WIRELESS COMMUNICATION SYSTEM
Sigfox WS868

WS868-srMt

Revision 1.0

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1 Introduction

This document describes features, parameters and setting possibilities of the WS868-srMt module, which is used for reading of up to two devices (meters or sensors) with SI data bus output and for radio-broadcasting of the data from connected meters/sensors to the superior remote reading system in form of Sigfox standard messages.

1.1 Sigfox communication network

Sigfox communication network is a global radio frequency (RF) communication system intended for collecting data from the huge number of terminal devices that transmit only a very limited amount of data. This kind of network services are commonly referred as „Internet of Things" ("IoT").

Sigfox technology (including communication protocol) is optimizing for **maximum radio range**, that enables building of country wide RF networks with a maximum cost effectivity. Unification of technology, global register of identification addresses as well as central registration and control system enable interconnection of national networks („roaming") into one global Sigfox network.

The module is designed for using in free **868 MHz frequency band** with maximum transmitting power of **25 mW** that is commonly used in European countries. Maximum reach of Sigfox services in this band for devices with maximum transmitting power in open terrain is in range of tens of kilometers. This extensive range is enabled by using of ultra-low modulation frequency (Ultra Narrow Band Modulation) where communication sub-channel bandwidth is just 100 - 600 bps (Baud). As the messages are transmitted with such extremely low speed, Sigfox message was invented as short as possible with maximum length of 26 Byte (maximum data content of 12 Byte). Optimized length of message has positive influence on the terminal device energy consumption during transmitting and receiving.

Sigfox network supports also **bi-directional communication**, if „Downlink" service for transfer of data in reverse direction is allowed, in earmarked time interval the Sigfox base station can deliver to terminal device a special downlink radio-message containing configuration commands.

National Sigfox RF network consists of number of base stations, that are connected by data channels into one central node („star" type topology). The messages from Sigfox RF network are transferred from Sigfox central network server to the application servers of authorized users through the **unified data interface** via public Internet.

1.2 Module usage

The WS868-srMt module can be used for remote reading of electronic consumption meters (electro-meters, water meters, gasmeters) that are equipped with SI physical data output with M-Bus type of data coding. The module is equipped with one SI Master data bus input that can be used for connection of up to two meters/sensors of various kind. The module regularly pulls down actual data from connected devices through the SI bus and broadcasts current values of preselected variables (up to two variables from each device) in form of Sigfox standard radio-messages (hereinafter „INFO-message").

Each INFO-messages contain either current values of preselected variables from connected devices, or module service information about battery voltage and processor temperature. Detailed information about the content and format of information messages can be found in paragraph 3.7.

The INFO-messages are transferred through the Sigfox network to the central network server („Back-End"), from which there are forwarded to assigned IP-address of their addressee through the Internet. The addressee of the messages is an application server of remote reading service operator, where the messages are decoded and processed.

1.3 Hardware features

The module is enclosed in humidity-proof plastic casing with IP65 degree of protection and can be used in interiors as well as in exteriors. The casing is designed for mounting on the wall or other construction element (beam, pipe...). Module can be treated with an additional sealing by high-adhesion silicon filling, that can ensure proof against inundation by water (IP68 grade). If this treatment is required from the manufacturer, it must be ordered separately.

The module is power supplied by internal battery with up to 10 years lifetime for frequency of 4 - 6 broadcastings per day. Battery lifetime can be negatively influenced by shorter broadcasting period, or by storing and operation in sites with the temperatures exceeding the recommended range.

The module can be controlled and configured either by configuration cable, or wirelessly - by infra-red remote control with using of optical converter. To facilitate work with the optical converter, the module is equipped with the special circular aperture ("peephole") for magnetic fixing of the converter.

External appearance of the WS868-srMt module is shown in the figure 1.

Figure 1: View of the WS868-srMt module

2 Technical parameters overview

Overview of WS868-srMt module technical parameters is shown in the Table1 below.

Table 1: Overview of WS868-srMt module technical parameters

RF subsystem parameters		
Frequency band	868,0 - 868,6	MHz
Modulation	DBPSK	
Sub-channel bandwidth	100	Hz
Transmitting power	15	mW
Receiver sensitivity	120	dBm
Communication protocol	Sigfox	
Transmission speed	100	Baud
Antenna connector	SMA female	
Antenna characteristic impedance	50	Ω
Configuration interface RS232		
Transmission speed	4800	Baud
Operation mode	asynchronous	
Transmission parameters	8 data bits, 1 stop bit, none parity	
Signal level	TTL/CMOS	
Optical configuration interface		
Transmission speed	115 200	Baud
Optical interface specification	IrPHY 1.4 standard	
Data bus interface		
Bus interface type	SI	two clamps
Transmission speed	300 ÷ 19200	Baud
Supported data protocol	M-Bus	
Supported number of meters/sensors	2	
Power supplying		
Lithium battery voltage	3,6	V
Lithium battery capacity	3,6	Ah
Weight and dimensions		
Length	145	mm
Width	45	mm
Height	100	mm
Weight	cca 300	g
Storage and installation conditions		
Installation environment (by ČSN 33 2000-3)	normal AA6, AB4, A4	
Operation temperature range	(-20 ÷ 40)	°C
Storage temperature range	(0 ÷ 40)	°C
Relative humidity *	95	% (w/o condensation)
Degree of protection *	IP65 or IP68	

* modules treated by additional silicon filling are waterproof with IP68 degree of protection.

3 Configuration of the WS868-srMt module

Configuration parameters of the WS868-srMt module can be displayed and changed from the common computer (PC) by one of these methods:

- with using of **„USB-CMOS"** converter and configuration cable connected to the module
- wirelessly, with using of **„USB-IRDA"** converter

Technique of interconnection of the module with configuration computer and general rules of configuration are described in detail in the section 3.1 „Configuration of the module with using of the configuration cable". The description and meaning of all configuration parameters that can be checked and changed by cable can be found in the section 3.5 „Setting of WS868-srMt parameters via configuration cable".

Description of interconnection of the "USB-IRDA" converter with PC and general rules of configuration with using of this **optical converter** are described in the section 3.2 „Configuration of the WS868-srMt module with using of optical converter". The description and meaning of the parameters that can be changed by optical converter can be found in the section 3.6 „Setting of parameters by using of optical „IRDA" converter".

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 printed circuit board.

3.1.1 Connecting of WS868-srMt 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 a 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).

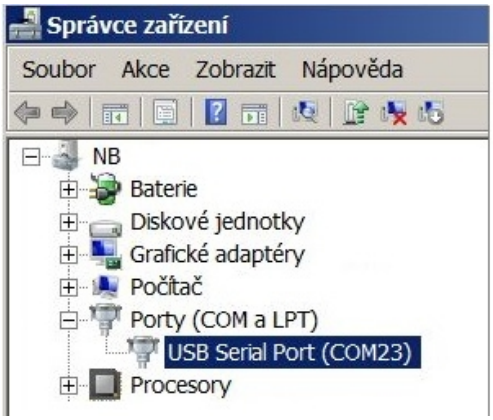

Figure 2: Appearance of the USB-CMOS converter in Windows „Device Manager"

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 3.3 „Installation of USB-CMOS converter driver".

Insert USB-CMOS converter to the USB port of computer. Open module's casing to enable access to the configuration connector. Connect configuration cable to the „CONFIG CMOS" port on the WS868-srMt module printed circuit board as depicted in the figure 3 „Configuration via USB port of computer". Thus the computer is connected with the module and ready for performing any changes in configuration.

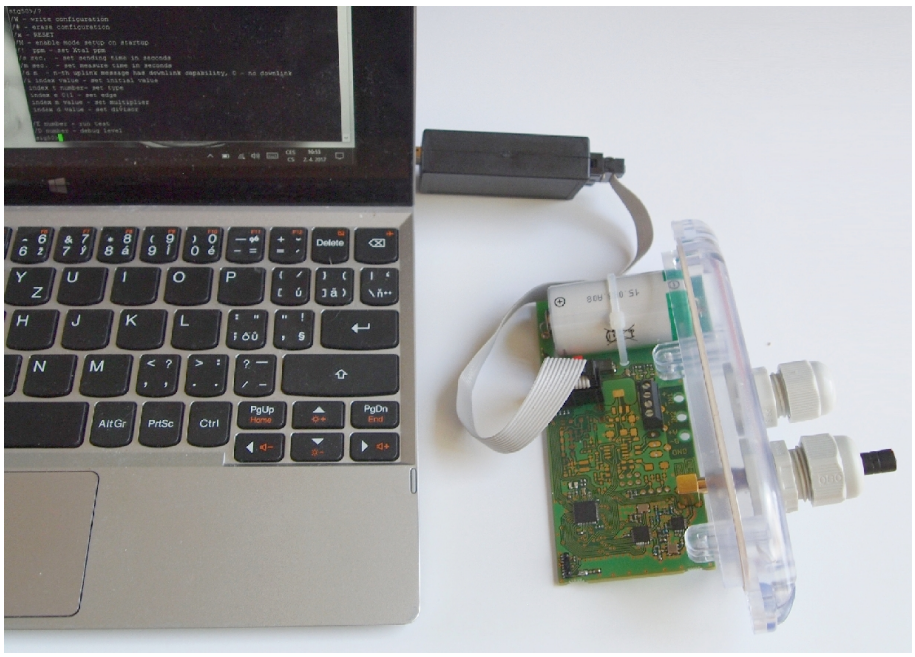

Figure 3: Configuration via USB port of computer

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.

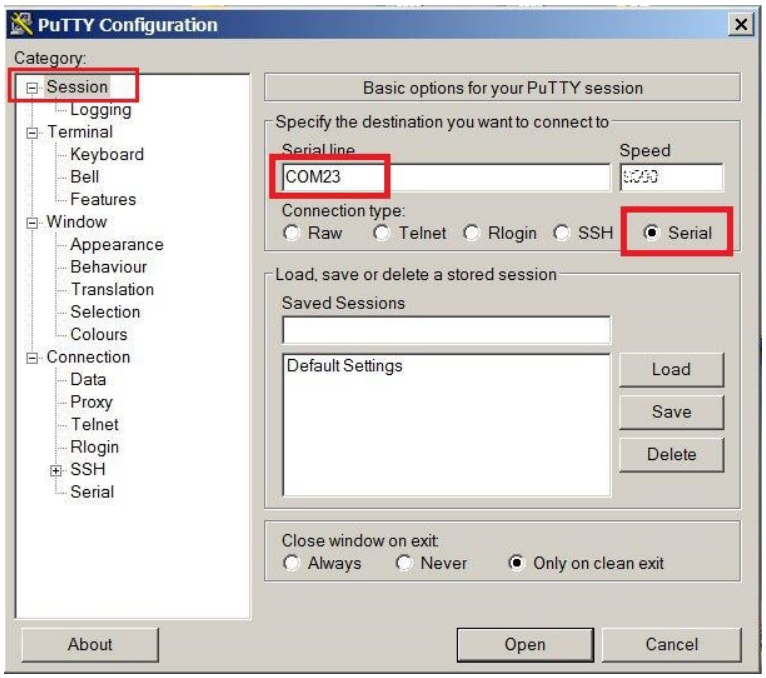

Figure 4: Terminal setting for serial line communication

„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.

Check (or set up) the communication speed („Speed") to 4800 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 **„WS868-SRMT"** 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 in 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 „WS868-SRMT" 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 „Configuration of the module with using of optical converter"

The module is equipped with an InfraRed interface that is intended for configuration with using of **„USB-IRDA"** converter. This converter serves for wireless transfer of configuration data (commands and values) between module and configuration computer via modulated beam of light in infrared band. By using of this kind of configuration there is possible to make all common settings through the transparent casing without necessity to open the module's cover (see figure 6). Optical beam goes through the transparent casing and it is decoded by the infrared modem placed on the module's printed board (PCB). A special software application program **„WACO OptoConf"** written in Java language can be used for required settings. This program can be installed to the computers with MS Windows as well as Linux operating systems.

3.2.1 Installation of the „WACO OptoConf" program

Installation of the **„WACO OptoConf"** program can be performed from the „Optoconf.zip" installation pack. Copy the pack to any folder of the computer and unpack it by any "unzip" program. The installation pack contains following files:

- „optoconf.jar" - executable file of the program
- „lib" - folder with „library" files
- „README.TXT" - "readme" file
- „SetupJSerial.msi" - serial port support for Java (installer)
- „ugw3.inf" - driver for USB-IRDA converter

The „WACO OptoConf" program can be started each time by launching of „optoconf.jar" file (clicking on the file name or to the created desktop shortcut to this file).

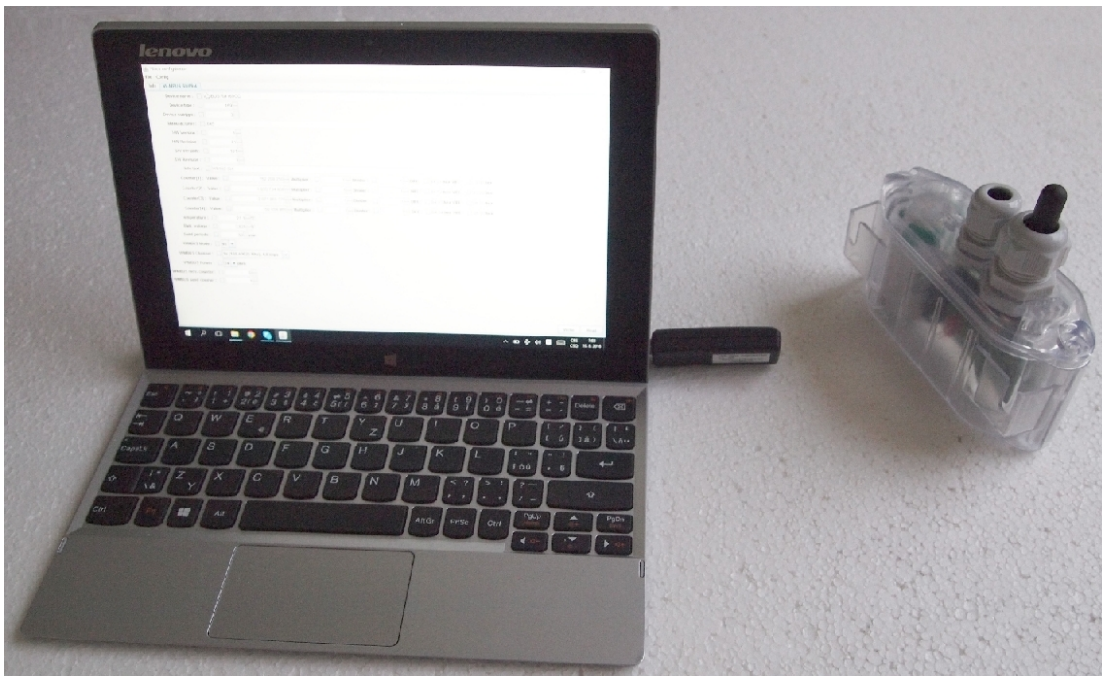

Figure 6: Configuration of the module with using of optical converter

Check whether the "Java Runtime Environment" (Java Virtual Machine) program in the 8 or higher version is pre-installed in the computer. If after launching of the „optoconf.jar" file a Java-window of the configuration program does not open (or pop-up window „How do you want to open this file?" appears) then the Java support it is not installed (or installed in older version) and it is necessary to perform its installation (32-bit version for Windows, 64-bit version for Linux). The Java Runtime Environment program is available on the official Oracle WEB site for Java support here: Download Free Java Software

After installation of the Java Runtime Environment install the driver for a serial interface support in Java environment by clicking to **„SetupJSerial.msi"** file. The installer of driver starts running. The installation is very simple - it only requires confirmation of necessary changes in computer configuration („Do you want to allow this app to make changes to your PC?"). After the driver is installed try to start „WACO OptoConf' program again and if everything is all right the program window will be opened. Close the program window.

3.2.2 Connection of „USB-IRDA" optical converter to computer

Before starting of the **„WACO OptoConf"** program connect the **„USB-IRDA"** converter to USB port of the computer. When the converter is connected to computer for the first time an operating system will automatically find and install correct driver for the converter (i.e. generic driver for „USB Serial Device" category of device). After driver is successfully installed to MS Windows computer, the device should appear in the „Device Manager" in section „Ports (COM and LPT)" as „USB Serial Device (COMx)" (see figure 7).

Older versions of MS Windows do not support generic driver for support of serial ports via USB. I this case install the „ugw3.inf" driver from delivered installation pack according to the instructions mentioned in the paragraph 3.4 „USB GateWay" and „USB-IRDA" driver installation" below.

3.2.3 Using of „WACO OptoConf' program for configuration of modules

Start the **„WACO OptoConf"** program by clicking on the **„optoconf.jar"** file name or to the pre-created desktop shortcut to this file. Program window **„WACO configuration"** will open (see figure 8). In **Config/Port** item of menu choose name of serial port assigned to USB-IRDA converter by operating system (see figure 7). The program is thus fully functional and ready for configuring parameters. Menu item **„Config/Look and Feel"** serves only for choice of window color and design by clicking to one of pre-configured options.

By clicking to **„Walk device"** button the list of all variables that are used for module configuration can be displayed (see figure 9.

Index and description of all variables of the NEP protocol, that is used for coding of data in Softlink's „wacoSystem" communication systems can be found on the producer's WEB site NEP Page.

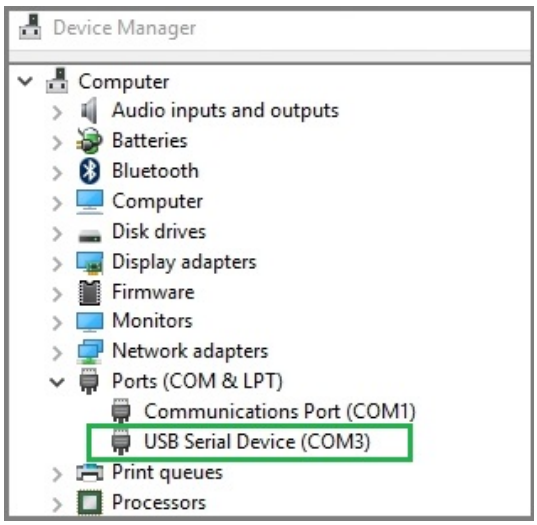

Figure 7: Displaying of the optical converter in the Windows' „Device Manager"

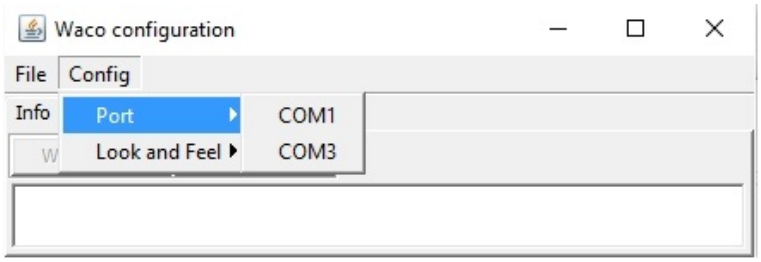

Figure 8: Displaying of „WACO OptoConf" configuration window"

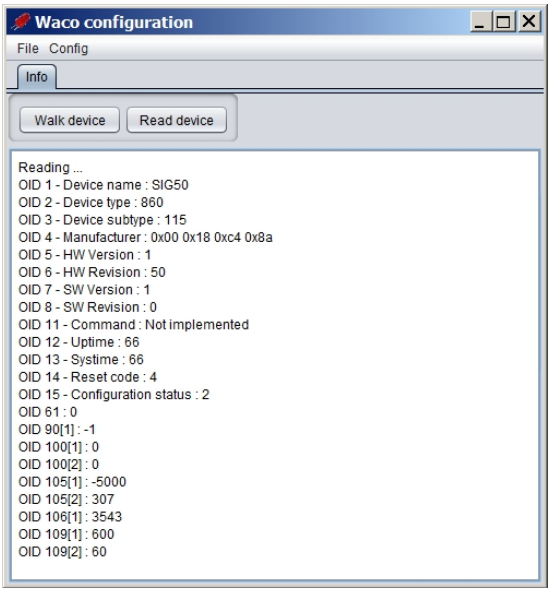

Figure 9: List of variables in the working window of „WACO OptoConf" program

By clicking to **„Read device"** button the textbfconfiguration table with all the relevant parameters of the module is displayed in the working window. Non-configurable (read only) parameters are displayed as "inactive" (with gray editing fields), while parameters that can be changed by „WACO OptoConf" program are displayed inside white editing fields ("active fields"). Example of configuration table of the module is depicted in the figure 10.

3.2.4 General rules for configuration of the module by optical converter

Connect **USB-IRDA** optical converter to the USB port of the computer. Flashing of green LED signalizes correct function of the converter. By clicking to „optoconf.jar" file (or its shortcut) launch **„WACO OptoConf"** program. If not chosen automatically by previous functioning, choose the name of serial port of the converter („COM XY")

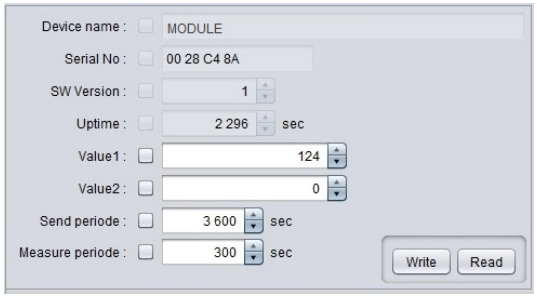

Figure 10: Example of module's configuration table in the „WACO OptoConf" window

in the „Config/port" menu.

The modifications of modules supporting magnetic fixing of optical converter can be easily configured by using of USB-IRDA optical converter with holding on magnet ("MAGNETIC"). In this case just simply put the converter to the circular crater-shaped pit on the module where it is kept by power of magnet in righ position. If the magnetic fixing cannot be used, configuration can be performed either on the working desk or with using of a special holder for attaching of optical converter to the module.

Configuration on the **working desk** means that computer as well as the module are placed on the any convenient work surface (e.g. on the desk - see figure 6). In this case the module should be placed not more than 15 cm from the tip of converter, the module's printed board must be facing to converter by its element side, and module's optical sensor should be lying approximately in the converter's axis of symmetry (i.e. in the direction of the infrared beam). Approximate position of the optical sensor of the module is marked in the figure 1 by green arrow. Correctness of mutual position module/converter can be checked by displaying of the current configuration as described below. It is necessary to fix and keep such position in which the communication between module and converter is reliable.

When working directly at the installation site always use **a special holder** that is designed for attaching of converter to the module. Put the holder to the WS868-srMt module as shown in the figure 11.

Figure 11: Attaching of optical converter to the holder

Put holder to the module from the element side and shift it to that side where the optical sensor is placed (approximate position of the optical sensor is marked in the figure 1 by green arrow). Connect the converter with laptop by using of extension USB cable and insert the converter to the slot in the holder as shown in the picture. Check correctness of converter's position by displaying of the current configuration as described below. If the connection is not reliable shift the holder along the module cover. The best position is if the converter is opposite to sensor.

By clicking to **„Read device"** open a configuration table with all the relevant parameters of the module. Parameters that can be changed are displayed in white colored editing fields. There are four types of editing fields:

- text fields, in which a text can be edited (e.g. "Info-text" field)
- numeric fields, in which a change of number can be done
- selection fields, in which a choice from pre-set options can be done
- hexadecimal fields (marked by "hex"), in which hexadecimal characters can be entered

Text fields can be changed by correcting, erasing, or rewriting of the text inside the field.

Numeric fields can be changed by rewriting number inside the field or by its increasing/decreasing with using of arrows $\triangle$ a $\triangledown$.

Selection fields can be changed by clicking to symbol ∇ and choosing required option from the list-box.

Hexadecimal number fields (e.g. "8B 01") can be changed by clicking on the character and rewriting its value

to another hexadecimal character (0 to F).

For editing of individual items keep following rules:

- after making any change in editing field there appears symbol "√" before the field that is an indication of active change request that will be sent to the module;
- by clicking to **„Write"** button in the lower part of the configuration table the program sends configuration commands through the USB-IRDA converter. During the process of establishing connection converter's LED light stops flashing for approximately 2 seconds and then lights-up;
- after sending data to module the program automatically requests a new status of configuration. Displaying of the new current status of configuration parameters (after requested changes) is signalized by disappearance of symbol "√" before editing field;
- if requested change of some parameter is out of its range, the change is not accomplished and after disappearance of symbol "√" there appears an original value in the editing field;
- the program enables making multiple configuration changes at one time. If there are changes in several editing fields of the table, each of them is marked by symbol "√" and after clicking to „Write" button all the changes are requested/performed;
- if some of the fields was edited unintentionally (by mistake) and the change of this field is not really requested, by clicking to symbol "√" the field can be „unchecked" and the change request of the parameter is not sent to module;
- current status of all configuration parameters of the module can be requested anytime by clicking to **„Read"** button in lower part of the table;
- ongoing communication between module and USB-IRDA converter may be signaled by flashing of LED on the configured device;
- if the connection between USB-IRDA and the module was not established until several seconds, error window "Error: Read timeout" will appear in the program window;
- the most common reason of connection failure is either bad position of the module (long distance, wrong orientation, dirty cover, obstacle in the beam), or the module's battery was switched off.

NOTE! „WACO OptoConf" program contains specific data and settings for interworking with certain types of modules. Each version of the program thus supports only the relevant versions of the wacoSystem modules (i.e. actual versions of the modules up to date of the software release). If after reading of data from the module the error window "Error: Unknown device" will appear, the current version of the program does not support configuration of this version of the module. In this case it is necessary to download a new version of the „WACO OptoConf" program from the product WEB site www.wacosystem.com/podpora, or contact manufacturer's technical support by e-mail: support@softlink.cz.

3.3 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 13 left).

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 13 right).

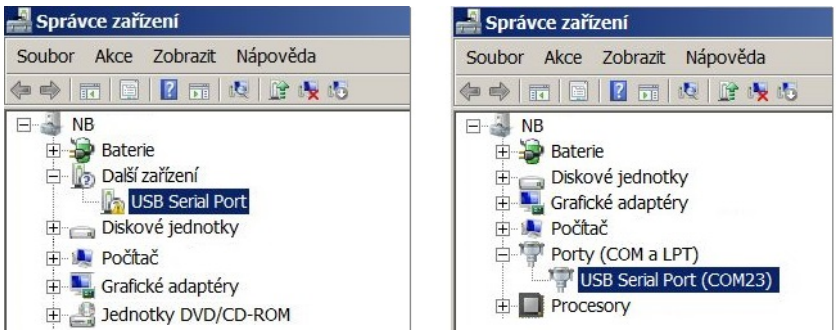

Figure 12: Appearance of converter without driver in the Windows „Device Manager" table

3.4 „USB GateWay" and „USB-IRDA" driver installation

The driver „ugw3.inf" intended for support of multiple virtual serial ports through the USB interface of a computer is a part of delivered installation pack. If your version of MS Windows operating system failed in automatic installation of a driver for connected „USB GateWay" or „USB-IRDA" device, make an installation of „ugw3.inf" driver manually.

Connect the device to computer and open a window of „Device Manager" tool. The device appears in the „Other device" section in upper part of the window as „USB Serial port" device (see figure 13 left).

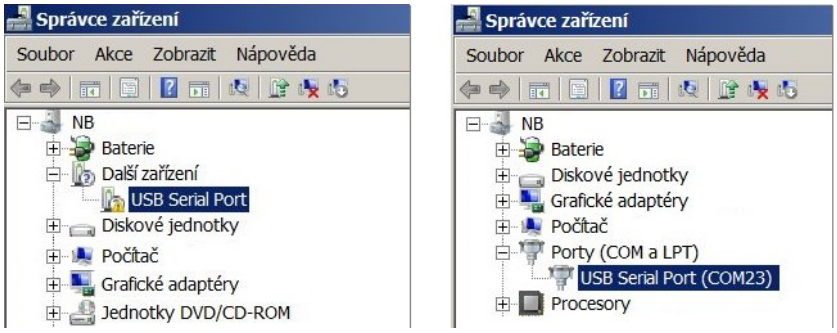

Figure 13: Displaying of the device without driver in "Device Manager" window

By right-clicking to „USB Serial port" open the context menu and choose „Update driver software" item. Click on „Find driver in this computer" in the opened window. Click to „Select driver from the list" and „Next" in next window. After a new „Select device type from the following list" window appears, select „Ports (CPM & LPT)" in the window and click to „Next" button (see figure 14 left). Choose „From disc" in the next „Choose driver which you want to install" window (figure 14 right).

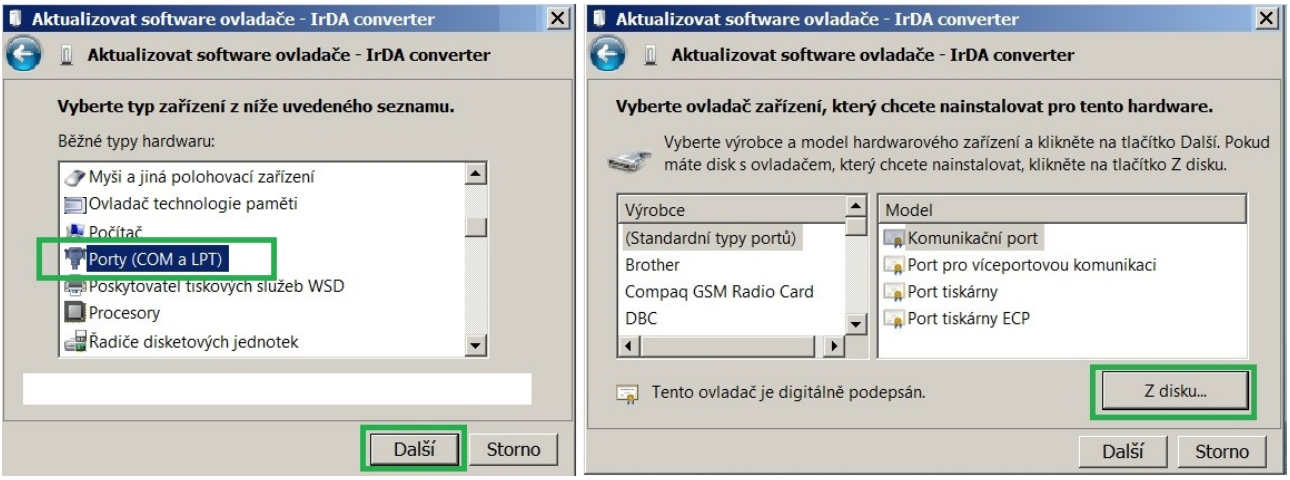

Figure 14: Manual selection of the driver file from a folder

After that a new „Find file" window appears. Set the folder with driver file in the „Browse" tool, select „ugw3.inf" file name that will appear in the window and click to „Open" button (see figure 15 left). A new „Choose driver

to be installed for the hardware" window will appear, select „RFU Gateway Serial port" item and click to „Next" button (see figure 15 right).

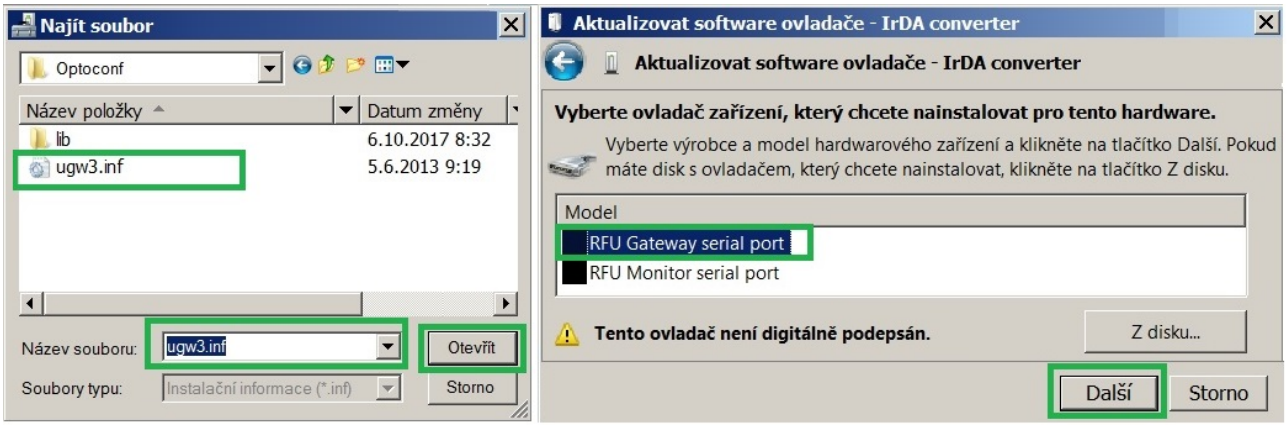

Figure 15: USB driver installation

A new „Driver software installation" window will appear with standard red „unknown driver producer" Windows system warning. Click to „Install the software anyway" option and the installation process will launch (*). After the process is completed the system shows positive message „The driver was successfully installed" (or similar). The device will move to the „Ports (COM & LPT)" section of the „Device Manager" window (see figure 13 right).

(*) If installing the driver into the Windows 8 or Windows 10 OS computer, it could be a security problem with the installation because the driver doesn't have a digital signature („unsigned driver"). In this case follow the instructions below.

3.4.1 How to disable driver signature enforcement in Windows 8 system

Enforcement of signed driver installation in Windows 8 can be disabled by following procedure:

- by pressing the „Windows + R" keys open the „Run" window;
- write a restart command "shutdown.exe /r /o /f /t 00" into the „Open" editable field;
- choose „Troubleshoot" option in the „Choose an option" window that will pop-up;
- choose „Advanced options" in opened „Troubleshoot" window;
- choose „Windows Startup Settings" in opened „Advanced options" window and run „Restart";
- during the system restart process a window „Advanced Boot Options" appears, choose „Disable Driver Signature Enforcement" option in this window;
- after launching the system install the driver according the above mentioned instructions.

Deactivation of the enforcement of signed driver function of the Windows 8 operating system is functional only until the next restart of the system.

3.4.2 How to disable driver signature enforcement in Windows 10 system

Enforcement of signed driver installation in Windows 10 can be switched-off by following procedure:

- click to „Windows" icon in left the bottom left corner of the screen and choose „Settings" icon;
- select „Update and security" in „Settings" window;
- select „Recovery" in next window';
- select „Advanced startup" section in „Recovery" window and click to „Restart" button in the section;
- in a few seconds the new „Choose an option" screen appears; select „Troubleshoot" option;
- in next steps select „Advanced options" and „Startup repair" options and click to „Restart" button;
- in this step an instruction for entering of „BitLocker" recovery key could appear (depends on the system settings). This is a 64-character access key for data section of the user that can be used in case of loss of OS Windows password. The key can be found in the „Microsoft Account Settings" page, that can be displayed by clicking to „Windows" icon and „User" item of main Windows menu. To get to the account it is necessary to click to „Change account setting" and „Manage my Microsoft account" and log into the account by using of Microsoft user login/password. Select „Device" in main menu of the user account page and click to „Obtain

BitLocker recovery key" in „Desktop" section and „Bitlocker" subsection. The new screen with recovery keys will open. Copy down the key that is valid for the required unit (according to the required unit identifier);

- after entering of the key the new screen with startup options will appear, select „Disable Driver Signature Enforcement" option from the list. The selection can be done with using of F1 - F10 keys, for selected option with order number „7" press key „F7";
- after OS Windows restart perform the driver installation according to the above described procedure.

Deactivation of the enforcement of signed driver function of the Windows 10 operating system is functional only until the next restart of the system.

3.4.3 Support of older OS Windows versions and OS Linux support

Earlier MS Windows versions (Vista, Windows XP and older ones) do not support sufficiently the installation of multiple virtual serial ports onto one physical USB port and the current versions of „USB GateWay" and „USB-IRDA" devices cannot be connected to the computers with these operating systems.

There is no need to install any drivers with serial port support to the computer with Linux OS as the Linux system will automatically use its own generic drivers.

3.5 Setting of WS868-srMt module parameters by configuration cable

In following part of the document there is a description of these parameters of the WS868-srMt module, that can be displayed and examined from PC connected to the module by configuration cable. Some of the parameters can be changed by configuration commands entered „from the console" as described in paragraph 3.1.

3.5.1 List of WS868-srMt module configuration parameters and commands

List of all configuration parameters of the module can be displayed by entering of **"show"** command and pressing of „ENTER" key.

The following list of parameters will display in the terminal window:

```
WS868-SRMT>show
Configuration    : OK,  size 178 bytes
 --- RF ---
Xtal PPM         : -24 ppm
Downlink         : 0
 --- Miscellaneous ---
Sending time     : 86400
Measure time     : 60
 --- Common interface params ---
ondelay          : 200
offdelay         : 5
 --- Profile [0] ---
periode          : 60 min.
ispeed           : 2400 baud
iresponse        : 220 ticks (50 ms)
idelay           : 200 ticks (50 ms)
iparity          : even
istop            : 1
idata            : 8
proto            : ModBus
Address          : 254  mode:ASCII
  SIGFOX index [0] : 10
  Register     [0] : 0
  Function     [0] : 0
  Type         [0] : 0
  SIGFOX index [1] : 11
  Register     [1] : 0
  Function     [1] : 0
  Type         [1] : 0
  --- Profile [1] ---
periode          : 60 min.
ispeed           : 2400 baud
iresponse        : 10 ticks (50 ms)
idelay           : 1 ticks (50 ms)
iparity          : even
istop            : 1
idata            : 8
proto            : MBUS
Address          : Sec. 00101970
  SIGFOX index : 4
  DIF [0] :  0x0c
  VIF [0] :  0x78
  SIGFOX index : 5
  DIF [1] :  0x84 0x40
  VIF [1] :  0x14
WS868-SRMT>
```

List of all configuration commands ("HELP") can be displayed by entering of **"?"** command into the command line and pressing of „ENTER" key.

The following list of commands will display in the terminal window:

```
WS868-SRMT>?
 Help:
 --- System commands ---
debug            : Show or set debug level
task             : Show tasks
mbox             : Show mailboxes
reset            : Reset device
info             : Show system info
?                : Show this help
measure          : measure period in seconds for internal A/D, I2C devices
 --- Configuration ---
show             : Show all configuration
write            : Write configuration to flash
clear            : Clear configuration and load defaults
 --- RF Commands ---
periode          : Change periode of send (in seconds)
cw               : Send CW
xtal             : calibrate Xtal, parameter is either 'clear' (clear calibration) or frequency of CW
mode             : display/clear ATA8520 Mode Setup request flag
 --- BUS Commands ---
iread            : Read BUS using profile [0-1]
ondelay          : Set ON delay in 50ms ticks
offdelay         : Set OFF delay in 50 ms ticks
 --- Profile Commands [0-1] ---
ispeed           : Set init. comm. speed (300 - 19200)
iparity          : Set init. parity (0-none, 1-even, 2-odd, 3-fixed 1, 4-fixed 0
idata            : Set init. DATA bits (5-8)
istop            : Set init. STOP bits (1-2)
iperiode         : Change periode of send in minutes
idelay           : Change delay between transactions in ticks
response         : Set response timeout in ticks (50mx)
proto            : Set protocol per meter [0 - 1] 0 - disable, 1 - mbus, 2 - opt                    o,
primary          : Show or set MBUS address (0 - 255)
secondary        : Show or set MBUS secondary address (0 - 99999999)
sid              : Set SIGFOX ID for the variable
reg              : Set register for the variable (OPTO, ModBus)
dib              : Set DIF bytes
vib              : Set DIF bytes
func             : Set Modbus function [1 - 4]
type             : Set Modbus type [0 - 12]
WS868-SRMT>
```

Overview of configuration parameters with short description of their meaning can be also found in table 2 on the page 25.

The meaning of individual parameters and detailed description of their usage can be found in the following part of chapter 3.5.

3.5.2 Commands for module basic settings

This group of parameters is intended for module factory setting, factory diagnostics and for basic settings on installation. In the list of all configuration parameters and commands ("HELP") they are displayed under „System commands", „Configuration" and „RF Commands" groups.

There are following commands:

debug	*setting of debug statement (Do not use! Only for factory diagnostics!)*
task	*list of tasks (Do not use! Only for factory diagnostics!)*
mbox	*statement of registers (Do not use! Only for factory diagnostics!)*
cw	*carrier transmission (Do not use! Only for factory activation!)*
xtal	*crystal frequency calibrating (Do not use! Only for factory activation!)*
mode	*initialization mode flag (Do not use! Only for factory activation!)*
write	*writing of configuration to FLASH memory*
clear	*erasing of FLASH and setting of default parameters*
measure	*setting of measuring interval of A/D converters*
periode	*setting of broadcasting period of module operational data*
reset	*module reset command*
show	*display of module configuration parameters overview*
?	*display of list of all configuration commands ("HELP")*
info	*display of module current status statement („system info")*

The **"debug", "task'** and **"mbox"** commands are intended only for factory diagnostics. It is not recommended to use these commands in normal operation. The **"cw", "xtal'** and **"mode"** commands are intended only for initial factory actibvation of the module. It is **strongly recommended not to use** these commands in normal operation.

The **"write"** and **"clear"** commands can be used for storing of configuration parameters into the FLASH memory and for clearing (erasing) of memory. The module contains two sets of configurations: operating configuration and saved configuration. At the start of the system the module copies saved configuration into the operating configuration, with which continues to work. If user changes configuration parameters, it does so only in operating configuration.

Current status of storing of configuration parameters can be displayed in the list of all configuration parameters as „CONFIGURATION" item:

```
CONFIGURATION: OK
```

Information **„OK"** means, that the operating configuration is stored (it is identical with stored configuration)

Information **„NOT WRITTEN"** means, that the operating configuration is different from the configuration stored in FLASH.

Configuration **can be saved** to FLASH memory by using of **"write"** command. Example:

```
WS868-SRMT>write
Writing configuration ...  OK, size 178 bytes
WS868-SRMT>
```

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, it is not necessary to save operating configuration into FLASH memory (after diagnostics the function will be switched-off anyway). If the parameter should be changed permanently, there is necessary to save the configuration to FLASH memory.

Configuration can be **erased from the Flash memory** by using of **"clear"** command. **WARNING!** This command is recommended to use only by users with good knowledge of the system, or after consultation with the manufacturer.

The **"measure [value]"** command can be used for setting of the **measuring interval of A/D converter and I2C bus** for measurement of some physical quantities by internal or external sensors. Example:

```
WS868-SRMT>measure 60
measure:  60
WS868-SRMT>
```

The measuring interval is set in seconds and should be significantly shorter than broadcasting period. The optimum

value of the period is factory preset and it is **not recommended to change** the value.

The **"periode [value]"** command can be used for setting of the module **broadcasting period of module operational data** in seconds. Example of setting of broadcasting period to 1 hour (3600 seconds) value:

```
WS868-SRMT>periode 3600
sending:  3600
WS868-SRMT>
```

WARNING!. *Frequency of broadcasting in Sigfox network is under regulation. Each device working in Sigfox network has assigned its service profile that enables only limited number of broadcasted messages per day. Exceeding this limit can cause some restriction or sanction from the Sigfox service provider. When setting this parameter, check whether the setting complies with a service contract, that is valid for configured device.*

The **module reset** can be performed by using of **"reset"** command. After entering the command, the module goes to software restart. Example:

```
WS868-SRMT>reset
WS868-SRMT>
...
smons - System monitor, Version 2.0
Copyright (c) 2018, Petr Volny *MSoft*
Compiled at Oct 2 2018, 08:52:41
WS868-SRMT>
```

By using of **"show"** and **"?"** commands the overview of current configuration parameters and the list of all configuration commands (HELP) can be displayed. Using of these commands is described in detail in paragraph 3.5.1 above. By using of "info" command the module current status statement can be displayed. Using of this command is described in detail in paragraph 3.5.5 below.

3.5.3 Commands for data-bus setting

The commands from **„BUS Commands"** group serve for setting of basic parameters of physical data-bus of SI type and for read-up of the data from the bus. There are following commands:

ondelay	*setting of bus switch-on delay*
offdelay	*setting of bus switch-off delay*
iread	*command for read-up data from the bus*

The **"ondelay"** command can be used for setting of protection interval after activation of physical bus. After the power is switched into the bus it takes some time until the bus circuits of connected devices (meters, sensors) are in stable condition. The different devices can have a very different time to be ready for receiving of commands from the bus. The "ondelay" parameter enables setting of such delay between rising of the bus and sending of the first command, when both connected devices reliably answer the first command from the bus. At the same time, the delay should be as short as possible, because power supplying of the bus significantly consumes battery power.

The **"offdelay"** command can be used for setting of protection interval before de-activation of physical bus, so as the connected device could manage to send the answer for last command before the bus is switched off. This parameter enables compensation of different response time of different devices.

Both parameters should be entered in 50 ms long system units („ticks"), what means that by entering of figure "20" the delay is set to 1 second. Both parameters are factory set to common averages (see list of configuration parameter). If reading of data through the bus by "iread" command (see below) is non-functional or unreliable, it is recommended to adjust protection intervals to get reliable readings from both connected devices connected through the SI bus.

Example of setting of "ondelay" and "offdelay" parameters:

```
WS868-SRMT>ondelay 20
ondelay:  20
WS868-SRMT>offdelay 4
offdelay:  4
WS868-SRMT>
```

By entering of the **"iread [index]"** command the module will read-up the message from connected meter with

requested index (profile) through the SI bus. Using of this command is described in following part of the document („Commands for setting of meters"), where there are also descriptions of statements (responses) obtained by this command. This command can be used for module initial setting and for diagnostics.

The commands from **„Profile Commands"** group serve for setting of parameters for communication with individual devices (meters, sensors..) on the bus. The commands should be always entered with the index of given device (virtual port number). There are following commands:

ispeed	*initial communication speed setting*
iparity	*initial parity setting*
idata	*initial data-bit setting*
istop	*initial stop-bit setting*
iperiode	*setting of device messages broadcasting period*
idelay	*communication delay setting*
iresponse	*setting of response timeout*
proto	*setting of meter communication protocol*

The **"ispeed [index] [value]"** command serves for setting of initial **bit transfer speed** („communication speed") on the SI interface between meter and WS868-srMt module. The speed must be adjusted to the value, that is required by parameters of connected meter.

(*) If the device (meter) supports automatic adjustment of communication parameters, the speed can be increased in the initial phase of connection („handshaking").

There are seven options of communication speed setting:

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

Example of checking and setting of the communication speed for device with index "0":

```
WS868-SRMT>ispeed 0
ispeed [0] :  2400
WS868-SRMT>ispeed 0 1200
ispeed [0] :  1200 WS868-SRMT>
```

It is evident that the communication speed of the device with "0" index was originally set to 2400 bps (baud). By entering of **"ispeed"** command with "0" index and "1200" parameter it was changed to 1200 baud value.

The **"iparity [index] [value]"** command serves for setting of **parity bit** of the serial/bus interface. There are five options of parity bit setting:

- value **„0"** means „none parity" (none)
- value **„1"** means „even parity" (even)
- value **„2"** means „odd parity" (odd)
- value **„3"** means „fixed 1" (mark)
- value **„4"** means „fixed 0" (space)

Example of checking and setting of the parity bit for device with index "0":

```
WS868-SRMT>iparity 0
iparity [0] :  0 - none
WS868-SRMT>iparity 0 1
iparity [0] :  1 - even
WS868-SRMT>
```

As evident from the example, the parity bit of the device with "0" index was originally set to "none". By entering of **"iparity"** command with "0" index and "1" parameter it was changed to "even" value.

The **"idata [index] [value]"** command serves for setting of **number of data bits** of the serial/bus interface, where the number from (5-8) interval can be used. Example of setting of the number of data bits for index "0" device to "8" value:

```
WS868-SRMT>idata 0 8
idata [0] :  8
WS868-SRMT>
```

The **"istop [index] [value]"** command serves for setting of **number of stop-bits** of the serial/bus interface, where the "1" or "2" value can be used. Example of setting of the number of stop-bits for index "0" device to "1" value:

```
WS868-SRMT>istop 0 1
istop [0] :  1
WS868-SRMT>
```

The **"idelay [index] [value]"** command serves for setting of minimum time interval between device (meter) response and following request that gives the meter time for switching of its bus circuits from transmitting to receiving mode. The parameter should be entered in system units („ticks"), where each unit represents 50 ms delay. Example of setting of "idelay" parameter of the index "0" device to 1000 ms (20 ticks) value:

```
WS868-SRMT>idelay 0 20
idelay [0] :  20
WS868-SRMT>
```

The **"iresponse [index] [value]"** command serves for setting of maximum time interval (timeout) for receiving of meter response to module's request. If a response from the device (meter) is not received during the timeout, the request is re-transmitted again. The request can be repeated two times (i.e. the request is transmitted maximum three times), if the response has not been received even after third timeout, communication with the meter is closed. Next request is transmitted in following scheduled broadcasting time fixed by broadcating period of the device. Example of setting of "iresponse" parameter of the index "0" device to 5000 ms (100 ticks) value:

```
WS868-SRMT>iresponse 0 100
iresponse [0] :  100
WS868-SRMT>
```

The **"proto [index] [value]"** command serves for setting of communication protocol for the internal port. The module supports connecting of meters/sensors with three communication protocols: 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: "1" for M-Bus protocol, "2" for „OPTO" protocol, and "3" for Modbus protocol. Internal port can be disabled by entering of "0" value.

Example of checking of parameter current value and follow-up setting of device with "0" internal input (index) to M-Bus protocol:

```
WS868-SRMT>proto 0
proto [0] :  3 - ModBus
WS868-SRMT>proto 0 1
proto [0] :  1 - MBUS
WS868-SRMT>
```

Important note! *Current version of WS868-srMt module supports only M-Bus type of coding.*

The **"iperiode [index] [value]"** command can be used for setting of **broadcasting period** of given meter info-messages. The period is set individually for each connected device (meter) and the module broadcasts info-messages related to the meter with this period. Current value of the parameter can be checked by using of **"iperiode [index]"** command (without parameter), the period can be set by entering of required number of minutes after index (up to 65535 minutes can be set).

Example of checking of parameter current value and setting of broadcasting period for the "0" index meter to 120 minutes value:

```
WS868-SRMT>iperiode 0
iperiode [0] :  60
WS868-SRMT>iperiode 0 120
iperiode [0] :  120
WS868-SRMT>
```

***WARNING!**. Frequency of broadcasting in Sigfox network is under regulation. Each device working in Sigfox network has assigned its service profile that enables only limited number of broadcasted messages per day. Exceeding this limit can cause some restriction or sanction from the Sigfox service provider. When setting this parameter, check whether the setting complies with a service contract, that is valid for configured device.*

3.5.4 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 WS868-srMt module. There are following commands:

primary	*setting of meter primary address in M-Bus standard*
secondary	*setting of meter secondary address in M-Bus standard*
sid	*setting of variable ID in Sigfox message payload*
dib	*setting of variable DIF code*
vib	*setting of variable VIF code*

The **"primary"** and **"secondary"** commands are intended for setting of connected devices addressing. With using of this setting, the module correctly sends queries and correctly identifies answers. These commands are related only to meters and should be always entered with meter index, that means in the **"[command] [index] [value]"** general form (e.g. **"primary 0 251"**).

The **"primary [index] [value]"** command 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 WS868-srMt 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 **"primary [index]"** command (without parameter). Identifier could be changed by entering of required address number after "primary" command and index. Entered address number must belong to the 0 to 255 range.

Example of displaying of primary M-Bus address current setting for the device with "0" index and follow-up changing of the address:

```
WS868-SRMT>primary 0
id [0] :  251
WS868-SRMT>primary 0 253
id [0] :  253
WS868-SRMT>
```

The **"secondary [index] [value]"** command serves for entering of **secondary** („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 WS868-srMt 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 **"secondary [index]"** command (without parameter). Identifier could be changed by entering of required address from the 0-99999999 range after "secondary" command and index.

Example of displaying of secondary M-Bus address current setting for the device with "0" index and follow-up changing of the address to "35343383" value:

```
WS868-SRMT>secondary 0
id [0] :  35343332
WS868-SRMT>secondary 0 35343383
id [0] :  35343383
WS868-SRMT>
```

***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 a secondary address is set to some internal port, primary address of the same port is automatically changed to "253" value.*

Connected devices (meters) with M-Bus output typically measure and evaluate higher number of quantities, so that their messages contain a lot of variables. As the data content of Sigfox standard messages is limited to maximum 12 Byte, the WS868-srMt module typically transfer in its info-messages only pre-selected variables. The **"sid", "dib"** and **"vib"** commands are intended for setting of required variables from connected meters. With using of this setting, the module correctly selects and decodes required variables from M-Bus messages of connected meters and assigns selected variables by its own identifiers („Sigfox ID"). As these commands are related not only

to individual meters, but also to individual variables, they should be always entered with meter index and variable index, that means in the **"[command] [index] [variable index] [value]"** general form (e.g. **"sid 0 0 111"**).

The **"sid [index] [variable index] [value]"** command is intended for setting of variable identifiers, that will be transferred in the data content of Sigfox info-message („Sigfox ID"). With using of these identifiers the central application (remote reading system) determines individual variables and associates them with relevant meters. The identifier value can be any number from the (0-255) range.

Example of setting of „Sigfox ID" variable identifiers:

There are two meters connected to the module and two variables should be transferred from each meter. Variable identifiers can be set as follows (example):

- first meter (index 0), first variable (variable index 0): identifier "11"
- first meter (index 0), second variable (variable index 1): identifier "12"
- second meter (index 1), first variable (variable index 0): identifier "21"
- second meter (index 1), second variable (variable index 1): identifier "22"

Any numbers from (0-255) range can be used as variable identifiers, the only requirement is that they must be different.

Current setting of „Sigfox ID" variable identifier can be displayed by using of **"sid [index] [variable index]"** command (without parameter). Identifier could be changed by entering of required number (from 0-255 range) after "sid" command and both indexes.

Example of displaying of current „Sigfox ID" value for the first variable (variable index "0") of the first device (index "0") and follow-up changing of the identifier to "11" value:

```
WS868-SRMT>sid 0 0
SIGFOX index for profile [0], variable [0] :  0
WS868-SRMT>sid 0 0 11
SIGFOX index for profile [0], variable [0] :  11
WS868-SRMT>
```

Above presented example of setting of all four identifiers can be performed as follows:

```
WS868-SRMT>sid 00 11
SIGFOX index for profile [0], variable [0] :  11
WS868-SRMT>sid 0 1 12
SIGFOX index for profile [0], variable [1] :  12
WS868-SRMT>sid 1 0 21
SIGFOX index for profile [1], variable [0] :  21
WS868-SRMT>sid 1 1 22
SIGFOX index for profile [1], variable [1] :  22
WS868-SRMT>
```

The **"dib [index] [variable index] [value]"** and **"vib [index] [variable index] [value]"** commands are intended for selection of M-Bus variables, that will be transferred in the data content of Sigfox info-messages. With using of DIF/VIF codes the module provides selection and decoding of required variable from the M-Bus message of the connected meter. Decoded value is broadcasted in Sigfox info-messages under given „Sigfox ID" label.

Example of setting of the DIF-code for selection of the first variable (variable index "0") of the first device (index "0") to "0x0b" value:

```
WS868-SRMT>dib 0 0 0x0b
DIF [0] :  0x0b
WS868-SRMT>
```

Same setting of DIF value ("0x0b") can be performed also by using of decimal equivalent of "0b" value, that is number "11":

```
WS868-SRMT>dib 0 0 11
DIF [0] :  0x0b
WS868-SRMT>
```

Example of setting of the VIF-code for selection of the first variable (variable index "0") of the first device (index "0") to "0x5a" value:

```
WS868-SRMT>vib 0 0 0x5a
VIF [0] :  0x5a
WS868-SRMT>
```

The VIF-code can be also entered in decimal equivalent of "5a", that is number "90":

```
WS868-SRMT>vib 0 0 90
VIF [0] :  0x5a
WS868-SRMT>
```

With setting of DIF/VIF parameters as presented in example above, the module would select the M-Bus data block with DIF=0b / VIF=5a from the first device and decoded variable of this block will be assigned in Sigfox info-message as the first variable of the first device. In the example of M-Bus message obtained by "iread' command below this variable is in the fifth data block ad its value is "238":

```
  DIF : 0b   VIF : 5a   DATA: 38 02 00   Value: 238 (0x000000ee)
```

Everytime a new device is connected to the WS868-srMt module, it is very useful to send a query and display answered M-Bus message from the device by using of **"iread [index]"** command. After this command is entered, the module sends query to the meter with required index and display the meter's response received from the bus. If connected device use **M-Bus coding** and corresponding internal input is correctly preset to M-Bus protocol (proto=1), decoded M-Bus message from the meter should be displayed in the statement as seen in the example:

```
WS868-SRMT>iread 0
MBUS: init
MBUS: TX done
Packet OK
 --- MBUS header ---
  C    : 08
  A    : 9
  CI   : 72
ID     : 00101970
Manuf  : SLB
Version: 6
Medium : 4
Access : 222
Status : 0
Sign   : 0000
 -------------------
  DIF : 0c   VIF : 78   DATA: 70 19 10 09   Value: 9101970 (0x008ae292)
  DIF : 0c   VIF : 06   DATA: 01 00 00 00   Value: 1 (0x00000001)
  DIF : 0c   VIF : 14   DATA: 42 00 00 00   Value: 42 (0x0000002a)
  DIF : 0a   VIF : 3b   DATA: 00 00   Value: 0 (0x00000000)
  DIF : 0b   VIF : 5a   DATA: 38 02 00   Value: 238 (0x000000ee)
  DIF : 0b   VIF : 5e   DATA: 41 02 00   Value: 241 (0x000000f1)
  DIF : 0b   VIF : 61   DATA: 32 00 f0   Value: 1500032 (0x0016e380)
  DIF : 32   VIF : 26   DATA: 00 00   Value: 0 (0x00000000)
  DIF : 02   VIF : 27   DATA: d6 0d   Value: 3542 (0x00000dd6)
  DIF : 04   VIF : 6d   DATA: 38 14 55 2b   Value: 726996024 (0x2b551438)
  DIF : 84 40   VIF : 14   DATA: 7f 01 00 00   Value: 383 (0x0000017f)
  DIF : 09   VIF : fd 0e   DATA: 03   Value: 3 (0x00000003)
  DIF : 09   VIF : fd 0f   DATA: 18   Value: 18 (0x00000012)
  DIF : 0f   VIF :   DATA: 00 06   Value: 0 (0x00000000)
MBUS packet in
timer fired
```

In the upper section of the statement („MBUS header") there are decoded data from the message M-Bus header. In the lower part of the statement there are multiple rows with all data blocks (variables) of the M-Bus message. Each row contains DIF, VIF, DATA and Value items („Value" = decoded DATA).

This statement enables selection and setting of transferred variables, that will be broadcasted in Sigfox info-messages (see using of "dib" and "vib" commands as described above).

3.5.5 Module current status statement

The**module current status statement** can be displayed by entering of **"info"** command into the command line and pressing of „ENTER" key. Following statement will appear in the terminal window:

```
WS868-SRMT>info
 --- Module ---
Device      : WS868-sRMt
ID          : 0018EBF4
PAC         : 81E636D62207B87D
HW version  : 1.50
SW version  : 2.0
Uptime      : 0 day(s), 1 hour(s), 0 min(s), 38 sec(s)  (3638 secs)
RTC         : 1:0:37  1.1.1900
RESET cause : (4) POWER (1) Brownout (BOR)

 --- Sensors ---
temperature[1]: -
temperature[2]: +24.6 Celsius
humidity[1]   : -
voltage[1]    : 3467 mV

Fast TX       : 0
ADC state     : 0
titemp state: IDLE
I2C failure counter: 0
WS868-SRMT>
```

In the first section there are displayed **device designation** (Device), **hardware version/revision** (HW version), **software version/revision** (SW vesion) and Sigfox network identifiers. These specifications are factory set and cannot be changed (except PAC-code).

The **"ID"** parameter is an **unique identifier of the device** in the Sigfox global network. This ID is permanently assigned to the given module and cannot be changed.

The **"PAC"** (Personal Authentication Code) is an unique identifier of **assigning** of the given device to **concrete customer** - service contractor. Initial PAC-code is assigned to the module in factory and can be changed only with co-operation with Sigfox network provider (with possible change of service contractor). Initial PAC-code is written in module configuration as an information for user. Setting of this parameter has no influence on the module functionality. After possible change of service contractor, the new contractor could decide to register change of PAC-code in the module configuration or not.

In the first section there are also current values of module **uptime**, **system time** in common time format („RTC") and **reset cause** of module last reset.

The **„Uptime"** parameter value shows the time interval passed from the last device reset in seconds so that the exact moment of the last module reset can be recognized by this parameter. The parameter cannot be changed by user („read only" type).

The **„Reset cause"** parameter value gives an information about the last reset circumstances. Following reset codes are relevant for this type of device:

- **„0"** means „Cold start" (caused by user „RESET" command)
- **„1"** means „Warm start" (based on „suspension" cause
- **„2"** means „Watchdog reset" (reset by „watchdog" system)
- **„3"** means „Error reset" (incorrect instruction or inconsistent data)
- **„4"** means „Power reset" (caused by low power voltage)

The parameter has „read only" character and it is used mainly for the diagnostics.

The **„Systime"** parameter value shows setting of module real time. System time is kept in the same format as in computer operating systems, i.e. in seconds, starting from 1.1.1970 („UNIX Epoch time"). In default status (after battery switch-on) there is zero value in the counter and it increases by one every second. As setting of this parameter is not required for any common application of the module, command for its setting is not included in the set of configuration commands.

In the second section of the statement there are values of **current temperature** measured by sensor (temperature [1]), **current processor temperature** (temperature [2]), **current humidity** measured by sensor (humidity[1]), and **current voltage of internal battery** (voltage [1]). As the module is not equipped by temperature/humidity sensors, the "temperature [1]" and "humidity[1]" values are not displayed.

In the last section of the statement there are entries for module diagnostics. This information has no practical meaning for user and can vary in dependence on the module modification, software version and factory setting.

3.6 Setting of parameters by using of optical „USB-IRDA" converter

All parameters that is necessary to set-up during common operation can be configured by optical interface. The settings can be performed through the transparent casing without necessity to open the module's cover. This is the significant advantage especially if the module is used in humid environment and has been sealed by additional silicon filling (additional adaptation for IP-68 proofing).

Principles of the optical configuration, technique of connection to computer and working procedure with using of the **„WACO OptoConf"** program are explained in detail in the section 3.2 „Configuration of the WS868-srMt module with using of optical converter".

Any changes in module's settings can be performed in **Module configuration table** that opens by click on the „Read device" button in „WACO OptoConf" program window.

In the **upper section of the table** there are „read only" type of parameters (factory settings) that refer to the identification of the module and its components. There are following parameters:

Device name	*device name by manufacturer*
Device type	*device type by manufacturer*
Device subtype	*device subtype by manufacturer*
Serial No.	*device serial number (as well MBUS-ID in M-Bus address)*
HW Version	*hardware version by manufacturer*
HW Revision	*hardware revision by manufacturer*
SW Version	*software version by manufacturer*
SW Revision	*software revision by manufacturer*
Uptime	*time from last module reset in seconds*

All the parameters (except „Uptime") contain information about device identification, series and hardware/software version and are intended only for manufacturer's use.

In the **middle section of the table** there is a group of commonly used configurable parameters of the WS868-srMt module.

In the **lower section of the table** there are current values of external and internal sensors (temperature, voltage...). There are following parameters:

Temperature	*current processor temperature (read only)*
Batt. voltage	*current battery voltage (read only)*

In the non-editable fields **„Temperature"** and **„Batt. voltage"** there are displayed current values of processor temperature and battery voltage of the module. These values are transmitted in each operational data message (see description of information messages in section 3.7 „Structure of WS868-srMt module data messages").

3.6.1 Overview of module configuration parameters

Overview of configuration parameters that can be used for user settings of the WS868-srMt module is shown in the Table 2 below. The parameters are presented in the same order as they appear in the List of all configuration parameters (see paragraph 3.5.1).

In the **„Type"** column there is a data type of the parameter. In the **„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 set in reliance on the specific usage
- red colour - parameters that are not recommended to change
- grey colour - values that cannot be changed („read only")

Table 2: Overview of WS868-srMt module configuration parameters

Item	Name	Type	Description	Default.
1	Configuration	text	Configuration status	read only
2	Xtal PPM	number	RF-transceiver correction constant	
3	Downlink	number	Downlink activation frequency	0
4	Sending time	number	Broadcasting period of status messages (min.)	1440
5	Measure time	number	A/D converter measurement interval	300
6	ondelay	number	Bus switch-on timeout	100
7	offdelay	number	Bus switch-off timeout	5
8	periode	number	Meter broadcasting period (min.)	1440
9	ispeed	number	Meter initial bus speed	2400
10	iresponse	number	Meter response timeout (ticks)	200
11	idelay	number	Minimum interval between messages (ticks)	20
12	iparity	number	Data parity setting (meter)	even
13	istop	number	Number of stop-bits (meter)	1
14	idata	number	Number of data bists (meter)	8
15	proto	text	Input protocol (type of coding)	
Internal inputs with "M-Bus" protocol				
16	Address	number	Meter M-Bus address	
17	SIGFOX index	number	Sigfox variable index	
18	DIF	code	Variable DIF-code	
19	VIF	code	Variable VIF-code	

3.7 Structure of module data messages

The WS868-srMt module is intended for reading of meters/sensors connected through the SI bus and broadcasting of current statuses („readings") of the meters through the Sigfox IoT network. The module regularly transmits standardized Sigfox INFO-messages with maximum length of 26 Byte, and with maximum length of data payload 12 Byte.

The module broadcasts two types of information messages:

a) „internal" messages with operational parameters - hereinafter **„operational data message"**
b) variable from connected meter - hereinafter **„meter info-message"**

Operational data message contains operational parameters of the module (battery voltage, temperature...) and it is broadcasted independently on the broadcasting of meter info-messages. Broadcasting period of operational data messages can be set by "periode" command as described in the paragraph 3.5.2 „Commands for module basic settings". The operational data message of the WS868-srMt module is 26 Byte long and contains 12 Byte long payload with following information:

Item	Bytes	Name	Description
1	1	type	Message type (0 - module internal message)
2	4	counter IN1	current value of counter 1 (32-bit integer, LSB first)
3	4	counter IN2	current value of counter 2 (32-bit integer, LSB first)
4	1	temperature	temperature in Celsius (8-bit signed integer, LSB first)
5	1	voltage	battery voltage in mV/20 (8-bit unsigned integer, LSB first)
6	1	humidity	relative humidity in per-cent (8-bit signed integer)

The **„Message type"** (1 Byte) enables distinguishing of messages by their content (internal operational messages, messages with meter variables, alarm messages). Operational data message is always marked as "0" type.

Values of IN1 and IN2 counters are reserved for current statuses of pulse inputs. As the WS868-srMt module is not equipped by pulse inputs, these values have no practical meaning.

The **„Temperature" value** represents current status of module processor temperature. It indirectly indicates ambient temperature in installation site.

The **„Voltage" value** represents current status of module battery voltage. It indirectly indicates status of batery lifetime. The value is indicated in „mV/20" units, what means that to get the real voltage value in mV, indicated value must be multiplied by 20.

*Example: If there is a "181" value in the message, real value of battery voltage is: 181 * 20 = 3620 mV.*

The **„Humidity" value** represent status of humidity sensor. As this model of device is not equipped with humidity sensor, „humidity" value has no practical meaning.

Meter info-messages serve for transfer of current values of selected variables (readings) of meters, connected to the module through bus interface. Each parameter is transferred in one message, what means that if the two variable of one meter are transferered, the module generates two meter info-messages in sequence (*). Broadcasting period of meter info-messages can be set by "iperiode" command with meter index as described in the paragraph 3.5.3 „Commands for data-bus setting". Meter info-messages contain up to 12 Byte long payload with following information:

Item	Bytes	Name	Description
1	1	type	Message type (1 - meter variable)
2	1	tid	Transaction ID (0÷255)
3	1	var	Variable index (0÷255)
4	1	valt	Value type (coding)
5	1÷8	value	Variable value (up to 8 Bytes)

The **„Message type"** (1 Byte) enables distinguishing of messages by their content (internal operational messages, messages with meter variables, alarm messages). Meter info-message is always marked as "1" type.

The **„Transaction ID"** (1 Byte) is a data packet identifier that serves for control of data communication.

The **„Variable index"** (1 Byte) is intended for identification of the variable in remote reading system (see using of "sid" command in paragraph 3.5.4).

The **„Value type"** (1 Byte) describes type and data coding of transferred variable value, where numeral values have following meanings:

0 - null, value is not valid
1 - 32-bit integer
2 - 64-bit integer
3 - float, 4 Byte
4 - double, B byte
5 - string, ASCIIZ string terminated by zero

The **„Variable value"** (up to 8 Bytes) is a current value („reading") of transferred variable.

(*) If, as an example, there are two meters connected to the module, and two variables are transferred from each of them, the module broadcasts two messages in sequence with the first meter variables (with "iperiode 0" period), and two messages in sequence with the second meter variables (with "iperiode 1" period). Besides, the module broadcasts its own operational data messages with "periode" broadcasting period.

4 Operational conditions

This section of the document describes basic recommendations for transportation, storing, installation and operation of WS868-srMt radio modules.

4.1 General Operation Risks

The radio modules are electronic devices power-supplied by internal batteries. The modules read counters or registers of the connected consumption meters or sensors.

During their operation be aware mainly of the following risks:

4.1.1 Risk of mechanical and/or electric damage

The devices are enclosed in plastic boxes, so that the electrical components are protected from the direct damage by human touch, tools, or static electricity. In normal operation no special precautions are needed, besides avoiding of the mechanical damage from strong pressure or shocks.

Special attention is required for cables that connect the radio modules with the meters, sensors, or external antennas. In operation it is necessary to ensure that the cables are not stressed by mechanical tension or bending. In 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 can 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.

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. It is recommended to lead antenna and signal cables as far from 230/50 Hz power cables as possible.

4.1.2 Risk of premature battery discharge

The devices are equipped with the long duration batteries. Battery life can be influenced by these factors:

- storage and operation temperature – in high temperatures the spontaneous discharging current increases, in low temperature the battery capacity reduces;
- frequency of radio-transmitting.

Modules are delivered with preset period of regular transmitting of info-messages as stated in the configuration table in section of this document and the battery life cycle is quoted for this period. If the transmitting period is significantly reduced, battery life will be proportionally shortened.

4.1.3 Risk of damage by excessive humidity

Radio modules could be (as any other electronic devices) damaged by water, that could cause a short-circuit among some electronic elements or corrosion of the elements. Correctly assembled plastic box protects the module's printed circuit board against direct penetration of water, but the damage could be caused also by gradual penetration of humid air which can cause corrosion or other damage by condensed water inside the box.

Modules are enclosed in IP65 grade plastic boxes (proof against short-time squirted water) or with additional sealing by high-adhesion silicon filling, that can ensure proof against inundation by water (IP68 grade). Modules, that are delivered with IP68 sealing from factory are clearly assigned by IP68 degree of protection on the manufacturer's production label (e.g.: "WS868-srMt/B13/IP68").

Risks of damage of the device in basic **"IP65"** design caused by penetration of excessive humidity can be eliminated by these precautions:

- install only modules that are correctly assembled, with undamaged box and undamaged rubber seal;
- in case of any doubt perform additional sealing of connection of both parts of the box and both cable bushings by silicon sealant;
- install modules only to the sites where relative humidity exceed value of 95% only occasionally;

- install modules only to the sites where they can be squirted or sprayed by water only occasionally and only for a short time;
- do not install modules to the sites where they can be dipped into the water.

Risks of damage of the device in waterproof **"IP68"** design caused by penetration of excessive humidity can be eliminated by these precautions:

- do not open the module with silicon filling without serious reason;
- if (from some reason) the module was already opened, manipulate with it very carefully or renew its silicon filling by pouring of a few milliliters of special silicon (same as original - consult the technique with manufacturer). **In case the module has been opened, there is no manufacturer's guarantee of IP68 degree of protection.**;
- install modules only to the sites where they can be dipped into the water only occasionally and only for a short time;
- do not install modules to the sites where their antenna could be submerged under water. Antenna must be installed to such place, where there is no possibility to be flooded. **Operating of the module with antenna submerged under water could cause irretrievable damage of the device!**

4.2 The condition of modules on delivery

Modules are delivered in standard cardboard boxes. The modules are commonly delivered in fully operating status with battery switched on and completed registration in Sigfox Network. For saving battery energy reasons the long transmitting period (e.g. 1 day) is pre-set in the factory.

4.3 Modules storage

As the modules are already registered in the Sigfox Network on delivery and the subscription period is already passing, it is strongly recommended to store modules only as short time as necessary. If necessary, store the modules in dry rooms or halls, in the temperature interval (0 ÷ 30) °C. To prevent the unwanted discharging of internal battery it is recommended to keep the long transmitting period configured until the module's installation.

IMPORTANT WARNING *Sigfox Network services are charged on the base of prepaid subscription, when each individual device can be operated only until the end of subscription period and then it is automatically deactivated. Operation of the module is the most economical in case the module was put into operation immediately after delivery and it is kept in operation for all the subscription period.*

4.4 Safety precautions

Warning! Mechanical and electrical installation of the WS868-srMt module can be provided only by a person with necessary qualification in electrical engineering.

4.5 Environmental protection and recycling

The equipment contains non-rechargeable lithium battery. It is necessary to remove battery before module disposal and dispose battery separately in compliance with the dangerous waste disposal rules. 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 WS868-srMt module installation

WS868-srMt radio modules are enclosed in plastic casings with an IP65 degree of protection equipped with mounts for mounting on the wall, pipe or any other construction element. Bus input clamps, battery switch, configuration connector as well as antenna connector are placed on the module's printed circuit board, so that it is necessary to open the casing to access these elements.

Modules with additional silicon filling (IP68 degree of protection) are delivered with battery switched on and with both cables connected before silicon filling. **It is recommended do not open the casing during operation until it is really necessary, and if so, do it very carefully**. Configuration of the modules should

be performed by USB-IRDA optical converter as described in section 3.6 „Setting of parameters by using of optical „IRDA" converter"

In the figure 16 right there is displayed the detail of WS868-srMt module printed circuit board with configuration connector marked by yellow colour, battery switch marked by red colour, input clamps marked by blue colour and antenna connector marked by green colour. Appearance of the module PCB could slightly vary in dependence on the module modification.

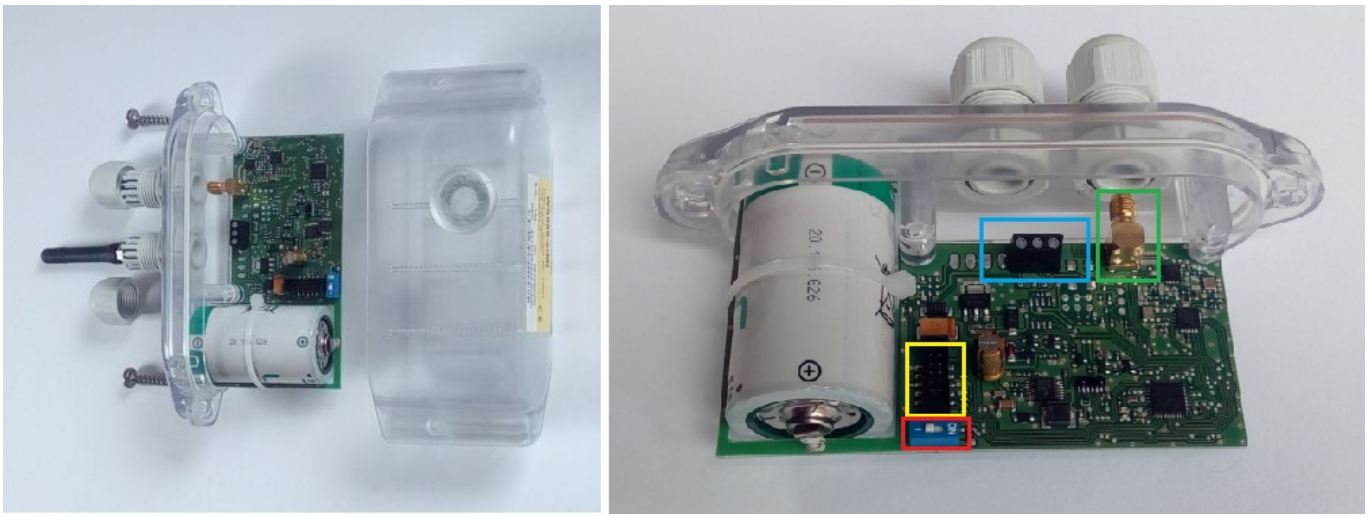

Figure 16: Detailed view of WS868-srMt module

The case of WS868-srMt module consists of two parts:

- module base with the printed circuit board attached. It is the where the cable bushings are placed;
- box cap that covers the printed circuit board, with mounts for attaching of the module to the wall or other construction element

When mounting the device follow these instructions:

- attach the module to a suitable firm object (wall, pipe) by two screws or by a clamping tape. There are mounts by the box sides for the attachment. The recommended position of the mounted module is in the way that the base is down, cable bushings are facing to the floor;
- unscrew the screws on the sides of the module base (right beside the cable bushings), loosen the cap of the module and slide the base out of the cap;
- pull the cables with the outputs from the consumption meters or sensors through the cable bushing (**) and connect the individual conductors to the input clamps of the module. The scheme of deployment and polarity of individual clamps is glued inside on the cap of the box. Make sure that the meters are connected to the relevant inputs according to the project materials or write down the diagram of individual connections;
- connect the local antenna (stick or rod type) or an antenna cable from a remote antenna into the antenna connector (coaxial connector on the printed circuit board beside the input clamps). Pull the antenna or the antenna cable through the cable bushings that is just right opposite to the antenna connector;
- switch-on battery by switching of both of the micro-switches („jumpers") placed on the PCB beside the configuration connector into the „ON" position. Some modifications of the module could be equipped with a pair of simple shortening pins, that should be short-circuited by shortening connector;
- perform an elementary module diagnostics and alternatively go through the module configuration (setting of parameters) with using of configuration cable as described in chapter 3 „Module configuration". In case the module has been fully pre-configured in the preparatory phase of installation, at least check and set-up input/output values to ensure that the information sent in the radio-messages will be correct;
- tighten the nuts on the cable bushings to seal them and protect the cables from unwanted pulling out of the clamps;
- insert the base back into the cap and fix with screws. For the mounting in a humid environment it is recommended to apply silicone sealant on the outer perimeter of the seating edge of the base before screwing the box back together;
- if the internal rules or the mounting process needs the antifraud seal to be installed (as the protection from the unwanted influencing), stick the antifraud seal across the joint between the two parts of the box.

*(*) **ATTENTION!** If the module is sealed by additional silicon filling with IP68 degree of protection do not open its casing during the installation! Meter outputs can be connected to appropriate wires of the input cable (that had been connected to the module before silicon filling) and configuration could be performed by radio or by using of an optical converter USB-IRDA.*

If the module is rated in IP65 or IP68 degree of protection, this declaration is valid only under condition of the proper mounting and sealing. When assembling the modules with IP68 degree of protection that will be placed in the humid environment, it is necessary to follow these rules:

- both cable bushings must be properly sealed;
- the joint of both parts of the box must be properly sealed by original rubber sealing).

After the mounting, write down the counter values of all consumption meters connected to the module into the mounting sheet and alternatively once again check out the module‘s functionality and the correctness of output values (which must correspond to consumption meter mechanical counters). Test the module functionality by „end-to-end” method, that means by checking of the readings directly in the central system of remote reading.

Follow the consumption meter manufacturer’s instructions for determination of the length of the connection cables between the consumption meters and the radio modules.

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 as well as protection of the device against possible mechanical damage. The radio-signal conditions can be estimated empirically on the base of previous experience, or examined by measuring of the signal strength by the reference transmitter/receiver.

4.7 Module and meter replacement

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

- check the antifraud seal before dismantling – the antifraud seal damage must be solved according to the internal rules of the customer/project;
- unscrew two screws on the sides of the module base (beside the cable bushings), loosen the cap of the module and slide out the base from the cap;
- disconnect the cables from the consumption meters from the input clamps, alternatively disconnect the cable of the external antenna from the antenna connector;
- by switching of both of the micro-switches („jumpers”) placed on the PCB beside the configuration connector into the „OFF“ position (or replacing of shortening connector from shortening pins) disconnect the module from the battery power supply;
- loosen the fixing screws (or clamping tape) that hold the module on the wall, pipe or other pad and dismantle the cap;
- put both parts of the module back together by screwing the cap together with base (*). Mark the module visibly as „defective”, alternatively you can fill in the form (mounting report) about the module replacement;
- install a new module in the same way as described in paragraph 4.6 above. Pay attention to the correct connection of the input cables (must be the same inputs as they were on the original module) and set up the relevant configuration parameters, namely broadcasting period and input/output values.
- write down the serial number and seal number of the module, alternatively also actual statuses of counters of connected meters;
- if possible, arrange making of all appropriate changes in the database of the remote reading system immediately.

*(*) **CAUTION!** The type label with RF-address and serial number of the module is always on the cap of the module so the base and the cap of the module must always be one whole unchangeable unit. Always pay attention to the completing of the correct cap with the correct base of the module, that is the reason why it is always necessary to replace the whole module – the base and the cap together. The correct module completion can be checked out according to the auxiliary label with the RF-address glued on the PCB (RF-address on the PCB must correspond with the RF-address on the cap of the module).*

When there is necessary to replace a consumption meter connected to the module due to the meter failure, expired metrology period or for any other reason, follow this procedure:

- check the antifraud seal before dismantling – the antifraud seal damage must be solved according to the internal rules of each customer/project;

- if the module is sealed by additional silicon filling with IP68 degree of protection do not open its casing! Disconnect replaced meter from the input cable and connect new meter to the same wires;
- if the module is in common IP-65 design, unscrew two screws on the sides of the box (beside the cable bushings), loosen the cap of the module and slide out the base from the cap;
- disconnect the cables from replaced consumption meter from the input clamps, replace the consumption meter and connect its cable back into the input clamps;
- perform setting of input/output values of the relevant input according to the instruction in the chapter 3 „Module configuration". Check out the correctness of output values (which must correspond to consumption meter mechanical counters) by checking of the readings directly in the remote reading system.
- fill in the required documentation for the meter replacement (mounting sheet), precisely write down the value of the mechanical counter of the new meter;
- cover the module and, if needed, apply the sealant according to the instructions in paragraph 4.6. Alternatively wait for the first reading and cover the module afterwards.

(*) CAUTION! *The new meter might require a different setting of module's input/output even if the meter is the same type and manufacturer. Conversion constants can differ from each other even in various modifications of the same type of the meter.*

4.8 Module dismantling

When dismantling, open the module, disconnect cables and dismantle the cap from the wall, pad or pipe. Switch the battery off and put the module parts back together (put the cap on the base of the module). After the dismantling mark the module as „dismantled" and fill in the relevant documentation, prescribed for this situation by the internal rules. If possible, arrange deactivation of the module in the database of remote reading system immediately.

4.9 Functional check of the module

After putting the module into operation (or after each repair and replacing of the module) it is recommended to check its basic functionality:

- check setting of basic module parameters, especially broadcasting period, measurement interval and "Downlink" mode as described in paragraph 3.5.2. If possible, examine network signal by Sigfox signal tester;
- after connection of bus input cables from connected meters/sensors check functionality of bus system by repetitive inspection of current parameters of connected meters/sensors by using of "iread" command entered through the configuration cable. If there is a real consumption in progress on the measured volume or energy, values of selected parameters should change in correspondence with changing of values on mechanical counters. Values of physical quantities (temperature, voltage..) should correspond with reality;
- perform complex (end-to-end) check of implementation of the module into the remote reading system by inspection of data rendered by module in reading system database. If the module broadcasting period is quite long, temporarily set broadcasting period to few minutes until the check is completed. WARNING! Don't forget setting the broadcasting period back to original value!

4.10 Operation of the WS868-srMt module

The WS868-srMt module performs broadcasting of radio messages fully automatically. The greatest risks of permanent breakdown of module broadcasting are commonly caused by human activities within the installation site, especially mechanical damage of the module, excessive humidity or water inundation, or shading the RF signal by metallic object due to building operations.

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 module mechanical damage. 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.

The risk of **premature battery discharge** could be eliminated by respecting the instructions described in paragraph 4.1.2.

5 Troubleshooting

5.1 Possible causes of module failures

If during operation of WS868-srMt 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 is supplied by electrical power from the long-life internal battery. Approximate battery life is specified in paragraph 1.3 „Hardware features". Battery life can be negatively influenced by circumstances that are described in detail in paragraph 4.1.2 „Risk of premature battery discharge".

Low battery power becomes evident as irregular drop-outs of signal reception from the module, finally the radio connection with the module completely fails.

Battery is soldered into the printed circuit board of the module and the module has to be disassembled for its replacement. Battery replacement can be performed only by qualified and experienced person. Soldering of battery by unskilled person can cause irretrievable damage of the module. There are only top-quality batteries used in the wacoSystem modules, that have been carefully selected and properly tested. In case of battery replacement by user the new battery parameters should meet same technical requirements (type, capacity, voltage, current load, auto-discharging current...) as the original battery. It is strongly recommended to use for replacement same type of battery as used in production.

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 module's battery voltage is correct, with no signs of discharging and 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 switching off and switching on its battery), 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 Failures of communication with meters and sensors

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 and other parameters of communication with particular device (meter, sensor) through the bus;
- 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 setting of communication parameters within the module configuration and within the connected meter/sensor settings (see setting of bus parameters in the paragraph 3.5.3;
- if the bus is physically functional and communication prameters of the module is correctly set-up for all connected devices but communication through the bus is still non-functional, the WS868-srMt 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 3.5.3 „Commands for data-bus setting").

5.1.4 Transmitter and receiver failures

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 with frequent breakdowns in the receiving data from the module.

All above described troubles could have on common ground, which is unreliability of radio-communication caused by one of these reasons:

- weak radio-signal of Sigfox network in installation site. RF signal availability can be influenced by weather conditions (rain, fog..), or by some changes in the transmitting or receiving side (around module installation site as well as around Sigfox base station).
- permanent or occasional shading 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 external source (another radio system in the same frequency band, or industrial disturbance);
- low level of transmitting signal caused by transmitter failure;
- low level of receiving signal caused by receiver failure;
- low level of transmitting and receiving signal caused by 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 relocation of the module or its antenna (if external antenna used);
- 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 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 of the new module as described in paragraph 4.9 after that;
- if the module is not properly working even after its replacement for proven device and equipment, the trouble can be caused by weak signal of Sigfox network or interference (jamming) from external source in the installation site. In this case consult actual status of Sigfox coverage and its future development with your Sigfox network provider.

5.2 Troubleshooting procedure

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

1. the module communicates normally, readings of its operational parameters are available, but data from some meters/sensors are apparently incorrect. In this case it is recommended to check functionality of the module subsystems in following order:

- check correctness of central application configuration related to the meter/sensor, especially correctness of its ID and address, correcness of meter/sensor identifications, identification of transferred variables and unit recalculation;
- check functionality of reading of parameters from connected meters through the bus as described in paragraph 5.1.3 „Failures of communication with meters and sensors".

2. Data from the module are coming irregularly, with periodical breakdowns. In this case it is recommended to check functionality of the module subsystems in following order:
   - check functionality of the transmitting and receiving of the radio-signal as described in the paragraph 5.1.4 „Transmitter and receiver failures";
   - check functionality of internal battery as described in the paragraph 5.1.1 „Power supplying failures";

3. No data are available from the WS868-srMt module. In this case it is recommended to check functionality of the module subsystems in following order:
   - check correctness of setting of the module in the central system database;
   - 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 functionality of transmitting and receiving of the radio-signal as described in the paragraph 5.1.4 „Transmitter and receiver failures".

NOTE: WS868-srMt 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 mechanical damage, excessive humidity, discharging of internal battery, or voltage pulses induced to the input cables. 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 WS868-srMt RF-modules, designed for operation in Sigfox IoT network in868 MHz frequency band, that are a part of the Softlink's **wacoSystem** product family. More information about all WS868 (Sigfox), WM868 (WACO), WB169 (Wireless M-BUS), or NB (NB-IoT) series of 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 WS868, WM868, WB169, NB series or other manufacturer's equipment for telemetry and remote reading of consumption meters, feel free to contact manufacturer:

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