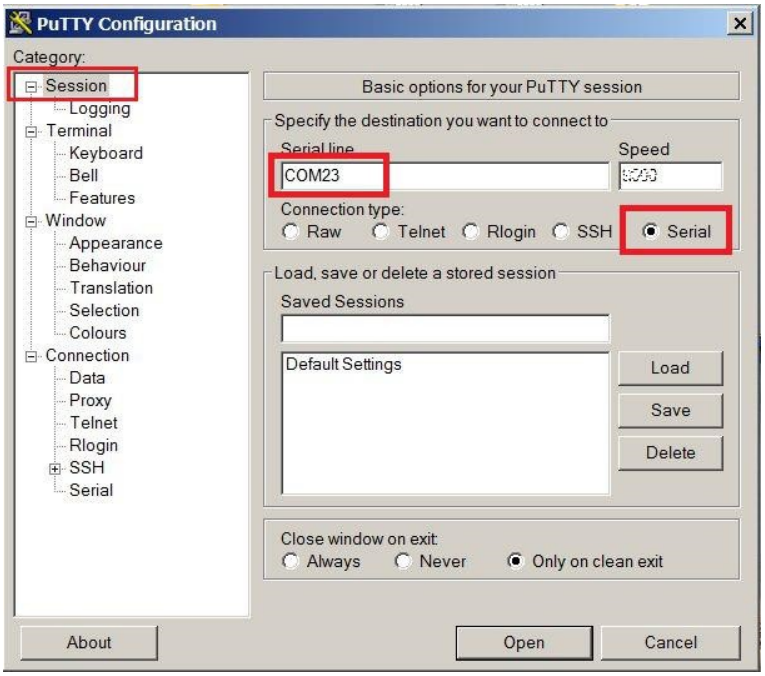


Figure 4: Terminal setting for serial line communication

Check (or set up) the communication speed („Speed") to 19200 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 **„mon"** 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 General rules for configuration of the module by configuration cable

Activate the terminal window for the configuration via the configuration cable according to the instructions above. These general rules are valid for entering commands into the command line:

- the command must be entered only when a prompt for command appears in front of the cursor mark (colored or flashing little square); the prompt is either „mon" or „mon" format (see figure 5);
- it is possible to enter only one command each time;
- the command could be entered in an alphanumeric character (or several characters);
- the command is sent to device by clicking on „ENTER" key. After the command being carried out, the prompt will appear again and it is ready for a new command to be entered. In case the command fails to execute, there will appear an error report;
- check the execution of the command by displaying of the list of configuration parameters which appears by entering "show" or "/" and pressing on „ENTER" key;
- to display a summary of configuration commands and their parameters („HELP"), enter "?" (question mark), or "/?" and press „ENTER" key;
- when entering characters, distinguish strictly the capital and small letters (according to the documentation or „HELP");
- Do not enter other characters than those listed in „HELP" or in the documentation, otherwise you would be risking the unwanted command enter that might be the same as the ones used for manufacturer settings, diagnostics or service and repair.

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).

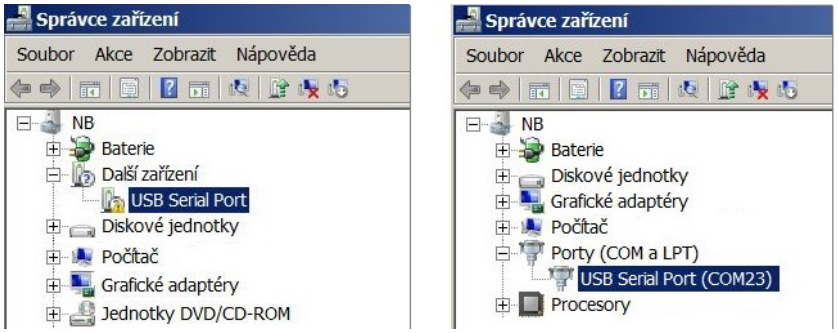


Figure 6: Appearance of converter without driver in the Windows „Device Manager" table

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 Setting of WB169-MM module parameters by configuration cable

In this section of the manual there are described these parameters of the WB169-MM module, that can be browsed, checked and changed from the computer connected with the module through the configuration cable („console configuration") as described in paragraph 3.1.

Table of all configuration parameters, as displayed in the list of configuration parameters viewed from the console, can be found in the paragraph 3.3.8, together with a short description of their meaning.

Up to 20 devices (meters, sensors...) with different setting can be connected to the module through the M-Bus bus. For that reason there are up to 20 internal „inputs" in the module's configuration and each of them carries setting of communication with one connected meter/sensor. All commands that are intended for setting of internal inputs (ports) contain an additional entry, which determines relevant internal input (for which port the command is assigned). This entry called **„index"** practically means number of internal input.

A general syntax of typical command for configuration of one particular input is [command] [index] [value], where „index" is number of internal input (port) from the (0 - 19) range. Example:

```
mon#ispeed 14 4800
```

By "ispeed" command for the device with index "14", the initial communication speed is set to "4800" baud.

As there are many internal inputs of the device, which have identical setting of some (or all) parameters, the system enables entering of „bulk" configuration commands, that are valid for specified range of indexes („from-to") or for all indexes („all"). Example of bulk configuration command for appointed range of indexes:

```
mon#ispeed 1-5 4800
Init speed [1] changed from 2400 to 4800 bps
Init speed [2] changed from 2400 to 4800 bps
Init speed [3] changed from 2400 to 4800 bps
Init speed [4] changed from 2400 to 4800 bps
Init speed [5] changed from 2400 to 4800 bps
Changed 5 configuration
```

By using of „bulk" appointed command for 1, 2, 3, 4 and 5 internal inputs (indexes from the range 1 - 5) the parameter "ispeed" was set to "4800" value. Example of bulk configuration command for all indexes:

```
mon#ispeed all 4800
Init speed [0] changed from 2400 to 4800 bps
Init speed [1] changed from 2400 to 4800 bps
Init speed [2] changed from 2400 to 4800 bps
...
Init speed [19] changed from 2400 to 4800 bps
Changed 20 configuration
```

By using of „bulk" appointed command for all internal inputs the parameter "ispeed" was set to "4800" value for all 20 devices connected to module.

Bulk appointed command will be executed **only for relevant indexes**. If the command is relevant only for „OPTO" type of interfaces, it will not execute for the „M-Bus" type of interface even if that port is inside the range of indexes. After execution of the command the system displays a summary where all changes are clearly stated. Example:

Types of interfaces of connected devices with indexes 1 - 5 can be displayed by "proto" command (w/o value):

```
cfg#proto 1-5
Protocol [1] is MBUS
Protocol [2] is OPTO
Protocol [3] is MBUS
Protocol [4] is OPTO
Protocol [5] is MBUS
cfg#
```

By using of „ver" command enter bulk configuration for 1-5 index (setting to of M-Bus version to „1" value):

```
cfg#ver 1-5 1
MBUS version [2] changed from 3 to 1
MBUS version [4] changed from 2 to 1
Changed 2 configuration
```

As the "ver" command is relevant only for inputs with „OPTO" coding, the command was executed only for relevant indexes 2 and 4.

3.3.1 List of module configuration parameters

List of configuration parameters relevant to required internal input (port) of the module can be displayed by entering of **"show [index]"** command and pressing of „ENTER" key. The following list of parameters will display in the terminal window:

```
mon#show 1
Show configuration : [1 - 1]
 WMBUS address : 00000081
 WMBUS manufacturer : SFT
 Info send periode : 24000 min.
 Next send : 21 min.
 No. sent : 2 msg(s)
 Repeater mode : Off
 Repeater sent : 0 msg(s), queue size 0
 Data will be unencrypted

---- Configuration 0 ------
  MBUS mode
  Uart speed 2400 bps
  Meter address : secondary
  MBUS secondary address : 99887766
  Send periode : 60 min.
  Next send : 54 min.
  No. sent : 0 msg(s)

WMBUS power : 60 (27 dBm)
 WMBUS mode    : N2
 WMBUS channel : 3 (169,43125 Mhz, 2,4 bps)
 Configuration version 4
 SW version 1.06, date Jul 26 2017
```

In the **upper section of the summary** there are parameters that are relevant for the WB169-MM module itself (module IDs, broadcasting period of module status information etc.).

The **„WMBUS address"** and **„WMBUS manufacturer"** parameters are components of the WB169-MM module own address within Wireless MBUS system. The module uses its own WMBUS address when sending its own status messages. These parameters are factory set (read only) and cannot be changed.

The **„Info send periode"** parameter is a broadcasting period of module's own status messages. The period is factory set (read only) and cannot be changed.

The **„Next send"** and **„No. sent"** records show time to next broadcasting of the module status message and number of broadcasted status messages from the last reset.

The **„Repeater mode"** record indicates whether the repeating function of the module is switched on ("On") or disabled ("Off").The **„Repeater sent"** record shows the number of repeated messages from last reset and number of queued messages to be repeated (as the messages are repeated with time shift of 5 - 25 seconds, some messages could be in the queue).

The **„Data will be unencrypted"** record indicates setting of data encryption system. In this example the encryption is disabled (see description and using of "ekey" command in paragraph 3.3.7).

In the **middle section of the summary** there are setting parameters of the individual internal inputs (relevant to connected meters). Their meaning and method of setting are described in detail in the following part of the paragraph 3.3. The two records **„Next send"** and **„No. sent"** show remaining time to next broadcasting message

from relevant meter and number of broadcasted messages since last restart.

In the **lower section of the summary** there are parameters of the radio-frequency (RF) subsystem of the module. Their meaning and method of setting are described in detail in paragraph 3.3.7. Last two records **„Configuration version"** and **„SW version"** are intended only for factory setting and diagnostics.

Overview of configuration parameters with short description of their meaning can be found in table 2 on the page 29.

List of configuration parameters for all internal inputs can be displayed by using of **„show"** command (w/o index).

3.3.2 Displaying the List of configuration commands („HELP")

List of all configuration commands can be displayed by entering of **„?"** command. The following list of commands will display in the terminal window:

```
cfg#?
 Help :
 --- System commands ---
deb               : Show or set debug level
iread             : Readout MBUS device
ta                : Show tasks
mb                : Show mail boxes
du addr           : Dump memory
rb addr           : Read byte from addr
rw addr           : Read word from addr
rd addr           : Read dword from addr
sb addr val       : Set byte on addr
sw addr val       : Set word on addr
sd addr val       : Set dword on addr
uptime            : Show uptime
reset             : Reset device
?                 : Show this help
 --- Configuration ---
show              : Show all configuration
write             : Write configuration to flash
cread             : Read configuration from flash
clear             : Clear configation and load defaults
proto             : Set protocol per meter [0 - 19] 0 - opto, 1 - mbus, 2 - modbus
 --- Wired MBUS commands per meter [0 - 19] ---
ispeed            : Set init. comm. speed
id                : Show or set MBUS address (0 - 255)
sid               : Show or set MBUS secondary address (0 - 99999999)
periode           : Change periode of send
 --- Opto protocol commands per meter [0 - 19] ---
ispeed            : Set init. comm. speed
oid               : Show or set Meter ID (0 - 99999999)
mid               : Show or set MBUS ID (0 - 99999999) or register number
ver               : Show or set MBUS version (0 - 255)
medium            : Show or set MBUS medium (0 - 255)
manuf             : Show or set MBUS manufacturer code (AAA)
reg1              : Set register for value 1
dec1              : Set No. of decimal digits for value 1
dib1              : Set DIF and DIFE for value 1
vib1              : Set VIF and VIFE for value 1
reg2              : Set register for value 2
dec2              : Set No. of decimal digits for value 2
dib2              : Set DIF and DIFE for value 2
vib2              : Set VIF and VIFE for value 2
periode           : Change periode of send
. . .
```

```
. . .

--- ModBus protocol commands per meter [0 - 19]
ispeed           : Set init. comm. speed
id               : Meter address (0 - 255)
reg0             : Register for MBUS address
type0            : Value type for MBUS address (default 0 - NONE)
func0            : Readout command (1 - 4)
sid              : MBUS address (0 - 99999999)
ver              : MBUS version (0 - 255)
medium           : MBUS medium (0 - 255)
manuf            : MBUS manufacturer code (AAA)
type1            : Value type (0 - none, 1 - int8, 2 - int16, 3 - int32, 4 - int48,
5 - int64, 6 - float, 7 - double, 8 - bcd2, 9 - bcd4, 10 - bcd8, 11 - bcd12, 12 - bcd16)
func1            : Readout command (1 - 4)
reg1             : Register address for value 1
dib1             : DIF and DIFE for value 1
vib1             : VIF and VIFE for value 1
type2            : Value type
func2            : Readout command (1 - 4)
reg2             : Register address for value 2
dib2             : DIF and DIFE for value 2
vib2             : VIF and VIFE for value 2
type3            : Value type
func3            : Readout command (1 - 4)
reg3             : Register for value 1
dib3             : DIF and DIFE for value 2
vib3             : VIF and VIFE for value 2
type4            : Value type
func4            : Readout command (1 - 4)
reg4             : Register for value 1
dib4             : DIF and DIFE for value 2
vib4             : VIF and VIFE for value 2
periode          : Periode of send
 ---  Modem commands ---
rep              : Repeater mode, 0 - off, 1 - on
power            : Show or set MBUS power (1 - 5)
ekey             : Set encrypt key, point '.' no eccrypt
mode             : Set WMBUS mode 1 - N1, 2 - N2
chan             : Set WMBUS channel, type ? for help
mr               : Modem receive mode
mt test time     : Set test on modem, 1 -TX carrier, 2 -TX PN9, 0 -off, time in sec, def. 10
ms               : Get modem state
mi               : Get modem info
mfreq            : Set or get radio frequency correction
cfreq            : Set +- frequency correction, 1 = 1Hz
send [prof]      : Send MBUS message profile [0 - 19]
mon#
```

The meaning and usage of individual commands are described in the following part of chapter 3.3.

3.3.3 „System commands" group for general diagnostics

Commands „**"deb", "ta", "mb", "du addr", "rw addr", "rb addr", "rd addr", "sw addr", "sb addr", "sd addr"** and **"uptime"** are used for troubleshooting and repair of the device in a factory. **Manufacturer strongly recommends not to use these commands during common operation.**

The command **"reset"** performs the equipment reset. Its meaning and using are described in the paragraph 3.3.6.

The command **„?'** can be used to display a list (summary) of configuration commands and their parameters (so called „Help"). Its meaning and using are described in the paragraph 3.3.2.

By entering of the **"iread [index]"** command the module will either read the M-Bus message of connected meter with M-Bus coding. or will read all registers of the meter with IEC 62056 coding („OPTO"), or will read all preset registers of the meter with Modbus coding. This command can be used during initial setting of newly connected meter or for module diagnostics.

Example of reading (loading and displaying) of **M-Bus** message from the meter with "0" index by using of "iread" command:

```
cfg#iread 0
Reading configuration 0 ...
Reading mbus...
 Enable uart on speed 2400
--- M-BUS header --
 Address   : 9
 Ident     : 00101970
 Manuf     : SLB
 Version   : 6
 Medium    : 4
 Access    : 62
 Status    : 0
 Signature : 0x0000
----------------------
 Disable uart, end 84
cfg#
```

As a result of the reading the list of M-Bus items will display. There are all components which are necessary for composition of Wireless M-BUS header (see paragraph 3.4 „Structure of the module data message"). Displayed values will be transferred into the short Wireless M-BUS message as follows:

- value "Ident" as „Serial number (A)"
- value "Manuf" as „Manufacturer ID (M)"
- value "Version" as „Version (V)"
- value "Medium" as „Medium (T)"

Value „Address" is a primary address of the meter connected to the module. This value is displayed only for the information, e.g. in case the primary address is not known and could be found out this way.

If a primary address of the particular meter/sensor is not known, it could be recognized from M-Bus meter by entering of command with „broadcast" address as follows:

- arrange that the only meter with unknown address is connected to the M-Bus bus of the module
- preset for the relevant internal input of the meter a special "254" address value that is reserved for broadcast addressing:

```
cfg#id 0 254
MBUS address [0] changed from 253 to 254
```

- enter "iread" command for reading of M-Bus items of the device
- device's primary address can be seen in the "Address" row.

Meaning of „Access", „Status" and „Signature" parameters is explained in detail in the paragraph 3.4 „Structure of the module data message".

Example of reading (loading and displaying) of all registers of the meter (with "0" index) with **IEC 62356** (OPTO) coding by using of "iread" command:

```
cfg#iread 0
Reading opto...
 Enable uart on speed 4800
 Send init id '' .. Recv 17 bytes : '/LGZ4ZMR120AR.510'
 ack 4 (4800)
 Set uart speed to 4800
: '/LGZ4ZMR120AR.510'
: 'F.F.0(00000000)'
: 'C.1.0(12420814)'
: 'C.90.1(11242814)'
 *Mid : 14 28 24 11
: '1.8.1(000010.741*kWh)'
 *Reg1 : '1.8.1' -> 1074
: '2.8.1(000000.000*kWh)'
: '21.8.0(000000.023*kWh)'
: '41.8.0(000010.636*kWh)'
: '61.8.0(000000.037*kWh)'
*Reg2 : '61.8.0' -> 37
: '22.8.0(000000.000*kWh)'
: '42.8.0(000000.000*kWh)'
: '62.8.0(000000.000*kWh)'
: 'C.7.1(0296)'
: 'C.7.2(0055)'
: 'C.7.3(0053)'
: 'C.7.0(0272)'
: 'C.8.0(00105143)'
: '32.7.0(240)'
: '52.7.0(001)'
: '72.7.0(001)'
: '31.7.0(000.04)'
: '51.7.0(000.03)'
: '71.7.0(000.03)'
: '36.7.0(000.00)'
: '56.7.0(000.00)'
: '76.7.0(000.00)'
: '21.6.0(0000.00*kW)'
: '41.6.0(0000.00*kW)'
: '61.6.0(0000.00*kW)'
: '!'

 BCC 0x50 (0x50)
Flags 92
Recv end, 573 bytes
cfg#
```

As seen in the example, by entering of "iread" command the module requests from the meter actual values of all registers and display the results into the summary. It is clear from the displayed summary that:

- serial number of the device (11242814) is stored in "C.90.1" register
- current value of the counter 1 (10,741 kWh) is stored in "1.8.1" register
- current value of the counter 2 (0,037 kWh) is stored in "61.8.0" register

These three registers are selected as a source of variables for the output WMBUS message by using of "mid", "reg1" and "reg2" commands (see below). The rows with selected variables are marked in the "iread" summary by asterisk and the transferred variables are displayed in the same form as the will be used in broadcasted WMBUS messages (i.e. including appropriate number of decimal places as set by "dec1" and "dec2" commands - see description of "reg" and "dec" setting in the paragraph 3.3.4 „Commands for setting of IEC 62056 ("OPTO") meters").

Example of reading (loading and displaying) of pre-selected registers of the meter (with "0" index) with **Modbus** coding by using of "iread" command:

```
mon#iread 0
Reading configuration 0 ...
Reading modbus...
 Enable uart on speed 9600
Modbus send  : (8 bytes):
01 03 01 c1 00 03 55 cb
Modbus recv  : (11 bytes):
01 03 06 00 00 00 00 06 4f 63 21
 Address : 1
 Register : 450 (0x01c2)
 Value (INT48) : 1615
 Read address register ...
Modbus send  : (8 bytes):
01 03 00 04 00 04 05 c8
Modbus recv  : (13 bytes):
01 03 08 00 00 00 00 17 11 27 24 db 8d
 Address : 1
 Register : 5 (0x0005)
 Value (BCD16) : 17112724
 Device address : 17112724
mon#
```

As seen in the example, by entering of "iread" command the module requests from the meter actual values of pre-selected registers and display the results into the summary. It is clear from the displayed summary that:

- device Modbus address is "1"
- device serial number (17112724) is read from the register No "5"
- required variable (current value "1615") is read from the register No "450"
- no other variable is preset for reading

It means that two registers are selected as a source of data for the output WMBUS message: serial number and value of "450" register. Detailed description of setting of required registers and their decoding information can be found in the paragraph 3.3.5 „Commands for setting of Modbus meters".

3.3.4 Commands for setting of M-Bus meters

This group of commands serves for setting of internal inputs of the meters with M-Bus coding, connected to the WB169-MM module. These commands should be always entered with meter index, that means in the **"[command] [index] [value]"** general form (e.g. **"periode 0 60"**), or (alternatively) by using of commands with bulk indexing as described in the first part of section 3.3 (Setting of WB169-MM module parameters by configuration cable).

There are following command:

ispeed	*setting of communication speed for the meter*
id	*setting of meter primary address in M-Bus standard (number from 0 - 255 range)*
sid	*setting of meter secondary address in M-Bus standard (number from 0 - 99999999 range)*
periode	*setting of broadcasting period of regular info messages*

Command **"ispeed"** serves for setting of **bit transfer speed** („communication speed") on the M-Bus interface between meter and WB169-MM module. The speed must be adjusted to the value, that is required by parameters of connected meter.

There are seven options of communication speed setting:

300 baud
600 baud
1200 baud
2400 baud
4800 baud
9600 baud
19200 baud

Example of displaying, setting and follow-up checking of the communication speed for device with index "0":

```
cfg#ispeed 0
Init speed [0] : 4800 bps
cfg#ispeed 0 1200
Init speed [0] changed from 4800 to 1200 bps
cfg#
```

It is evident that the communication speed of the device with "0" index was originally set to 4800 bps (baud). By entering of **"ispeed"** command with "0" index and "1200" parameter it was changed to 1200 baud value.

Command **"id"** serves for entering of **primary** („bus") address of connected meter according to the M-Bus standard. This identifier can be used for addressing of data messages between the WB169-MM module and connected meter. This parameter practically determines which meter is connected to which internal input of the module. Current setting of primary address can be displayed by using of **"id [index]"** command (without parameter). Identifier could be changed by entering of required address number after "id" command and index. Entered address number must belong to the 0 to 255 range.

Example of displaying, setting to "254" value and follow-up checking of primary M-Bus address for the device with "0" index:

```
cfg#id 0
MBUS address [0] : 253
cfg#id 0 254
MBUS address [0] changed from 253 to 254
cfg#
```

Command **"sid"** serves for entering of **secundary** („individual") address of connected meter according to the M-Bus standard (usually identical with serial number). This identifier can be used for addressing of data messages between the WB169-MM module and connected meter. This parameter practically determines which meter is connected to which internal input of the module. Current setting of secondary address can be displayed by using of **"sid [index]"** command (without parameter). Identifier could be changed by entering of required address from the 0-99999999 range after "sid" command and index.

Example of displaying, setting to "12459832" value and follow-up checking of secondary M-Bus address for the device with "0" index:

```
cfg#sid 0
MBUS secondary address [0] :
cfg#sid 0 12459832
MBUS secondary address [0] changed from  to 12459832
cfg#
```

***Important note**: When making queries in M-Bus bus system, either primary (bus) or secondary (individual) addressing can be used. According to the M-Bus standard rules when using of secondary address, the primary address must be set to specially assigned "253" value. If the WB169-MM module is set to make queries with using of secondary address, primary address of same internal port must be always preset to "253" value.*

Example of correct setting of "0" internal port for communication with using of secondary address:

```
cfg#id 0
MBUS address [0] : 253
cfg#sid 0
MBUS secondary address [0] : 00000456
```

If the internal port is preset this way, the information about switching to secondary addressing will show in the summary of the particular meter configuration parameters (shown by "show 0" command) in „Meter address" row:

```
---- Configuration 0 ------
  MBUS mode
  Uart speed 2400 bps
  Meter address : secondary
  MBUS secondary address : 00000456
```

If the communication is preset to primary addressing mode, the same summary looks like this:

```
---- Configuration 1 ------
  MBUS mode
  Uart speed 2400 bps
  Meter address : 250
  MBUS secondary address : 00004583
```

„Periode” command serves for setting of broadcasting period of regular info messages of the meter. Value of the parameter can be preset for each connected meter individually. Value of broadcasting period is factory preset to 60 minutes. Current value can be checked by **”periode [index]“** command (without parameter). Broadcasting period can be changed by entering of required number of minutes (theoretically up to 65535 minutes) after „periode” command nad device index.

Example of displaying and setting of broadcasting period for the device with ”0” index:

```
cfg#periode 0
Periode [0] is 60 min.
cfg#periode 0 120
Periode [0] changed from 60 to 120 min.
cfg#
```

subsubsectionCommands for setting of IEC 62056 (”OPTO”) meters

This section describes setting of internal inputs of the meters with IEC 62056 coding (commonly used for „OPTO” interface), connected to the WB169-MM module. These commands should be always entered with meter index, that means in the **”[command] [index] [value]”** general form (e.g. **”periode 0 60”**), or (alternatively) by using of commands with bulk indexing as described in the first part of section 3.3 (Setting of WB169-MM module parameters by configuration cable).

There are following commands:

ispeed	*setting of initial communication speed for the meter (7 options)*
oid	*setting of meter identifier in IEC 62056 standard (up to 16 characters)*
mid	*setting of meter identifier (M-Bus ID) in M-Bus standard (0 - 99999999)*
ver	*setting of „addressing version” („Version” - supplement of M-Bus address)*
medium	*setting of media code („Medium” - supplement of M-Bus address)*
manuf	*setting of manufacturer code („Manufacturer” - supplement of M-Bus address)*
periode	*setting of broadcasting period of regular info messages of the meter*
reg1	*setting of register where the variable ”1” is stored*
dec1	*setting of number of decimal places for variable ”1”*
dib1	*setting of DIF(E) value (= coding method information) for variable ”1”*
vib1	*setting of VIF(E) value (= measuring unit information) for variable ”1”*
reg2	*setting of register where the variable ”2” is stored*
dec2	*setting of number of decimal places for variable ”2”*
dib2	*setting of DIF(E) value (= coding method information) for variable ”2”*
vib2	*setting of VIF(E) value (= measuring unit information) for variable ”2”*

Command **”ispeed”** serves for setting of **bit transfer speed** („communication speed”) on the interface between meter and the WB169-MM module. The speed must be adjusted to the value of the initial communication speed of connected meter. The communication with meter starts with this speed and it could be switched to higher speed by „hand-shaking” function of the communication startup procedure.

There are seven options of communication speed setting:

300 baud
600 baud
1200 baud
2400 baud
4800 baud
9600 baud
19200 baud

Example of displaying, setting and follow-up checking of the communication speed for device with index ”0”:

```
cfg#ispeed 0
Init speed [0] : 4800 bps
cfg#ispeed 0 1200
Init speed [0] changed from 4800 to 1200 bps
cfg#
```

It is evident that the initial communication speed of the device with "0" index was originally set to 4800 bps (baud). By entering of **"ispeed"** command with "0" index and "1200" parameter it was changed to 1200 baud value.

Command **"oid"** serves for entering of identifier (address) of connected meter according to the IEC 62056 (DLMS) standard. This identifier is used for addressing of data messages between the WB169-MM module and connected meter. Current setting of the IEC 62056 identifier can be displayed by using of **"oid [index]"** command (w/o parameter). Identifier can be changed by entering of required ID (up to 16 characters) after "oid" command and index.

Example of setting of the meter ID for the meter with "0" index' and follow-up checking of the setting:

```
cfg#oid 0 11242814
Meter ID [0] changed from  to 11242814
cfg#id 0
Meter ID [0] : 11242814
cfg#
```

Variable **„M-BUS ID"** is a serial number of the device in M-Bus standard identification system. The variable is editable for the WB169-MM module and can be configured by one of following two ways:

- setting of number of „communication address" register, where the variable „M-BUS ID" is stored. In this case the ID is read up from the assigned IEC 62056 register (e.g. "C.90.1" - see description of "iread" command below). If the „M-BUS ID" is defined this way, the address from incoming IEC 62056 message is copied into the outgoing WMBUS message;
- „manually" as any integer number with maximum 8 digits (1 - 99999999) by using of "mid" command.

Current value of serial number M-BUS ID can be displayed by **"mid [index]"** command (without parameter). Serial number can be changed by entering of required integer (1 - 99999999) after "mid" command and index.

Example of displaying of M-BUS ID current setting (reference to "C.90.1" register) and making of its change to the manually entered 12459832 value:

```
cfg#mid 0
MBUS ID [0] : C.90.1
cfg#mid 0 12459832
MBUS ID [0] changed from C.90.1 to 12459832
cfg#
```

Variable **„Version"** is number of addressing version according to the M-Bus standard (each type and modification of the device could have its own line of serial numbers). The code is editable for the WB169-MM module and it is preset to default 1 value. Current setting of version number can be displayed by **"ver [index]"** command (w/o parameter). Version can be changed by entering of any number from 0 - 255 range after "ver" command and index.

Example of displaying and changing of version parameter:

```
cfg#ver 1
MBUS version [1] : 1
cfg#ver 1 2
MBUS version [1] changed from 1 to 2
cfg#
```

Variable **„Medium"** is an international code of measured medium (water, energy, physical quantity...) according to the M-Bus standard. The variable is editable, and it is factory preset to 02 ("Electricity"). Current setting of the medium value can be displayed by **"medium [index]"** command (without parameter). Medium parameter can be changed by entering of required code of medium according to M-Bus standard (range: 0 to 255) after "medium" command and meter index.

Example of displaying and changing of medium code:

```
cfg#medium 0
MBUS medium [0] : 2
cfg#medium 0 7
MBUS medium [0] changed from 2 to 7
cfg#
```

Variable **„Manufacturer"** is an international code of device producer according to the M-Bus standard. The code is editable for the WB169-MM module, and its value is factory preset to „SFT" value. Current setting of the manufacturer code can be displayed by **"manuf [index]"** command (without parameter). Manufacturer code can be changed by entering of required code (3 charcters) after "manuf" command and meter index.

Example of manufacturer code setting:

```
cfg#manuf
MBUS manufacturer : SFT
cfg#manuf XYZ
MBUS manufacturer change from SFT to XYZ
cfg#
```

Warning: *Use only officially registered international codes of M-Bus devices manufacturers.*

Note*: The full identification of the device in M-Bus standard systems is done by combination of four ID components: „M-BUS ID", „Manufacturer", „Version" and „Medium". This combination must be unambiguous that means there cannot exist two M-Bus devices worldwide, that have the same combination of all these parameters. If there are fixed configuration of the address components used, producer of the device is responsible for unique setting of „read only" address components for each device. If M-Bus address components are configurable, operator of the M-Bus system can use serial number of connected meter in combining with its type, subtype and manufacturer. Using of „independent" addressing line is possible only in that case, if the operator of the system owns its M-Bus manufacturer code and can assure that the identification of all operated devices under his code will be unique.*

For typical application of the WB169-MM module it is possible to use as „M-BUS ID" value an original serial number of the device (meter), that can be obtained from the relevant IEC 62065 register. Remaining M-Bus address components (i.e. „Manufacturer", „Version" and „Medium") should be set for each connected device in the module's configuration by using of above described methods and commands.

„Periode" command serves for setting of broadcasting period of regular info messages of the meter. Value of the parameter can be preset for each connected meter individually. Value of broadcasting period is factory preset to 60 minutes. Current value can be checked by **"periode [index]"** command (without parameter). Broadcasting period can be changed by entering of required number of minutes (theoretically up to 65535 minutes) after „periode" command and device index.

Example of displaying and setting of broadcasting period for the device with "0" index:

```
cfg#periode 0
Periode [0] is 60 min.
cfg#periode 0 120
Periode [0] changed from 60 to 120 min.
cfg#
```

Group of ***"reg1", "reg2", "dec1", "dec2", "dib1", "dib2", "vib1"*** and ***"vib2"*** command serves for selection of these two variables from the meter's IEC 62056 registers, that will be used as broadcasted variables in outgoing WMBUS messages and also for setting of M-Bus auxiliary codes that enable their decoding.

The **"reg1 [index]"** and **"reg2 [index]"** commands serve for selection of these two IEC 62056 registers of the meter, in which the required variables are stored. Up to 20 meters can be connected to the WB169-MM module and it is possible to read one or two variables from each meter (e.g. values of „High tariff" and „Low tariff" counters). The meter can store in its registers quite high number of variables (e.g. currents, voltages, reactive energy...) so it is necessary to select these two of them, that will be used for broadcasting of WMBUS radio messages.

For selection of registers use **"iread"** command to display the a summary of all registers and their current values. In case of any doubts check the meaning of individual variables in meter's documentation. Actual selection of registers can be checked by "reg1 [index]" and "reg2 [index]" commands (without parameter). Selection of the registers can be performed by entering of register name (address) after "reg1" or "reg2" command and meter index.

Example of displaying and setting of register address for the first variable of the meter with "0" index:

```
cfg#reg1 0
Reg1 [0] : 1.8.2
cfg#reg1 0 1.8.1
Reg1 [0] changed from 1.8.2 to 1.8.1
cfg#
```

As it is evident from the example, originally selected "1.8.2" register was replaced by new setting to "1.8.1" register address. If the two variables should be read from the meter, set second variable similarly by using of "reg2" command. If there are several meters connected to the WB169-MM module, perform similar setting for each of them with using of respective index.

By using of **"dec1 [index]"** and **"dec2 [index]"** commands set for each register number of gathered decimal places of the variable. If, as an example, there is a variable stored in the register with 4 decimal places (AAAAA.BBBB) and only two decimal places are required for broadcasting, use value "2" in the command. In this case the transferred number will be in the "AAAAABB" form.

Actual setting of number of decimal places can be displayed by using of "dec1 [index]" and "dec2 [index]" commands (without parameter). Number of transferred decimal places can be preset by entering of required number after "dec1" or "dec2" command and meter index.

Example of displaying and setting of the number of decimal places for the first variable of the meter with "0" index:

```
cfg#dec1 0
No. of decimal digits [0] for value1 is 2
cfg#dec1 0 4
Change no of decimal digits [0] for value1 from 2 to 4
cfg#
```

As it is evident from the example, number of transferred decimal places was changed from "2" to "4". Output number transferred in WMBUS message will contain 4 decimal places, what can be observed in the change of summary displayed by "iread" command:

a) original display of variable in "iread" summary (with dec1=2 setting):

```
: '1.8.1(000010.741*kWh)'
 *Reg1 : '1.8.1' -> 1074
```

b) display of same variable in "iread" summary after change of decimal places to dec1=4:

```
: '1.8.1(000010.741*kWh)'
 *Reg1 : '1.8.1' -> 107410
```

Auxiliary DIF(E) code can be entered for the individual variables by using of **"dib1 [index]"** and **"dib2 [index]"** commands. The DIF code determines character of variable and its „storage" number. There are following default settings of the DIF/DIFE parameter:

dib1 (first variable): DIF = "04" (instant value, 32-bit integer, storage "0"), DIFE= "00"
dib2 (second variable): DIF = "44" (instant value, 32-bit integer, storage "1"), DIFE= "00"

It is not recommended to change this DIF/DIFE setting.

Current setting of DIF/DIFE value can be displayed by using of "dib1 [index]" or "dib2 [index]" command (without parameter). Change of DIF/DIFE value for given read variable can be performed for by entering of DIF code after the command and index. DIF code can be entered either in hexadecimal, or in decimal form.

a) Example of setting of DIF/DIFE code for variable "1" of the meter with "0" index in decimal form and follow-up checking of the DIF value:

```
cfg#dib1 0 68 0
Set dib1[0] , DIF 0x44, DIFE 0x00
cfg#dib1 0
 dib1[0] , DIF 0x44, DIFE 0x00
cfg#
```

b) Example of setting of DIF/DIFE code for variable "1" of the meter with "0" index in hexadecimal form:

```
cfg#dib1 0 0x04 0x00
Set dib1[0] , DIF 0x04, DIFE 0x00
cfg#
```

Auxiliary VIF/VIFE code can be entered for the individual variables by using of **"vib1 [index]"** and **"vib2 [index]"** commands. The VIF/VIFE code determines kind of measured quantity (e.g. volume, temperature, voltage...) and its measuring unit (e.g. m^3, °C, mV, kWh...). Factory setting of this parameter for both variables of the WB169-MM module is:

VIF = "04" („Energy" in 10^1 * Wh units), VIFE = "00"

It means that the module is factory preset for broadcasting of data from electrometers in tens of "Wh" units. After connecting of an electrometer to the module it is necessary to check in the "opto" summary in which units the variable is stored in its register and possibly set the number of transferred decimal places by using of "dec" command so as to get the output number in tens of Wh. If the "dec" and "vib" parameters would be set as in the example above, output value will be decoded this way:

- value of "1.8.1" register is 000010.741*kWh
- "dec" parameter is set to "2", so the number transferred to WMBUS message is 1074 units
- VIF code is set to "04" value, that means energy in 10^1 Wh (10 Wh)
- WMBUS value is decoded as 1074 * 10 Wh = 10 740 Wh = 10,74 KWh

If there is an energy in other measuring units (e.g. in KWh), or there is other kind of quantity (e.g. water consumption) stored in the counter, it is necessary to preset the VIB value for this counter to the appropriate code to enable correct decoding on the receiving end.

Example of setting of "dec" and "vib" values for the situation when the read quantity is electricity in KWh:

- value of "1.8.1" register is 000010.741*kWh
- "dec" parameter is set to "0", so the number transferred to WMBUS message is 10 units
- VIF code is set to "06" value, that means energy in 10^3 Wh (1 KWh)
- WMBUS value is decoded as 10 * 1 KWh = 10 KWh

Example of setting of "dec" and "vib" values for the situation when the read quantity is water in litres:

- value of the register is 000124.359*m^3
- "dec" parameter is set to "3", so the number transferred to WMBUS message is 124359 units
- VIF code is set to "13" value, that means volume in 10^{-3} m^3
- WMBUS value is decoded as 124359 * 0,001 m^3 = 124359 litres

*(*) „Codes for Value Information Field (VIF)" table of M-Bus standard prescribes for „Volume" quantity "0001 0nnn" code, where the result is in $10^{(nnn-6)}$ m^3. Last three bits of this code determine multiplier of the value. To get the volume in litres it is necessary to use multiplier 10^{-3} (because 1 liter = 0,001 m^3), so the "nnn" value must be "3". The VIF code for the volume in litres should be "0001 0**011**" then, because decimal nnn=3 value means "011" in binary. Binary value of "00010011" means "13" in hexadecimal form, that is required setting of the VIF parameter.*

VIF parameter can be set to "13" value as follows:

```
cfg#vib1 0 0x13 0x00
Set vib1[0] , VIF 0x13, VIFE 0x00
cfg#
```

Alternatively, the same code could be entered in decimal form as follows:

```
cfg#vib1 0 19 0
Set vib1[0] , VIF 0x13, VIFE 0x00
cfg#
```

3.3.5 Commands for setting of Modbus meters

This group of commands serves for setting of internal inputs of the meters with Modbus coding, connected to the WB169-MM module. These commands should be always entered with meter index, that means in the **"[command] [index] [value]"** form (e.g. **"periode 0 60"**), or (alternatively) by using of commands with bulk indexing as described in the first part of section 3.3 (Setting of module parameters by configuration cable).

There are following commands:

ispeed	*setting of communication speed for the meter*
id	*setting of meter identifier within Modbus bus (0 - 255)*
reg0	*setting of „register address" where the meter M-Bus address is stored*
type0	*setting of register „data type" for M-Bus address register (default 0 = NONE)*
func0	*setting of „command type" for reading of the M-Bus address (default 3)*
sid	*setting of meter identifier (M-Bus ID) in M-Bus standard (0 - 99999999)*
ver	*setting of „addressing version" („Version" - supplement of M-Bus address)*
medium	*setting of media code („Medium" - supplement of M-Bus address)*
manuf	*setting of manufacturer code („Manufacturer" - supplement of M-Bus address)*
periode	*setting of broadcasting period of regular info messages of the meter*
reg1	*setting of „register address" where the variable "1" is stored*
type1	*setting of register „data type" for register of variable "1" (0 - 12)*
func1	*setting of „command type" for reading of variable "1" register (default 3)*
dib1	*setting of DIF(E) value (= coding method information) for variable "1"*
vib1	*setting of VIF(E) value (= measuring unit information) for variable "1"*

The module supports reading of **up to four register values** and broadcasting them in the form of M-Bus standard variables. For reading and interpretation of the variables number "2", "3" and "4" corresponding "type2", "func2", "reg2", "dib2", "vib2", "type3", "func3", "reg3", "dib3", "vib3","type4", "func4", "reg4", "dib4" and "vib4" command will be used.

Command **"ispeed"** serves for setting of **bit transfer speed** („communication speed") on the interface between meter and the WB169-MM module. The speed must be adjusted to the value, that is required by parameters of connected meter. There are seven options of communication speed setting:

300 baud
600 baud
1200 baud
2400 baud
4800 baud
9600 baud
19200 baud

Example of displaying, setting and follow-up checking of the communication speed for device with index "0":

```
cfg#ispeed 0
Init speed [0] : 4800 bps
cfg#ispeed 0 9600
Init speed [0] changed from 4800 to 9600 bps
cfg#
```

It is evident that communication speed of the device with "0" index was originally set to 4800 bps (baud). By entering of **"ispeed"** command with "0" index and "9600" parameter it was changed to 9600 baud value.

Command **"id"** serves for entering of identifier (address) of connected meter according to the Modbus standard. This identifier is used for addressing of data messages between the WB169-MM module and connected meter. Current setting of the Modbus identifier can be displayed by using of **"id [index]"** command (without parameter). Identifier could be changed by entering of required address number after "id" command and index. Entered identifier number must belong to the 1 - 247 range ("0" value is assigned for broadcast queries, values from "248" to "255" are reserved).

Example of setting of the Modbus identifier for "0" index to value "5" and follow-up checking of the setting:

```
cfg#id 0 5
MOdBus address [0] changed from 1 to 5
cfg#id 0
MOdBus address [0] : 5
cfg#
```

Variable **„M-BUS ID"** is a serial number of the device in M-Bus standard identification system. The variable is editable for the WB169-MM module and can be configured by one of following two ways:

- setting of Modbus register address, where the variable „M-BUS ID" is stored. In this case the ID is read up from the register with using of triplet parameters of Modbus command: "reg0", "type0" and "func0".
- „manually" as any integer number with maximum 8 digits (1 - 99999999) by using of "sid" command.

If reading from Modbus register is configured for „M-Bus ID", the value obtained that way would be used primarily in broadcasted messages. If the reading of ID from registers is disabled by command "type" = "0" (NONE), manually preset ID (by "sid" command) will be used.

Manual setting of meter identifier according to M-Bus standard („M-BUS ID") can be done by using of **"sid [index]"** command followed by any integer number with maximum 8 digits (1 - 99999999).

Example of displaying of manually preset ID and making of its change to the 11223344 value for meter with "0" index:

```
mon#sid 0
MBUS address [0] : 12345678
mon#sid 0 11223344
MBUS address [0] changed from 12345678 to 11223344
cfg#
```

Configuration of reading of the M-Bus ID from the Modbus register is in principle the same as reading of any other variable value. Principles of getting values from Modbus registers as well as examples of using "reg", "type" and "func" commands are described in the second part of this paragraph below.

Variable **„Version"** is number of addressing version according to the M-Bus standard (each type and modification of the device could have its own line of serial numbers). The code is editable for the WB169-MM module and it is preset to default 1 value. Current setting of version number can be displayed by **"ver [index]"** command (without parameter). Version can be changed by entering of any number from 0 - 255 range after "ver" command and meter index.

Example of displaying and changing of version parameter:

```
cfg#ver 1
MBUS version [1] : 1
cfg#ver 1 2
MBUS version [1] changed from 1 to 2
cfg#
```

Variable **„Medium"** is an international code of measured medium (water, energy, physical quantity...) according to the M-Bus standard. The variable is editable, and it is factory preset to 02 ("Electricity"). Current setting of the medium value can be displayed by **"medium [index]"** command (without parameter). Medium parameter can be changed by entering of required code of medium according to M-Bus standard (range: 0 to 255) after "medium" command and meter index. .

Example of displaying and changing of medium code:

```
cfg#medium 0
MBUS medium [0] : 2
cfg#medium 0 7
MBUS medium [0] changed from 2 to 7
cfg#
```

Variable **„Manufacturer"** is an international code of device producer according to the M-Bus standard. The code is editable for the WB169-MM module, and its value is factory preset to „SFT" value. Current setting of the manufacturer code can be displayed by **"manuf [index]"** command (without parameter). Manufacturer code can be changed by entering of required code (3 charcters) after "manuf" command and meter index.

Example of manufacturer code setting:

```
cfg#manuf
MBUS manufacturer : SFT
cfg#manuf XYZ
MBUS manufacturer change from SFT to XYZ
cfg#
```

Warning: *Use only officially registered international codes of M-Bus devices manufacturers.*

Note*: The full identification of the device in M-Bus standard systems is done by combination of four ID components: „M-BUS ID", „Manufacturer", „Version" and „Medium". This combination must be unambiguous that means there cannot exist two M-Bus devices worldwide, that have the same combination of all these parameters. If there are fixed configuration of the address components used, producer of the device is responsible for unique setting of „read only" address components for each device. If M-Bus address components are configurable, operator of the M-Bus system can use serial number of connected meter in combining with its type, subtype and manufacturer. Using of „independent" addressing line is possible only in that case, if the operator of the system owns its M-Bus manufacturer code and can assure that the identification of all operated devices under his code will be unique.*

For typical application of the WB169-MM module it is possible to use as „M-BUS ID" value an original serial number of the device (meter), that can be obtained from Modbus registers. Remaining M-Bus address components (i.e. „Manufacturer", „Version" and „Medium") should be set for each connected device in the module's configuration by using of above described methods and commands.

„Periode" command serves for setting of broadcasting period of regular info messages of the meter. Value of the parameter can be preset for each connected meter individually. Value of broadcasting period is factory preset to 60 minutes. Current value can be checked by **"periode [index]"** command (without parameter). Broadcasting period can be changed by entering of required number of minutes (theoretically up to 65535 minutes) after „periode" command nad device index.

Example of displaying and setting of broadcasting period for the device with "0" index:

```
cfg#periode 0
Periode [0] is 60 min.
cfg#periode 0 120
Periode [0] changed from 60 to 120 min.
cfg#
```

Nastavení vyčítání hodnot z registrů Modbus

Triplet of **"reg", "type" and "func"** commands serves for assembly of Modbus query for reading of any Modbus device register. For correct decoding within M-Bus systems each value of variable, obtained from the Modbus register, must be supplemented by auxiliary VIF (VIFE) and DIF (DIFE) codes. These codes should be preset manually for each variable of each device by using of **"vib" and "dib"** commands (except "M-BUS ID" value, that serves as identifier in header, not as variable in data block).

The "reg0", "type0" and "func0" commands are used only for setting of Modbus query for reading of register where the device serial number is stored.

By using of **"reg0 [index]"** command an iinitial address (number) of that register, in which the value of "M-BUS ID" (typically serial number of the meter) is stored, can be entered. Initial address (*) of the register could be found out in the device documentation.

Example of setting of initial address of the register with device serial number for the device with "0" index, where the initial address is "5":

```
mon#reg0 0 5
Reg0 [0] changed from 0 to 5
cfg#
```

(*) Modbus systems store data into 16-bits registers („words"). If the information contains more than 16 bits (= 2 Byte), then several successive registers can be used for its storing. For reading of whole information it is necessary to enter an initial register address and number of successive registers that should be read (see description of "type" command).

By using of **"type0 [index]"** command a data format of the stored information can be entered. It contains information how many successive registers („words") should be read out and in which format the data should be coded into the M-Bus variable (Integer, BCD...). The variable of the command is a number from 0 - 12 range, that represents one pre-defined variant of data format.

There are following variants of data format available: 0 - NONE (register is not read - „disabled" variable)

1 - INT8 (1 word, "1")
2 - INT16 (1 word, "2")
3 - INT32 (2 words, "4")
4 - INT48 (3 words, "6")
5 - INT64 (4 words, "7")
6 - float (2 words, "5")
7 - double (4 words, "D")
8 - BCD2 (1 word, "9")
9 - BCD4 (1 word, "A")
10 - BCD8 (2 words, "C")
11 - BCD12 (3 words, "E")
12 - BCD16 (4 words, "D")

By selecting of number from 0 - 12 range the number of successive registers with whole parameter value is defined, together with setting of 4 lower bits of DIF code of the variable. In the brackets, there are displayed information about the number of read „words" and setting of lower bits of DIF code for each variant of setting.

When setting of "type0" parameter, consider format (number of words) of required ID number (typically serial number). If the serial number is stored in 4 words, set for its coding "BCD16" format (M-BUs ID is always a number and it is usually stored in BCD format). Example of setting of register format "type0" to "12" (BCD16) value:

```
mon#type0 0 12
Type0 [0] changed from 10 to 12 (BCD16)
cfg#
```

In contrast to setting of real variables 1- 4, the value of "type0" parameter is used as device serial number in header of WMBUS message, so that the definition of DIF code has no relevance in this case.

By using of **"func0 [index]"** command a function of Modbus protocol, that will be used for reading of required register, can be selected. There are following four functions (1 - 4) available:

1 - reading of series of binary information of „Coils" type (typically binary sensors outputs)
2 - reading of series of binary information of „Discrete Inputs" type (typically settable binary inputs)
3 - reading of series of 16-bit registers of „Holding Registers" type (typically settable parameters)
4 - reading of series of 16-bit registers of „Input Registers" type (typically analog „read only" inputs)

When selecting the function it is necessary to follow the type of read register (if it is „Coil", „Disceret Input", „Input Register", or „Holding Register") and whether the different types of registers are organized into separate blocks required function for reading of whole block (see description of Modbus protocol - „Modbus Application Protocol Specification" at www.modbus.org).

Funkction 1 and 2 are intended for reading of binary registers. Function 4 is intended for reading of older registers of „Input Registers" type, that are used in newer devices very rarely. In the „consumption meter" category of devices there are ***commonly used registers of "Holding Register" type, that can be read by using of function 3.***

Example of setting Modbus function "3" for reading of "reg0" register of the device with "0" index:

```
cfg#func0 0 3
Func0 [0] changed from 1 to 3
cfg#
```

For reading of variables number "1", "2", "3" and "4" the corresponding "reg1", "type1", func1", "reg2", "type2", func2", "reg3", "type3", func3", "reg4", "type4" and func4" commands can be used. The module supports reading and M-Bus coding of maximum four variables (in case of reading electrometer it could be e.g. two counters of two tariffs of real power and two counters of Qi and Qc reactive power). If lower number of variables is read (e.g. only two counters of real power), remaining variables can be switched-off by setting of "type" parameters into "0" (NONE) value.

Overall checking of "reg", "type" and "func" parameters, that serve for reading of a variable from the Modbus register, can be performed by trial reading of the variable by "iread" command this way:

```
mon#iread 0
Reading configuration 0 ...
Reading modbus...
 Enable uart on speed 9600
Modbus send  : (8 bytes):
01 03 01 c1 00 03 55 cb
Modbus recv  : (11 bytes):
01 03 06 00 00 00 00 06 4f 63 21
 Address : 1
 Register : 450 (0x01c2)
 Value (INT48) : 1615
 Read address register ...
Modbus send  : (8 bytes):
01 03 00 04 00 04 05 c8
Modbus recv  : (13 bytes):
01 03 08 00 00 00 00 17 11 27 24 db 8d
 Address : 1
 Register : 5 (0x0005)
 Value (BCD16) : 17112724
 Device address : 17112724
mon#
```

System returns a summary of all read variables of the device with required index ("0"). It is evident from the summary, that there were two registers read:

- register "450", type INT48, read value "1615"
- register "5", type BCD16, read value "17112724"

In contrast to setting of "M-BUS ID" register reading (by "reg0", "type0", "func0" commands), in case of reading „real" variables 1, 2, 3 and 4, that are placed into the data segments of WMBUS message, it is necessary to setup by "dib1", "dib2", "dib3", "dib4" and "vib1", "vib2", "vib3", "vib4" commands also their auxiliary information DIF and VIF, that are important for decoding.

Auxiliary DIF(E) code can be entered for the individual variables by using of **"dib1 [index]"**, **"dib2 [index]"**, **"dib3 [index]"** and **"dib4 [index]"** commands. The DIF code determines character of variable and its „storage" number. By these commands only upper four bits of the code will be defined. Lower four bits of the DIF code are defined by register format setting (see using of "type" command above), regardless of the DIF setting by "dib" command.

Current setting of DIF value can be displayed by using of "dib [index]" command (without parameter). Change of DIF value for given read variable can be performed for by entering of DIF code after the command and index. DIF code can be entered either in hexadecimal, or in decimal form.

a) Example of setting of DIF code for variable "1" of the meter with "0" index in decimal form and follow-up checking of the DIF value:

```
cfg#dib1 0 68
Set dib1[0] , from 0d to 44
cfg#dib1 0
 dib1[0] : 44
cfg#
```

b) Example of setting of DIF code for variable "1" of the meter with "0" index in hexadecimal form:

```
cfg#dib1 0 0x44
Set dib1[0], from 0d to 44
cfg#
```

Auxiliary VIF(E) code can be entered for the individual variables by using of **"vib1 [index]"**, **"vib2 [index]"**, **"vib3 [index]"** and **"vib4 [index]"** commands. The VIF code determines kind of measured quantity (e.g. volume, temperature, voltage...) and its measuring unit (e.g. m^3, °C, mV, kWh...). Factory setting of this parameter for all four variables of the WB169-MM module is VIF = "03" (quantity = „Energy", measuring unit = 10^0 * Wh), which means that the module is factory preset for broadcasting of data from electrometers in "Wh" units.

If there is an energy in other measuring units (e.g. in KWh), or there is other kind of quantity (e.g. water

consumption) stored in the counter, it is necessary to preset the VIB value for this counter to the appropriate code to enable correct decoding on the receiving end.

Example of setting of "03" VIF code for variable "1" of the meter with "0" index in hexadecimal form:

```
cfg#vib1 0 0x03
Set vib1[0], from 13 to 03
cfg#
```

The VIF value could be alternatively entered also in decimal form.

3.3.6 „Configuration“ group of commands for writing of configuration and reset

The module contains two sets of configuration: operating configuration and saved configuration. At the start of the system the module copies saved configuration to operating configuration, with which continues to work. If the user changes configuration parameters, it does so only in operating configuration.

If the current operating configuration was not stored to FLASH memory, the module returns to the saved configuration after reset. If the parameter should be changed only temporarily (for example shorten of the broadcasting period during installation), it is not necessary to save operating configuration in FLASH memory (after the work finishing module can be returned to normal configuration by its reset). If the parameter should be changed permanently, there is necessary to save configuration to FLASH memory.

If operating configuration corresponds to the saved set (ie. there are no differences between commands in FLASH and in the operating set), the module will „report“ prompt in the format "mon#“. If operating configuration was changed so that it no longer matches to the saved set, the module will report prompt in the format „cfg#".

Every time the current configuration is saved into FLASH memory the value of the „Configuration version" parameter increases by one and the prompt changes to „mon#". The parameter resets to zero by erasing of the FLASH memory.

Current operating configuration can be displayed by using of **„show“** command (see paragraph 3.3.1):

```
cfg#show
```

Current operating configuration can be rewrite the to FLASH memory by using of **„write“** command:

```
cfg#write
Writing config ... OK, version 3
```

Reading of the configuration from FLASH memory can be done by by using of **„read“** command (for some modifications the command is **„cread“**):

```
cfg#read
Reading config ... OK, version 3
```

The configuration can be erased in Flash memory by using of **„clear“** command:

```
cfg#clear
Clearing configuration ... OK, version
```

This command deletes all configuration parameters from the FLASH memory, so it is necessary to set them again. If after erasing all parameters in FLASH memory the module goes to reset, default set of parameters (configured in the program of the device) is duplicated to FLASH memory. There is only one exception - frequency constant keeps the actual value also after cleaning of FLASH memory by "clean" command.

This command is recommended to use only by users with good knowledge of the system or after consultaion with the manufacturer.

The module reset can be performed by using of **„reset“** command:

```
cfg#reset
cfg#
Reset code 22 : WDT time out (PUC)
RF module started, sw version 1.02, date Aug 15 2014
mon#
```

The **"proto [index]"** command serves for setting of communication protocol for the internal port. Communication protocol is a system of commands and rules for data transfer between the module and meter/sensor and system of coding data. The module supports connecting of meters/sensors with three communication protocol options: M-Bus, IEC 62056 („OPTO") and Modbus. Each internal input must be set to the protocol of connected meter/sensor and the values of "proto" command for the individual protocol options are as follows: "0" for „OPTO" protocol, "1" for M-Bus protocol and "2" for Modbus protocol.

Example of setting of internal input "11" to M-Bus protocol:

```
cfg#proto 11 1
Set Protocol [11] to MBUS with default values
cfg#
```

3.3.7 „Modem commands" group for radio-frequency settings

This group of commands enables setting of transmitting system and setting of radio-frequency modem parameters.

The first part comprises commands for setting of Wireless M-Bus messages transmitting system. These parameters are relevant for all messages of the module. There are following commands:

power	*setting of transmitting power (5 options)*
mode	*setting of communication mode (N1 or N2)*
chan	*setting of transmitting channel (7 options)*
ekey	*setting of necryption key (".." - no encryption)*

The command **„Power"** is used for adjusting of the module broadcasting power. Factory setting is 100 mW (average power). Actual value of the power can be displayed by using of the **"power"** command without parameter. Transmitting power can be set-up by entering of the number of power level. There are five levels available:

- value "1" for transmitting power 14 dBm (25 mW)
- value "2" for transmitting power 17 dBm (50 mW)
- value "3" for transmitting power 20 dBm (100 mW)
- value "4" for transmitting power 24 dBm (250 mW)
- value "5" for transmitting power 27 dBm (500 mW)

An example of checking, setting and re-checking of transmitting power:

```
cfg#power
MBUS power : 3 (20 dBm)
cfg#power 5
MBUS power changed from 3 to 5 (27 dbm)
cfg#power
MBUS power : 5 (27 dBm)
cfg#
```

The command **„Communication mode"** is used for selecting of the module's communication mode. Factory setting is N1, N2, actual setting can be checked by using of **„mode"** command without parameter. Change of mode can be done by entering of desired option as a parameter of the command. Communication modes are defined by the Wireless M-BUS standard, accurate choice of relevant communication modes of the module is stated in the line "mode" of "Help" summary (see the paragraph 3.3.2).

An example of checking, setting and re-checking of communication mode:

```
cfg#mode
Mode N1
cfg#mode 2
CC1120 state 0x0f, marcstate 65, fifo tx 0, rx 0
Mode changed from 1 to 2
cfg#mode
Mode N2
cfg#
```

The command **„Frequency channel"** is used for selecting of the module's radio frequency channel. Frequency channels for the particular frequency bands are defined by the Wireless M-BUS standard. Actual setting can be checked by using of **„chan"** command without parameter. Change of channel can be done by entering of desired option as a parameter of the command. Accurate choice of relevant broacasting communication modes of the module is stated in a line "mode" in "Help" summary (see the paragraph 3.3.2).

An example of checking, setting, saving and re-checking of frequency channel:

```
cfg#chan
Help :
  1 - chan 1a (169.40625 Mhz), 4.8 kbps
  2 - chan 1b (169.41875 Mhz), 4.8 kbps
* 3 - chan 2a (169.43125 Mhz), 2.4 kbps
  4 - chan 2b (169.44375 Mhz), 2.4 kbps
  5 - chan 3a (169.45625 Mhz), 4.8 kbps
  6 - chan 3b (169.46875 Mhz), 4.8 kbps
  7 - chan 3g (169.43750 Mhz), 19.2 kbps
cfg#chan 1
Channel changed from 3 to 1 : chan 1a (169.40625 Mhz), 4.8 kbps
CC1120 state 0x0f, marcstate 65, fifo tx 0, rx 0
cfg#chan
Help :
* 1 - chan 1a (169.40625 Mhz), 4.8 kbps
  2 - chan 1b (169.41875 Mhz), 4.8 kbps
  3 - chan 2a (169.43125 Mhz), 2.4 kbps
...
  7 - chan 3g (169.43750 Mhz), 19.2 kbps
cfg#
```

The command **„Encryption key"** is used for setting of the encryption key for an encryption of transmitted messages by using of AES-128 key. The encryption key of 16 bytes length is entered by using of **„ekey"** command, followed by the string of 16 bytes that can be entered in a decimal or hexadecimal format (see examples).

An example of insertion of the encryption key in hexadecimal format:

```
cfg#ekey 0x1a 0x2b 0x3c 0x4d 0x5e 0x6f 0xa1 0xb2 0xc3 0xd4 0xe5 0xf6 0x77 0x88 0x99 0xaf
Setting encyption key : 1a 2b 3c 4d 5e 6f a1 b2 c3 d4 e5 f6 77 88 99 af
cfg#
```

An example of insertion of the encryption key in decimal format:

```
cfg#ekey42 53 159 188 255 138 241 202 136 21 98 147 235 15 145 136
Setting encyption key : 2a 35 9f bc ff 8a f1 ca 88 15 62 93 eb 0f 91 88
cfg#
```

If the encryption key is set to the module's configuration, an information ***„Data will be encrypted by AES"*** displays in the list of configuration parameters (see chapter 3.3.1)

Encryption can be switched off by setting of "." (dot) parameter after the „ekey" command:

```
cfg#ekey.
Encyption disabling
cfg#
```

In this case an information ***„Data will be unencrypted"*** *appers in the list of configuration parameters .*

The second part comprises commands for setting of radio-frequency sub-system of the module. These commands are used primarily for the initial setting of the module in factory. There are following commands:

mr	*receiving mode switch-on (diagnostics)*
mt test	*testing broadcasting switch-on (set-up and diagnostics)*
ms	*internal status of RF-modem (diagnostics)*
mi	*dump of modem internal registers (diagnostics)*
mfreq	*frequency constant setting (frequency setting)*
cfreq	*frequency constant correction (frequency tunnig)*
send	*immediate sending of radio message*

The command **„send"** can be used for immediate („out od turn") transmitting of the standard Wireless M-Bus information message that contents information about temperature, voltage and other measured parameters (see paragraph 3.4) relevant to the connected device (meter) specified by index. This command can be used for example for checking of radio signal availability during the system installation, or for any adjustments and testing of the module, connected meter, or receiving device. The command makes possible to send the information message anytime without necessity to change the transmission period or without waiting until the message will be sent spontaneously within the pre-set period.

An example of the command for immediate sending of the information message with the information from the device (attached meter) with index "2":

```
mon#send 2
Send [2] ...
 send [2] msg 255
mon#
```

Similar command **„sendp [number]"** can be used for transmitting of series of several message when the first message is transmitted immediately. Number of messages in the series is done by "number" parameter after command, where maximum number of messages in series is 30. This command can be used during installation and testing of the module. The command is implemented only in newer modifications of the module (only if it appears in "HELP").

An example of the command for sending of series of 5 messages:

```
mon#sendp 5
 send 5 msgs
mon#
```

Commands **„mr", „mt test", „ms" „mi", „mfreq"** and **„cfreq"** are used for radio-frequency subsystem diagnostics and initial adjustment of the nominal frequency during the manufacturing process and outgoing inspection in factory.

Manufacturer strongly recommends not to use these commands during the common operation. Using of these commands can cause inoperability of the device.

The **"rep"** command is a **special command** for activation/deactivation of repeating function of the module. If the repeating function („Repeater") is switched on, the WB169-MM module repeats all received messages of „Slave-to-Master" type („Long Header" as well as „Short Header"), that are not assigned in the „Signature" field of „M-BUS Application Layer" header by special sign, that means that the message was already repeated. In the same time the module assigns the repeated message by „repeated" sign (*). This function can be used for mediation of data transfer from other modules, that are out of the range of receiving (master) device.

By using of "0" parameter (default setting) the repeating function is switched off, by entering a command with "1" parameter the module is switched to repeating mode. Example of activation of repeating function:

```
cfg#rep 1
Repeater mode is On
cfg#
```

(*) Sign of the message that was already repeated is setting of lower bit of the first „Signature" Byte to value "1".

3.3.8 Overview of module configuration parameters

Overview of configuration parameters that can be used for user settings of the WB169-MM module is shown in the Table 2 below. The parameters are presented in the same order as they appear in the List of configuration parameters (see paragraph 3.3.1).

Table 2: Overview of WB169-MM module configuration parameters

Item	Name	Value	Description	Default.
1	WMBUS address	0 - 99999999	module WMBUS address	read only
2	WMBUS Manufact.	code	Device producer (M-Bus address suppl.)	read only
3	Info send periode	1 - 65535	Module status broadcasting period	read only
4	Next send	curr. status	Time to next status broadcasting	read only
5	No. sent	curr. status	No of status messages from reset	read only
6	Repeater mode	Off/On	Status of repeating function (act./deact.)	off
7	Repeater sent	curr. status	No of queued messages for repeating	read only
8	Encryption	code	Encryption key	off
Internal inputs with "M-Bus" protocol				
9	Uart speed	300 - 19200 bps	Initial speed of the M-Bus bus	2400 bps
10	Meter address	(0 - 255)	Meter primary M-Bus address	broadcast
11	MBUS second. addr.	(0 - 99999999)	Meter secondary M-Bus address	-
12	Send periode	1 - 65535	Broadcasting period of meter data (INFO)	60
13	Next send	curr. status	Time to next INFO broadacsting in minutes	read only
14	No. sent	curr. status	No of INFO messages from reset	read only
Internal inputs with "OPTO" protocol				
15	Uart init speed	300 - 19200 bps	Initial speed of the OPTO bus	300 bps
16	Meter address	16 charact.	Module IEC 62056I identifier	-
17	MBUS Reg addr.	0-99999999/reg.code	Serial number (M-Bus address)	-
18	MBUS Version	0 - 255	Generation/version (M-Bus address suppl.)	1
19	MBUS Medium	code	Medium (M-Bus address suppl.)	02
20	MBUS Manufact.	code	Manufacturer (M-Bus address suppl.)	SFT
21	Reg value	register number	Setting of read value 1	-
22	No. decimal digits	0 - 7	No of decimal places of value 1	2
23	MBUS value	code	Setting of DIF/VIF codes for value 1	04 04
24	Send periode	1 - 65535	Broadcasting period of meter data (INFO)	60
25	Next send	curr. status	Time to next INFO broadcasting in minutes	read only
26	No. sent	curr. status	No of INFO messages from reset	read only
Internal inputs with "Modbus" protocol				
27	Uart init speed	300 - 19200 bps	Initial speed of Modbus bus	300 bps
28	Meter address	0 - 255	Meter Modbus address	-
29	MBUS Reg. addr.	0-99999999/reg. code	Serial number (M-Bus address)	-
30	MBUS Version	0 - 255	Generation/version (M-Bus address suppl.)	1
31	MBUS Medium	code	Medium (M-Bus address suppl.)	02
32	MBUS Manufact.	code	Manufacturer (M-Bus address suppl.)	SFT
33	Reg address	number	Setting of read value register	-
34	Reg. type	0 - 12	Type (data format) of read value	2
35	Reg. function	1 - 4	Modbus read function for the value	3
36	MBUS DIB	code	Setting of value DIF code	-
37	MBUS VIB	code	Setting of value VIF code	-
38	Send periode	1 - 65535	Broadcasting period of meter data (INFO)	60
39	Next send	curr. status	Time to next INFO broadcasting in minutes	read only
40	No. sent	curr. status	No of INFO messages from reset	read only
41	WMBUS power	1 - 5	Transmitting power	3
42	WMBUS mode	1 - 2	Communication mode	1 (N1)
43	WMBUS channel	1 - 7	Frequency channel	1
44	Config. Version	curr. status	No of stored images since last FLASH erasure	read only
45	SW Version	curr. status	Software version and date of issue	read only

In **„Value”** column there are allowable ranges of parameter values. If there is a „code” indication in the „Value” column, it means that the value is displayed in hexadecimal code (where couple of hexadecimal characters represents one Byte).

In **„Default”** column there are default (factory) settings of the parameter. Colour marking of this field has following meaning:

- green colour - commonly used parameters that should be setup in reliance on the specific usage
- red colour - parameters that are not recommended to change
- grey colour - values that cannot be changed („read only”)

Items 1 - 8 refer to setting of Wireless M-BUS parameters of the WB169-MM module itself (i.e. its address, period of its status messages, repeating and encryption functions).

Items 9 - 14 refer to configuration of internal inputs with M-Bus coding (protocol).

Items 15 - 26 refer to configuration of internal ports with IEC 62056 („OPTO”) coding. The module enables reading of up to two IEC 62056 registers, so that the 21 - 23 items occur in the list two times (”Reg. value 1”, ”Reg. value 2” etc.).

Items 27 - 40 refer to configuration of internal ports with Modbus coding. The module enables reading of up to four Modbus registers, so that the 33 - 37 items occur in the list four times (”Register 1”, ”Register 2” etc.).

Items 41 - 45 refer to setting of radio-frequency (RF) parameters of the module.

3.4 Structure of module data messages

An information message with the readings of connected meter, sent by WB169-MM module on behalf of that meter, consists from the Wireless M-BUS header and the M-Bus application layer with different length that depends on the type and settings of the meter.

The information message is sent on behalf of each connected device, with different broadcasting period (preset for each connected device), and with the identification of the device in the message header.

When transmitting of messages from („on behalf of”) **M-Bus meters**, the message is re-transmitted in an original form, as received from the meter through the M-Bus bus. M-Bus header type (long/short) as well as number of data segments of data block depends on the setting of M-Bus application layer in the meter itself. If the meter/sensor sends data in encrypted mode, message content remains encrypted regardless of ”ekey” parameter setting.

When transmitting of messages on behalf of **IEC 62056 („OPTO”) meters**, the message is assembled by the WB169-MM module as described in detail in paragraph 3.3.4 „Commands for setting of IEC 62056 (”OPTO”) meters”. In this case the application layer of the message consists of the short (4 Byte) M-Bus header and a data block with four or five data segments with total length of 20 or 26 Byte, in reliance on the number of transmitted variables (one or two values).

Structure of Wireless M-BUS message header of the WB169-MM module is described in the Table 3.

Table 3: Structure of Wireless M-BUS message header of the WB169-MM module

Name	Length (Byte)	Description/meaning
Length (L)	1	Message length in Byte
Type (C)	1	”Spontaneous User Data”
Manufacturer ID (M)	2	”SFT” (manufacturer code of Softlink)
Address (A)	4	M-BUS Device ID (configurable)
Version (V)	1	M-BUS Version/Generation (configurable)
Medium (T)	1	M-BUS type of medium (configurable)
Application type (Cl)	1	”Slave to Master, 4-Byte header, variable data format”

Wireless M-BUS header contains full identification of the device according to the M-Bus specification (manufacturer/medium/version/serial number) and also message type and format of content.

Short 4-Byte M-Bus header of the message application layer contains following data:

- item ”Access No” that increases by one with each sent message;
- item „Status” that is normally ”00”, value ”04“ („Low Power”) signalizes low battery volatge;
- item „Signature” contains encryption type and parameter (”00 00” means no encryption).

If the message has been re-transmitted (repeated), item „Signature" is modified by Wireless M-Bus repeater to "01 XX" (low bit of the first Byte changes from "0" to "1").

Data block of "OPTO" coding meter consists of four or five data segments, each of them carries data to one variable. Overview of variables of the message from "OPTO" meter can be seen in the Table 4.

Table 4: Overview of variables of the message from "OPTO" meter

Order	Variable (description)	Unit	Type	Data format
1	Current consumption (register 1)	m^3 (10^{-3})	Inst.	32 bit Integer
2	Current consumption (register 2)	m^3 (10^{-3})	Inst.	32 bit Integer
3	Internal voltage	V (10^{-2})	Inst.	16 bit Integer
4	Processor temperature	°C (1)	Inst.	8 bit Integer
5	"Uptime" from last reset	seconds	Inst.	32 bit Integer

If „register2" is not defined, or it is not found (see paragraph 3.3.4 „Commands for setting of IEC 62056 ("OPTO") meters", the data segment for this variable is not created. In this case the data block has only 4 segments with total length of 20 Byte. In case of standard setting with one transferred register the total length of the message is 34 Byte (10 Byte WMBUS header, 4 Byte short M-Bus header, 20 Byte data block). If two registers are transferred, then the data block has 26 Byte and the whole message is 40 Byte long.

View of message from a meter with "OPTO" coding with standard setting and one transferred variable, as received and decoded by *WMBUS RFAN1* Wireless M-BUS analyzer, can be seen in the Figure 7.

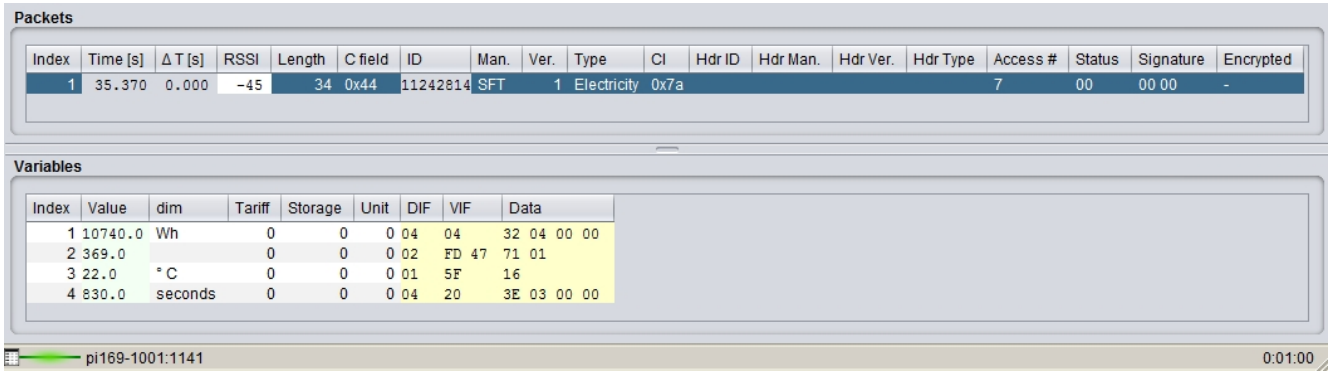


Figure 7: View of "OPTO" meter message received by *WMBUS RFAN1* analyzer

When transmitting of messages on behalf of **Modbus meters**, the message is assembled by the WB169-MM module as described in detail in paragraph 3.3.5 „Commands for setting of Modbus meters". In this case the application layer of the message consists of the short M-Bus header (same as for "OPTO" meters - see Table 3) and a data block with 4 - 7 data segments (in reliance on the number of transmitted variables).

List of transferred variables in the individual data segments is similar as for "OPTO" type of meter (see Table 4), just a number of transferred registers can be higher (it is possible to transfer up to 4 registers) and their data format could be more variable. Besides the segments with transferred registers the data block contains also three „mandatory" segments related to the module itself: internal voltage, processor temperature and module uptime.

If the data format of some Modbus register is set to "0" value (see paragraph 3.3.5 „Commands for setting of Modbus meters"), data segment for this register is not created. Data segment is not created also in case the register with preset address was not found.

4 Operational conditions

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

4.1 General operational risks

Radio modules WB169-MM are electronic devices powered from an external power source that broadcast radio messages with reading data from consumption meters and sensors connected to them. The modules are connected with meters and sensors through the two-wire M-Bus data bus. 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 ÷ +50)°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 a 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.

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 ÷ 30) °C.

4.4 Safety precautions

Warning! Mechanical and electrical installation of the WB169-MM 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-MM module installation

The WB169-MM 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-MM module from the antenna connector side and the rear side is shown in Figure 8.

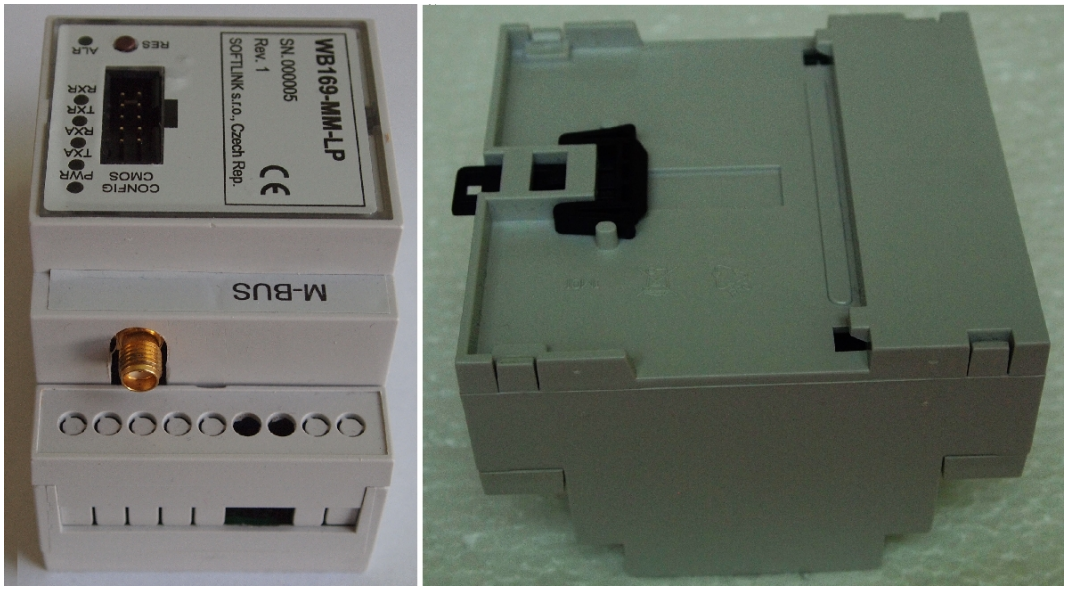


Figure 8: Detailed view of WB169-MM module

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;
- 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

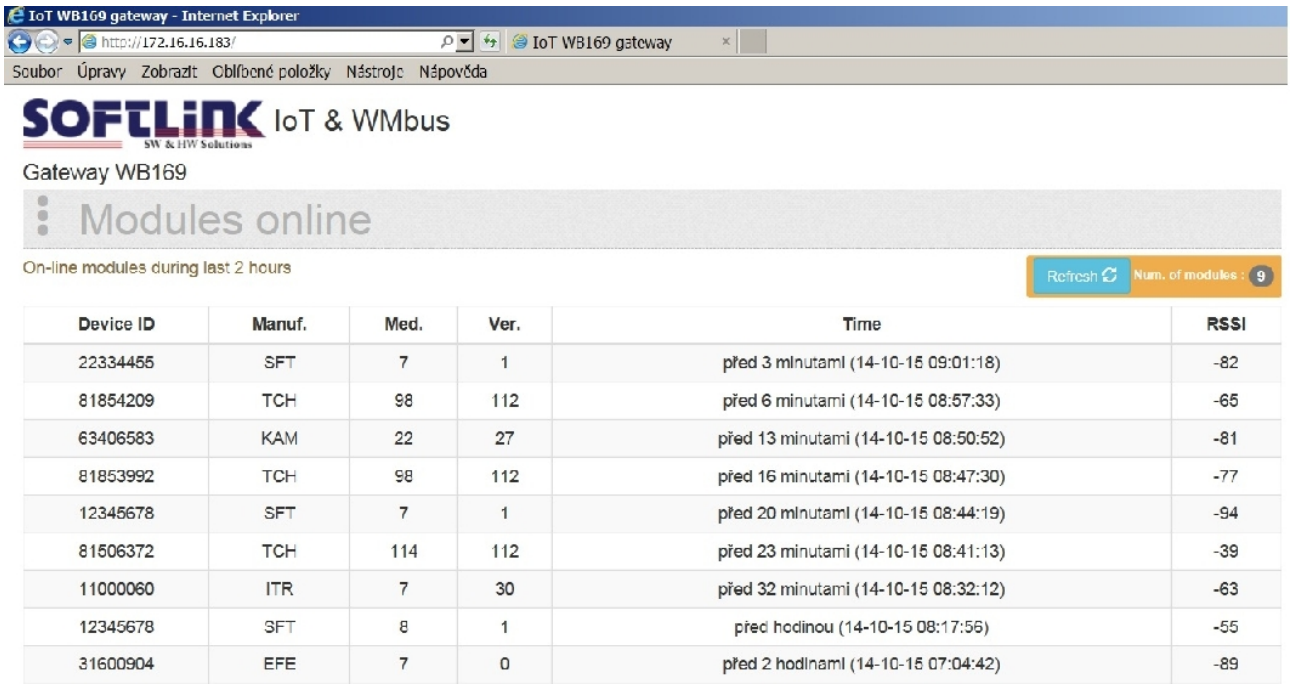
After putting the module into operation (or after each repair and replacing of the module) it is recommended to check functionality of its broadcasting with using of common „Master" receiver, testing (reference) receiver, signal analyzer or any other convenient device.

If the WB169-MM module is connected to remote data collecting system with using of WB169-RFE gateway, functionality of its broadcasting could be checked from any computer in **„Radar" mode** by presence of module's signal in the „Radar" application. Open any WEB browser in the computer and enter IP-address of the module's superior WB169-RFE gateway. URL address of the gateway should be entered in „**http://ip_adresa/**" form and search should be started after that. If an IP-connectivity between the computer and gateway is available, the website of „Radar" application opens (see figure 9), where there is a table with last reports from all devices broadcasting in the area of the gateway radio receiving (that work on the same frequency and with same communication mode).

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

- equipment identification
- receiving time of the last report from the equipment
- 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-MM module was putting into operation (or since its rebooting), the table should contain reports from meters and sensors connected to the module, including the evaluation of the receiving quality. The „Radar" table displays only records received during last 2 hours.



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 9: Example of „Radar" application table

4.10 Operation of the WB169-MM module

The WB169-MM module performs broadcasting of radio messages 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 permanent breakdown of module broadcasting 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);
- 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.

To prevent an unexpected breakdown, it is recommended to perform regular monitoring of all broadcasting data, i.e. readings, processor temperature and battery voltage. If some of the parameters goes beyond the common steady value, 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.

5 Troubleshooting

5.1 Possible causes of module failures

If during operation of WB169-MM module some anomaly, malfunctions or other troubles are recognized, the possible causes of the failures can be classified by following categories:

5.1.1 Power supplying failures

The module requires an external power supplying according to the specification in paragraph 2 „Technical parameters overview". Power supplying voltage is signaled by shining of green LED "PWR" on the module front panel.

Malfunction or breakdown of the power supplying will cause a complete breakdown of the device. Correctness of power supplying can be checked by this procedure: [-18pt]

- check if there is no electricity breakdown in the building;
- check, if the power supply is “on” and properly working;
- check on the installation site whether the module is really under voltage (that means the ”PWR” LED is shining);
- in case of any doubt take the measurement of the voltage.

If the reason of the failure is external power supplying system, repair the power supply or power distribution system. In case of failure of power supply, circuit breaker, surge protection (or any other protecting element) try to find out the primary cause of the failure, especially check short circuit possibility caused by penetration of humidity or water or malfunction of other device connected to the same power supply.

If the power supplying is properly working with correct voltage but the green ”PWR” LED is still not shining, the module is probably out of order. Perform the replacement of the module according to the instructions in paragraph 4.7 and check functionality of the new module. If the new device works properly, label the original module as „defective” and fill in the appropriate documentation prescribed by internal rules for this case.

5.1.2 System failures

As „system failure” are considered mainly failures of module’s processor, memory, internal supplying or any other failures that cause a complete breakdown of the device. If the power supplying of the module is properly working with correct voltage (green ”PWR” LED is shining) but the device still does not communicate through its configuration port and does not respond to any commands and this status will not change even after module’s restart (by ”RES” button on the front panel), the system failure probably occur. Perform the replacement of the module according to the instructions in paragraph 4.7 and check functionality of the new module. If the new device works properly, label the original module as „defective” and fill in the appropriate documentation prescribed by internal rules for this case.

5.1.3 Transmitter and receiver failures

Transmission and reception of RF messages is signaled by flashing of yellow ”TXA” and ”RXA” LEDs on the module front panel.

If the module is powered by correct voltage, the module communicates through the configuration port, responds to the configuration commands but the radio-messages from the module are still not received steadily, the possible reason of the trouble can be a failure of transmitting or receiving of radio signal. The typical indication of transmitting or receiving failures is state of „partial” functionality, when there are repetitive breakdowns in reception data from the module or occasional malfunctions of back channel (if implemented).

The ground of all above described troubles with communication could be unreliable radio-communication caused by one of these reasons:

- incorrect setting of transmitter parameters, mainly frequency channel, mode, or transmitting power;
- permanent or occasional blocking of radio signal caused by construction works or any construction changes within the premises, or by operation around the installation site (moving of machines, cars, etc.);
- permanent, periodical or occasional interference (jamming) of radio signal from externel source (another radio system in the same frequency band, or industrial disturbance);
- low level of transmitting power caused by wrong setting or by failure of transmitter;
- failure of receiver that causes malfunction of back channel;
- damage of antenna or antenna cable (if external antenna used).

If above described indications of unreliable radio-communication become evident, proceed with troubleshooting of the malfunctioning in following steps:

- visually check surrounding of the installation site to find out if there are any changes that can influence radio signal (e.g. new objects, things, machines...). If there are such negative circumstances, solve the trouble by reorganization of the object or by redesign of radio network;
- visually check an external antenna and antenna cable (if used), possibly replace these elements for the spare ones with proven functionality;

- check correctness of module settings, especially setting of radio parameters as described in paragraph 3.3.7 and perform the check of module overall functionality as described in paragraph 4.9;
- replace the module according to the paragraph 4.7 and perform the setting and check of overall functionality off the new module after that;
- if the module is not properly working even after its replacement for proven device and equipment, the trouble can be caused by local interference (jamming) from external source. Another possible reason could be an unsuitable setting of some configuration parameter that has not been discovered. In this case ask for your supplier, producer, or other experienced person for some form of assistance.

Appropriate level of transmitting power can be checked by comparing of its signal strength with the reference signal from another module (modules) under comparable circumstances, for example with using of signal analyzer or testing receiver placed to the suitable spot. If the signal strength is similar to the signal of reference transmitter, then the module's transmitting power is adequate, and the reason of troubles could be in insufficient signal strength on the receiving side. Attenuation of the signal can be caused by making of some change in module installation site (e.g. turning of antenna or placing of some object nearby, installation of iron bars, rack or shelfs...) or similar changes in the installation site of receiver (GateWay). This kind of troubles can be solved by redesign of the radio network in order to secure sufficient signal reception (that means changing of antenna for better type, moving of antenna or whole device etc.).

5.1.4 Data bus failures

Functionality of M-Bus data bus is signaled by flashing of yellow "TXR" and "RXR" LEDs on the module front panel. These two LEDs indicate transmitting of data message into the bus (flash of "TXR") and receiving of data packet from the bus (flash of "RXR").

Data bus failures manifest themselves by full or partial malfunctioning of the bus communication. Module with inoperative data bus communicates through its configuration port, responds to configuration commands, but the messages from some of the connected meters (or from all of them) do not come to the radio network. In some cases the malfunction of the bus is partial - interruptions are either random in time or their affect is limited to only some of the connected devices (meters, sensors).

Data bus failures and breakdowns can be caused by following reasons:

- incorrect setting of communication speed for communication with particular device (meter, sensor);
- mechanical damage of the bus cable;
- fault of module's link amplifier;
- worsening of the bus transmission capacity as a result of some changes or modifications of the bus (...a new device connected to bus, order alteration, wiring replacement, terminator connection/disconnection...);
- disturbance of the electrical signal within the bus by induction of the interfering signal into the bus, or troubles caused by differences of electrical potential among devices connected to the bus.

Recommendation: *Troubles with bus transmission capacity as described in the last two items generally occur especially if there is a bus with lengthy wiring and with high number of connected devices. Troubleshooting of the bus failures can be quite complicated and requires a specific knowledge and experiences. It is recommended to entrust the task to the specialist with experiences with given type of bus.*

If there is a suspicion that the operational troubles with data collection from the remote bus could be caused by failure of data bus itself, first of all check correctness of data collection system settings, especially correct identification (addressing) of individual devices within central system (master) database. If the correctness of the identification is positively checked, proceed with troubleshooting of the data bus communication malfunctioning in following steps:

- visually check whether the bus cable from the given meter/sensor is attached correctly to the module and test its functionality by ohmmeter. If the inspection of the cable shows any signs of its damage (or it is evidently inoperative), repair or replace the cable immediately;
- if the bus wiring is undamaged and messages from other devices on the same bus came to the central system correctly, check consistency of communication speed settings within the module configuration and within the connected meter/sensor settings (see setting of "ispeed" parameter in the paragraph 3.3.4, 3.3.4, or 3.3.5;
- if the bus is physically functional and communication speed of the module is correctly set-up for all connected devices but communication through the bus is still non-functional, the WB169-MM module is probably defective and it is necessary to make its replacement as described in the paragraph 4.7;

Correctness of gaining data from all the devices connected to the module via data bus could be checked out by using of "iread" command (see paragraph 3.3.3 „System commands group for general diagnostics").

5.2 Troubleshooting procedure

To identify a reason of device failure or any anomaly in its operation follow this procedure:

1. No data are available from all meters/sensors connected to the WB169-MM module. In this case it is recommended to check functionality of the module subsystems in following order:
   - check functionality of power supplying as described in the paragraph 5.1.1 „Power supplying failures"
   - check functionality of the system as described in the paragraph 5.1.2 „System failures"
   - check bus functionality as described in the paragraph 5.1.4 „Data bus failures"
   - check functionality of the transmitting and receiving of the radio-signal as described in the paragraph 5.1.3 „Transmitter and receiver failures"
2. No data are available from only one meter/sensor connected to the WB169-MM module. In this case it is recommended to check functionality of the module subsystems in following order:
   - check functionality of the meter/sensor
   - check correctness of central application configuration related to the meter/sensor, especially correctness of its ID, address and association of the meter/sensor with right port of reading module
   - check bus functionality as described in the paragraph 5.1.4 „Data bus failures"

NOTE: WB169-MM module is a reliable device with relatively simple and resilient construction, so that any possible failure of the device is very likely caused by external circumstances, especially installation environment, mechanical damage, excessive humidity, overvoltage of power supplying, or voltage pulses induced to the module data bus. After each replacement of the module caused by its failure it is recommended to check the root cause of the failure and take necessary measures to eliminate any persisting troubles.

6 Additional information

This manual is focused on description, parameters and configuration options of radio modules WB169-MM, 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, WB868 (Wireless M-BUS), WM169, WM868 (WACO) or WS868 (Sigfox) 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, WB868, WM169, WM868, WB868, WS868 series or other manufacturer's equipment for telemetry and remote reading of consumption meters, feel free to contact the manufacturer:

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