WIRELESS COMMUNICATION SYSTEM
wacoSystem

Configuration of wacoSystem product family devices

Revision 1.0

Contents

List of Tables

List of Figures

1 Possibilities of waccoSystem product range configuration

This document is focused on the possibilities of **checking and setting of operational parameters** od RF-modules and other devices of **wacoSystem** product family produced by SOFTLINK. There are namely RF-modules of WM868 (WACO), WB169 (Wireless M-Bus), WS868 (Sigfox) and NB (NB-IoT) product ranges, that are intended for using in the area of smart metering and telemetry, commonly called as „Internet of Things" („IoT"). Full overview of *wacoSystem* family devices together with their detailed description can be found on the manufacturer website:

<div align="center">

www.wacosystem.com
www.softlink.cz

</div>

Checking and setting of wacoSystem devices operational parameters (hereinafter „configuration of devices") can be performed with using of supporting hardware and software tools, invented for this purpose by manufacturer. This manual contains general description of working with these tools. **Detailed description of configuration parameters of particular device, as well as recommendations for their setting, can be found in the device installation and operation manual, that can be downloaded from the manufacturer website.**

Each device is equipped with a configuration interface of some type, that serves for its configuration. Depending on the device facilities the configuration can be generally performed by following three methods (ways):

1. Configuration by cable through the serial configuration connector ("COM")
2. Configuration by optical beam through the infrared optical interface ("IRDA")
3. Configuration via radio with using of device RF-subsystem

Each of above-mentioned configuration methods is described in individual chapter of this document. Different types of wacoSystem devices support different configuration methods (e.g. "NB-SI2" RF-module supports configuration through the serial connector and optical configuration), where each type of device supports at least one of the above-mentioned configuration methods.

This manual describes all above mentioned configuration methods. The methods, that are supported by particular type of device, are clearly stated in the device documentation.

2 Configuration of the module with using of the configuration cable

Most of the *wacoSystem* family modules are equipped with configuration interface of RS-232 (COM) type. Its „CONFIG CMOS" connector can be placed either on the module's front panel (typically for DIN-bar designed modules) or inside the device (typically for battery-driven modules). Placing of connector for cable configuration is always specified in the module documentation.

Configuration of the module can be performed by using of any PC with MS Windows or Linux operating systems. The module should be interconnected with the PC's USB port as described below.

2.1 Connecting of module to computer

Configuration can be performed by using of common USB port of the computer. For the interconnection with a USB port of computer it is necessary to use a manufacturer's original configuration cable with „USB-CMOS" converter (see Figure 2). 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 1).
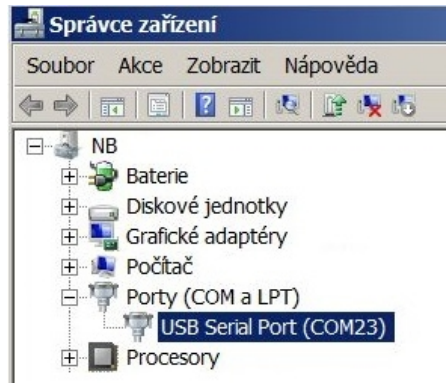
Figure 1: Appearance of the USB-CMOS converter in Windows „Device Manager"

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 5.1 „Installation of USB-CMOS converter driver".

Insert „USB-CMOS" converter to the USB port of computer. Connect configuration cable to the „CONFIG CMOS" port, that is placed either on the module's front panel. (see figure 2 left) or inside the module (see figure 2 right). Thus, the computer is connected with the module and ready for performing any changes in configuration.
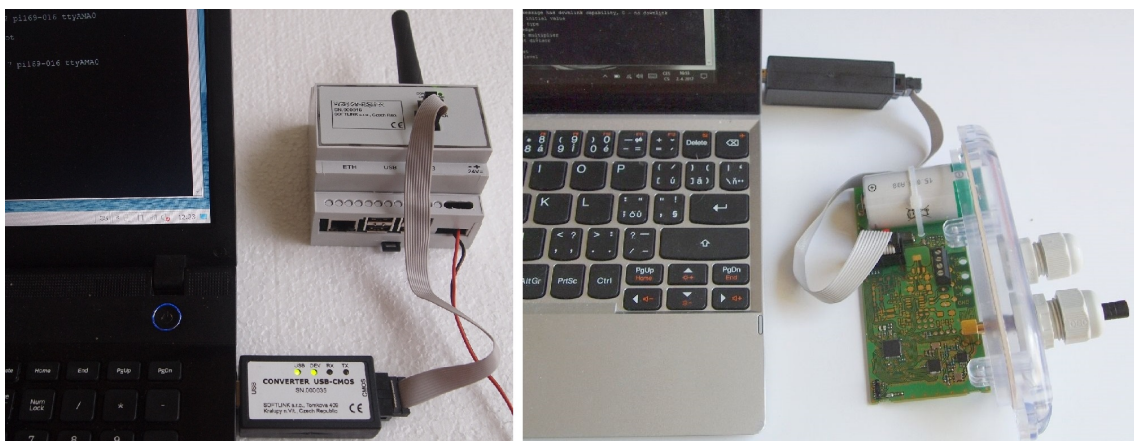
Figure 2: Configuration via USB port of computer

2.2 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.
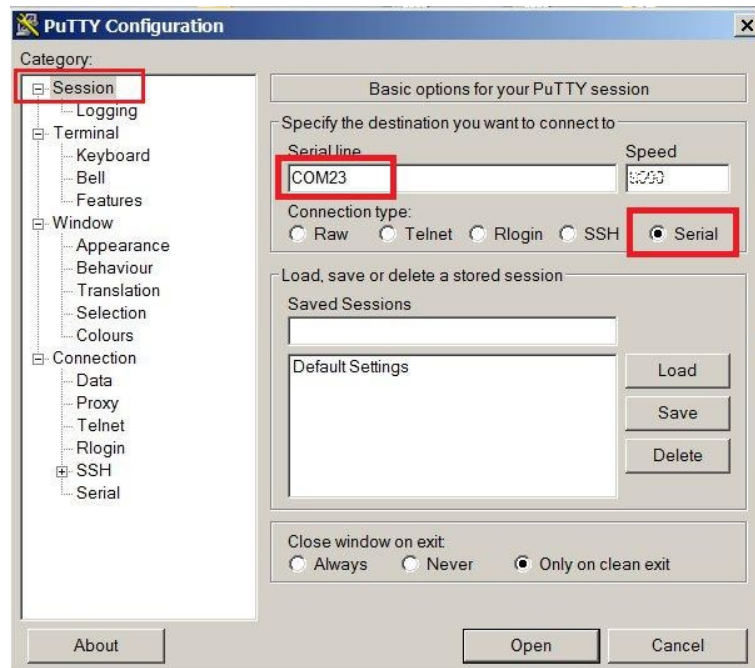
Figure 3: Terminal setting for serial line communication

„PuTTY" software runs after clicking on the downloaded file „putty.exe". There will open a window of the terminal communication (see Figure 3). 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 the configuration interface speed according to the documentation of the module 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 1).

Click on „Open" button in „PuTTY" program and open the terminal window. After pressing of „ENTER" key there will appear a „prompt" command, which announces that the module is ready to be configured (see figure 4).
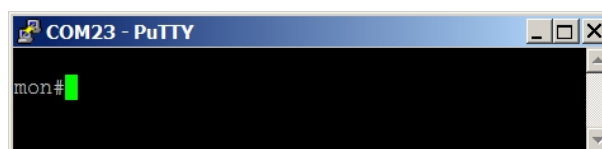
Figure 4: Open terminal window for module configuration via serial line

Format of „prompt" can be different for different types of wacoSystem modules and it is alwas described in the module documentation.

2.3 General rules for configuration of the module by configuration cable

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

- the command must be entered only when a prompt for command appears in front of the cursor mark (colored or flashing little square) - see figure 4;
- 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 of appropriate command according to the module documentation (e.g. "show", or "/") and pressing on „ENTER" key;
- to display a summary of configuration commands and their parameters („HELP") enter appropriate command according to the module documentation (e.g. "?", 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 Configuration of the module through the optical interface

Some of the series of *wacoSystem* family module are equipped with an InfraRed interface that is intended for configuration with using of **„USB-IRDA"** or **„BT-IRDA"** converter. These converters serve for wireless transfer of configuration data (commands and values) between the configured 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 5). Optical beam goes through the transparent casing (or special aperture) and it is decoded by the infrared modem placed on the module's printed board (PCB).

The configuration can be performed either from a *PC* with MS Windows or Linux operating systems with using of *„USB-IRDA"* converter, or from a *smartphone* with Android operating system with using of *„BT-IRDA"* converter. When configuring a module, the converter of convenient type should be placed in the nearest proximity of the module (so that the optical beam is directed through the module cover to the infrared sensor) and connected with the computer or smartphone. Setting of module parameters should by performed by using of convenient software as described in following part of this manual.

Possibilities of configuration through the IRDA interface of the particular type of module are described in detail in the module documentation.

3.1 Configuration of the module from PC with using of „USB-IRDA" converter

Configuration of the module from standard PC can be performed with using of **„USB-IRDA"** converter, that converts an electric signal from the **USB** port of computer into the optical signal of **IRDA** interface. The converter can be placed directly to the USB port of computer (see figure 5 left), or interconnected with the USB port through the USB extension cord (see figure 5 right).

Figure 5: Configuration of the module with using of optical converter

Producer of *wacoSystem* modules (SOFTLINK s.r.o.) has delivered several modifications of „USB-IRDA" converter, that differ either only by external design, or by possibility of magnetic fixing to the configured module (see paragraph 3.1.2).

Configuration of the modules from PC can be performed with using of a special software application **„WACO OptoConf"** written by SOFTLINK. Process of installation of this program is described in following paragraph 3.1.1.

3.1.1 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)
- „irdaconf.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).

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.

3.1.2   Placing of the „USB-IRDA" converter towards the module

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 right 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 5). 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). Position of optical sensor can be found out either from the documentation of configured module. or recognized visually by blinking of LED after activation of optical interface. 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 at the installation site use **a special holder** that is designed for attaching of converter to the module. Original holders are available only for the most frequently used types of modules. The only purpose of this holder is fixing of converter in the best position towards the module. Example of using of a special holder for fixing of USB-IRDA converter to the WB169-SI4 module is shown in the figure 6).

Figure 6: Attaching of optical converter to the holder

The holder designed for WB169-SI4 can be used also for other types of modules with the same casing („SI-design" casing). Put holder to the module from the element side and shift it to that side, where the optical sensor is placed. 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.

3.1.3 Activation of USB interface between PC and „USB-IRDA" converter

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).
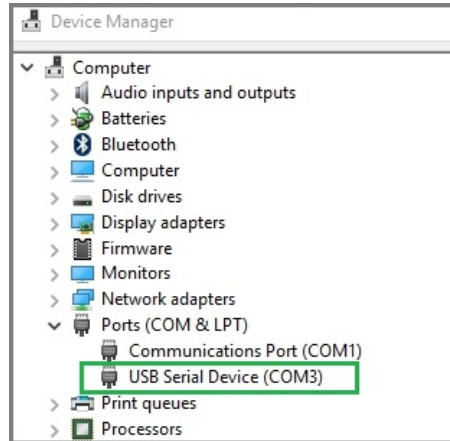

Figure 7: Displaying of the optical converter in the Windows' „Device Manager"

Older versions of MS Windows do not support generic driver for support of serial ports via USB. I this case install the „irdaconf.inf" driver from delivered installation pack according to the instructions mentioned in the paragraph 5.2 „USB GateWay" and „USB-IRDA" driver installation" below.

3.1.4 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.
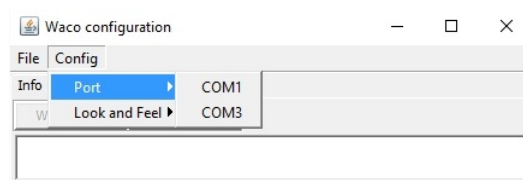
Figure 8: Displaying of „WACO OptoConf" configuration window"

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.

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.

Different types of *wacoSystem* family modules require setting of different set of parameters. That is why the „WACO OptoConf" program contains specific templates („configuration tables") 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.
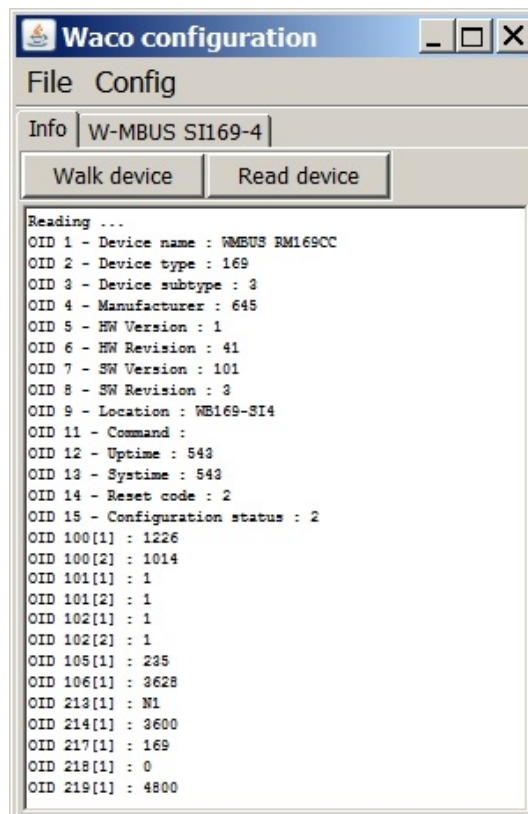
Figure 9: List of variables in the working window of „WACO OptoConf" program
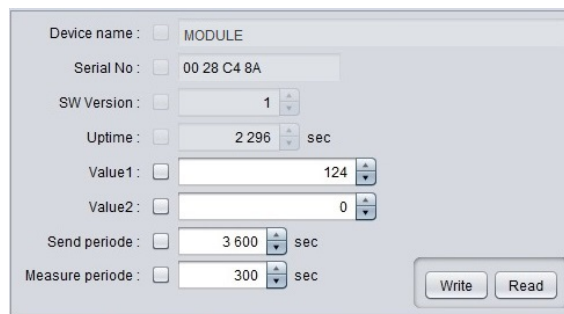
Figure 10: Example of module's configuration table in the „WACO OptoConf" window

3.1.5 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") in the „Config/port" menu.

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 △ a ▽ .

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 "$\sqrt{}$" 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 "$\sqrt{}$" before editing field;

- if requested change of some parameter is out of its range, the change is not accomplished and after disappearance of symbol "$\sqrt{}$" 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 "$\sqrt{}$" 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 "$\sqrt{}$" 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.

3.2 Configuration of the module with using of „BT-IRDA" optical converter

The **„BT-IRDA"** converter can be used for wireless configuration of the module from a smartphone with using of **„SOFTLINK Configurator"** mobile application. The modules equipped with magnetic attachment of the converter can be easily configured from common smartphone from the distance of several meters. The converter, that is attached to the module, performs conversion between optical IRDA communication and wireless Bluetooth communication. The converter receives messages from the mobile phone through the standard Bluetooth radio and retransmits them to the configured module in form of modulated light beam in infrared spectrum (IRDA). Analogously, the messages from module are converted from infrared modulation to Bluetooth radio modulation and transmitted to smartphone. This way of configuration is very convenient especially for setting of modules installed in cramped premises (e.g. watermeter pits), where manipulation with a laptop can be difficult.

Configuration through the „BT-IRDA" converter can be performed by using of any smartphone with Android OS (5.x and higher). The **„SOFTLINK Configurator"** application (by Softlink s.r.o.) can be downloaded usual way - with using of Google Play service. Application icon presents itself as **„SNepConf"**.

Detailed description of module configuration with using of „SOFTLINK Configurator" program can be found in paragraph 3.2.1.

3.2.1 Procedure of module configuring from the smartphone

Switch „BT-IRDA" converter into the active mode by using of micro-switch on its side. Active mode is indicated by blinking of blue LED. Attach converter to the circular pit for magnetic fixing on the configured Configuration of wacoSystem product family devices module and place your mobile phone nearby, so that the devices are in the reach of Bluetooth communication. Make sure that the Bluetooth function of the smartphone is switched on and launch „SOFTLINK Configurator" application. For creating of Bluetooth connection with converter and initialization of communication with configured module follow this procedure:

- tap to „BLUETOOTH" button on the initial screen (see figure 11 very left);
- tap to „SEARCH" button on the next screen (see figure 11 second from left);
- „BT-IRDA" converter will display as „BLEconfig" type of device (see figure 11 third from left);
- tap to „BLEconfig" tile for connecting (pairing) of both devices (phone and converter) (see figure 11 very right);

- successful pairing of devices will be indicated by green „interconnection" symbol in right corner of upper toolbar.
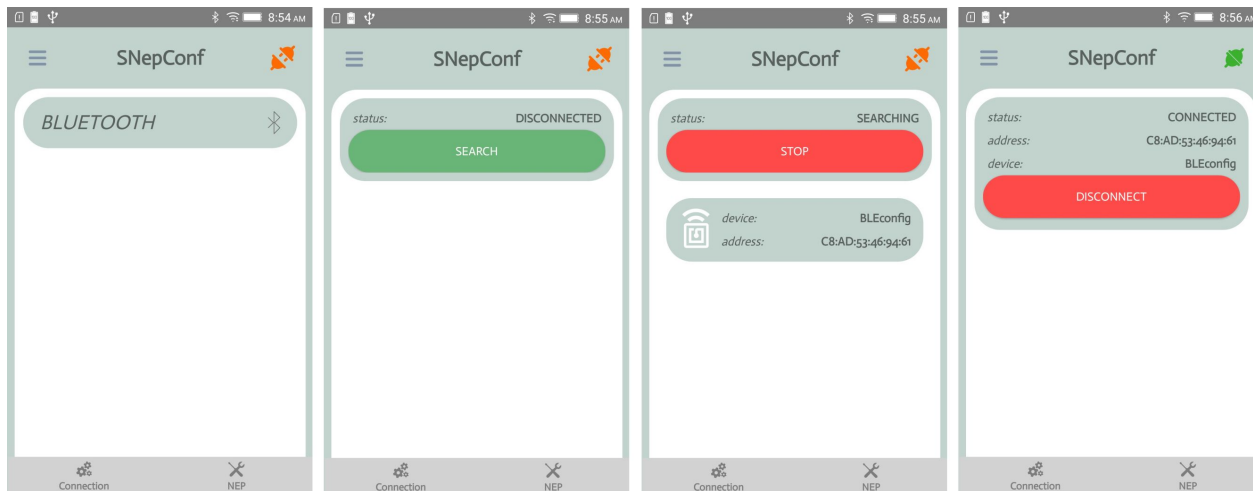

Figure 11: Bluetooth pairing of smartphone with „BT-IRDA" converter

- tap to „NEP" icon in lower toolbar for starting of communication with the configured module by NEP protocol;
- tap to the „WAKE UP" button (that will appear) for activation of optical communication with the configured module (see figure 12 very left);
- successful setting of connection through the optical interface is announced by „Operation was successful" window (see figure 12 second from left);
- after that the form with basic module data („module tile") will appear in the screen of smartphone (see figure 12 third from left);
- a **red „Select action" icon** (with train of gears picture) will appear under the basic module data form. This icon will open a form offering next steps (actions) in module configuration
- tap to „Select action" icon and choose „SELECT FORM" option. The new form with a list of configuration tables („forms"), that are currently available for the module, will open (see figure 12 very right).
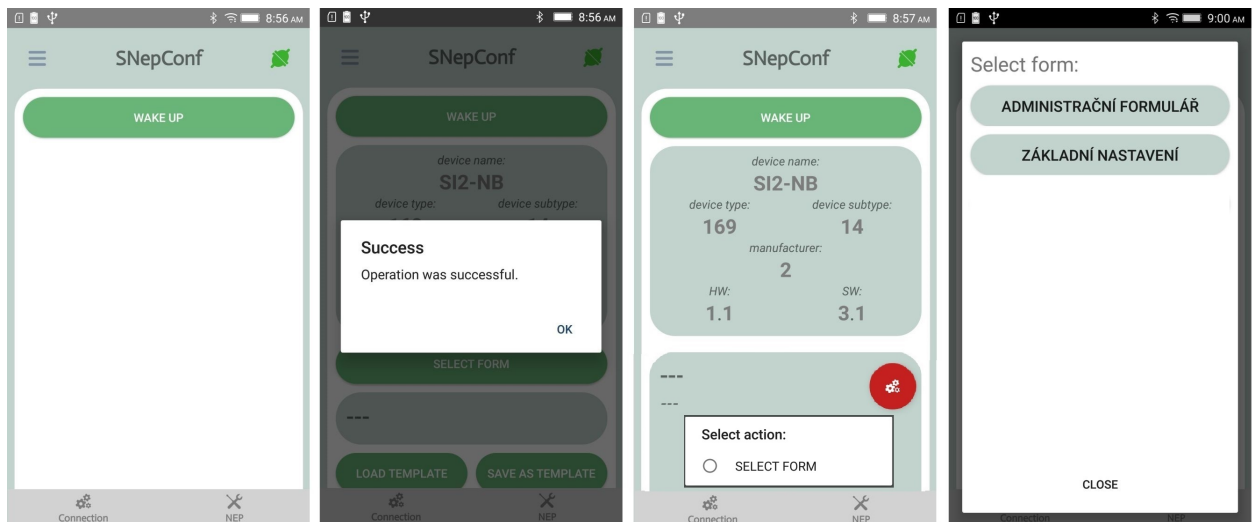
Figure 12: Setting of connection between „SOFTLINK Configurator" application and the module

Each configuration form from the list is intended for checking and setting of some specific group of parameters of given type of module. As the forms are gradually developed and improved in the course of time, it is recommended to update the list of forms regularly by using of „UPDATE" option in the application main menu (left icon in upper toolbar). The two form screens showed and described below are entirely examples and could not correspond with the current offer. Each type of module can be supported by several other configuration forms.

The **„Administration form"** typically contains current values of „read only" parameters about the module current status (uptime, battery voltage, processor temperature...) and some functional buttons (RESET, TEST...). Example of administration form is in the figure 13 very left.

The **„Basic settings"** form typically contains the most frequently changed parameters (e.g. input values, transmitting period, transmitting power, frequency...). Example of „Basic settings" form is in the figure 13 second from left.

Figure 13: Checking and setting of module with using of configuration forms

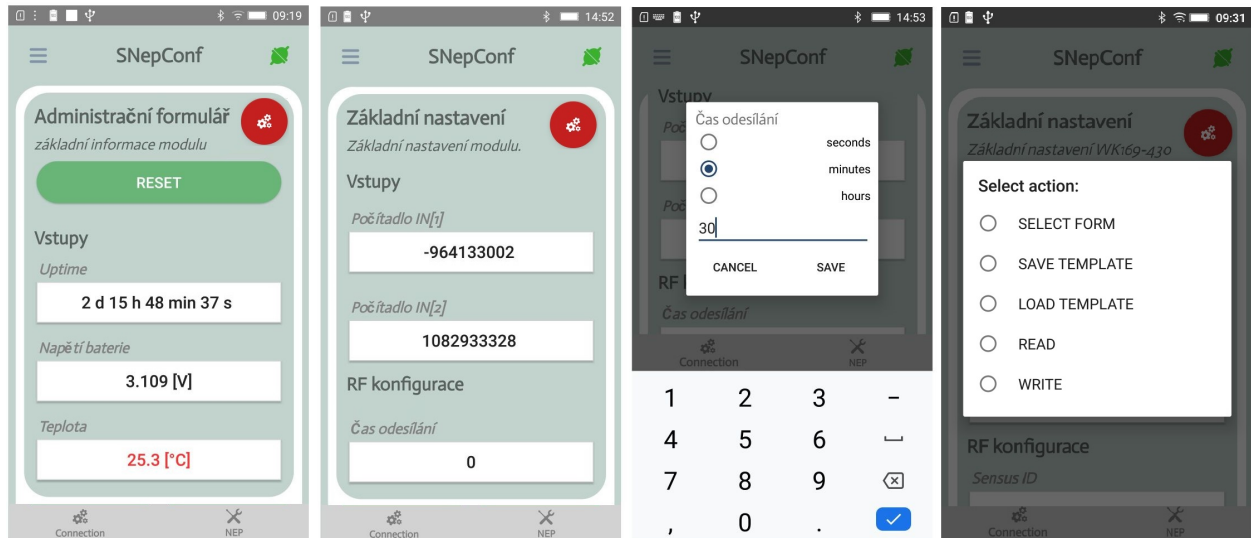Tap to form button for opening of required form. The empty form will open, by using of „Select action" icon open menu of possible actions related to the form. Tap to **„READ"** button for reading and displaying of current module values in the form. The values can be edited manually (by editing of individual fields) or by copying of prepared values from stored template as described in paragraph 3.2.2 below. Example of manual editing of transmitting period is shown in the figure 13 third from left. After editing of all values upload the new values into the module by using of **„WRITE"** option of the „Select action" menu (see figure 13 very right).

After editing and uploading of new values into the module configuration by „WRITE" action the application automatically re-reads current values from the module. If required value is out of enabled range, the module will not change that parameter and after re-reading the original value will appear in the form.

After finishing of configuration switch the „BT-IRDA" converter off to prevent discharging of its battery. Internal battery can be charged from any common battery charger for mobile phones through the „microUSB" connector placed in lower side of converter. The battery should be recharged after approximately 40 hours of work (once a week).

3.2.2   Using of templates

To make setting of same parameters (e.g. set input values to zero and set transmitting period to unified value) of higher quantity of modules easier, there is a possibility to use prepared **templates** with preset values. The template can be created by saving of current setting of group of parameters (particular form) directly to the smartphone. These parameters can be re-used for setting of same parameters of other modules of same type. As the template is always tied to the specific form of specific module type, after connecting to the certain module only relevant templates will be offered in the list of templates.

For creating of template and using it for configuration of series of modules follow these steps:

- interconnect your smartphone with the first module and set its parameters in particular form to required values;
- by using of **„SAVE TEMPLATE"** action store template into your smartphone under suitable name;
- if needed, store another set of parameters (another form) from the same module same way;
- when setting of another module of same type open relevant configuration form;
- open list of relevant templates by using of **„LOAD TEMPLATE"** action and select convenient template by tapping to its name;
- stored values from template are loaded into the configuration form. Check the values, make manual corrections (if need be) and upload the values to the module by „WRITE" action.

Useless templates can be erased in the „Templates" section of the settings menu, that can be opened by „Open setting" option in the main application menu.

4 Configuration of the module via radio

Radio-communication protocol **WACO** invented by SOFTLINK company enables bi-directional data transfer with multi-application support. One of supported applications is configuration of WACO product range modules via radio, when configured module responds to the special radio messages (queries and commands), received through its RF-interface.

Configuration of the module via radio can be performed either locally, from the convenient spot within module radio range (for example from PC with connected gateway WM868-RFU - see figure 14), or remotely, from a remote computer via local gateway WM868-RFE (WACO Ethernet Gateway) or WM868-RFG (WACO GSM Gateway) as depicted in the figure 15.
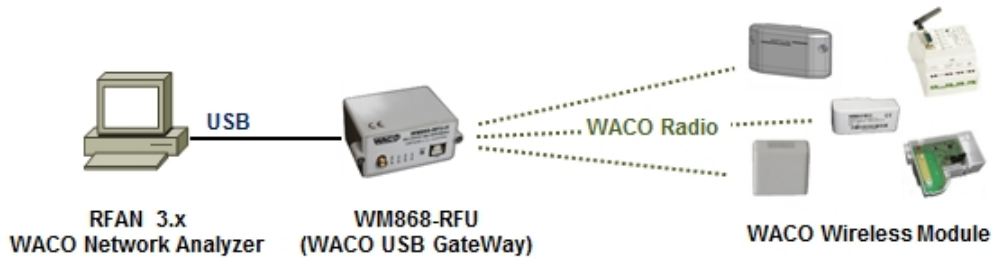

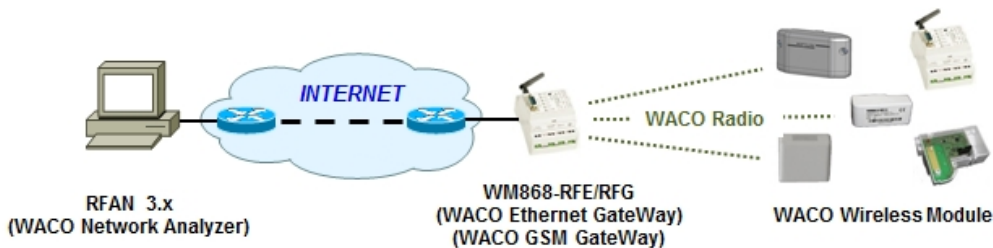Figure 14: Principle of local configuration via radio

Figure 15: Principle of remote configuration via radio

In both cases there must be direct radio visibility between the configured module and the communication gateway, so it is totally **impossible to configure the modules via repeater**.

4.1 Using of „RFAN 3.x" program for the module configuration via radio

The universal tool for the configuration of WACO family modules is „WACO Radiofrequency Analyzer RFAN 3.x" (hereinafter „analyzer") that can be used for setting up of all remotely configurable parameters of the module. Analyzer is a computer program written in Java language, which can be installed to any common PC (desktop, laptop, tablet...) with operating system with Java Virtual Machine support. Functionality of RFAN 3.x analyzer is described in detail in the „WACO RFAN 3.x – Software description and configuration" manual, where there is also detailed information how to check current setting of a particular parameter and how to change the setting.

General principles and technique of configuration of WACO modules via radio are described in details in section 4.3 „General rules of configuration via radio".

Overview of parameters of particular type of WACO module, that can be configured via radio, can be found in the module documentation, together with detailed description of their meaning and purpose.

4.2 Connection and activation of WACO communication GateWay

WACO Communication Gateway is the device intended for communication among a WACO supported software application (e.g. RFAN 3.x) and all subordinate elements of WACO wireless network. The GateWay can be connected to the computer with the RFAN 3.x application directly (through a convenient port of PC) or indirectly through the IP network. „WACO USB GateWay" (with USB support) as well as „WACO Ethernet GateWay" (with ethernet support) can be connected directly, while „WACO Ethernet GateWay", and „WACO GSM GateWay" can be connected indirectly, what means that the GateWay is not connected to the computer with analyzer, but it is connected to the remote Ethernet/IP port of the IP-network (Internet) anywhere over the world provided that there is an IP-connection between the computer and the GateWay (see figure 15).

Connect WM868-RFU (WACO USB GateWay) to the USB port of computer with RFAN 3.x program. The module is powered from the USB port of computer, so it automatically goes „on" and three virtual serial ports are activated: one for data connection, one for configuration and one for possible firmware upgrade. The device appears in the „Other devices" section of the „Device manager" window and its virtual serial ports appear in the „Ports (COM and LPT)" section as depicted in the figure 16.
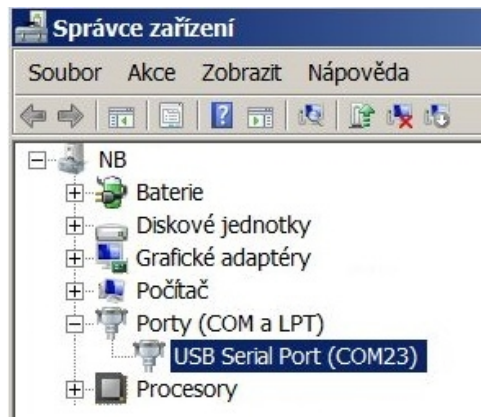

Figure 16: Appearance of WACO USB GateWay in the MS Windows „Device Manager"

If there is no appropriate driver with support of multiple virtual serial ports over USB installed in the computer, it is not possible to select serial port in RFAN 3.x setting (no serial port is available for choice). In this case the virtual serial ports appear in the „Other devices" section of „Device Manager" and it is necessary to install appropriate driver according to the instructions stated in part 5.2 „USB GateWay and USB-IRDA driver installation".

4.3   General rules for configuration via radio

RFAN 3.x Analyzer enables remote configuration of WACO radio devices. This function is accessible in folder „Remote Config".

The principles of the configuration tools are following:

- select the device to be configured (or read current configuration)
- select variable that should be changed (or read)
- launch GET function for reading current value, or SET' for its changing, or WALK for reading of all values

When performing of configuration (i. e. making changes or just reading of current settings) keep these general rules:

1. the configuration cannot be made in bulk, there must be always only one device chosen that will be configured;

2. each single variable is set up/queried by a single command/query;

3. there is a possibility to define more configured/queried variables within the tool and run their configuration/query by one click as a sequence, nevertheless, the configuration/querying of each variable is processed individually, one after another, in the order in which the sequence was set up;

4. in case the „WALK" command for querying the current status of all module's variables is used, the analyzer starts dispatching queries that will ask the individual variables step by step;

5. when a „SET" command was sent to device, the device will proceed the command (or not – see rule 6. and 7.) and turns back a value that is really valid after the command execution;

6. if a „SET" command was sent to a variable, that is of „Read Only" character (for example type of the device, or serial number), then the device will not process the command and turns back current value of the variable;

7. if a „SET" command contains such value that is out of the defined range of values of the variable, or that has no sense, then the device either not process the command or change the variable to closest possible value. In any case, the device will send back the value which is really set after proceeding the command;

8. if a „GET"/„SET" command contains variable that is not implemented in the particular device (the device „doesn't recognize" the variable), then the device turns back „null" value which appears in the analyzer as not accomplished command/query.

4.4 Remote configuration with using of RFAN 3.x Analyzer in steps

The configuration could be performed in „Remote configuration" mode (fold „Remote Config"). Add the device that should be configured into the left section of the screen by using of „Add RF Address" option of the section context menu (displayed by right-click).

The new „Add RF Address" window (form) will open, where there it is necessary to fill in:

    - fill device RF address in hexadecimal format marked „0x" (for example „0xffffef6d")
    - tick the „Wake On Radio" option for battery powered modules
    - write any description into the „Description" field for better module recognition
    - by clicking to „Add" button add the device into the configuration list.

Entering of a device into the „RF Address" window is depicted in the left part of the figure 17.
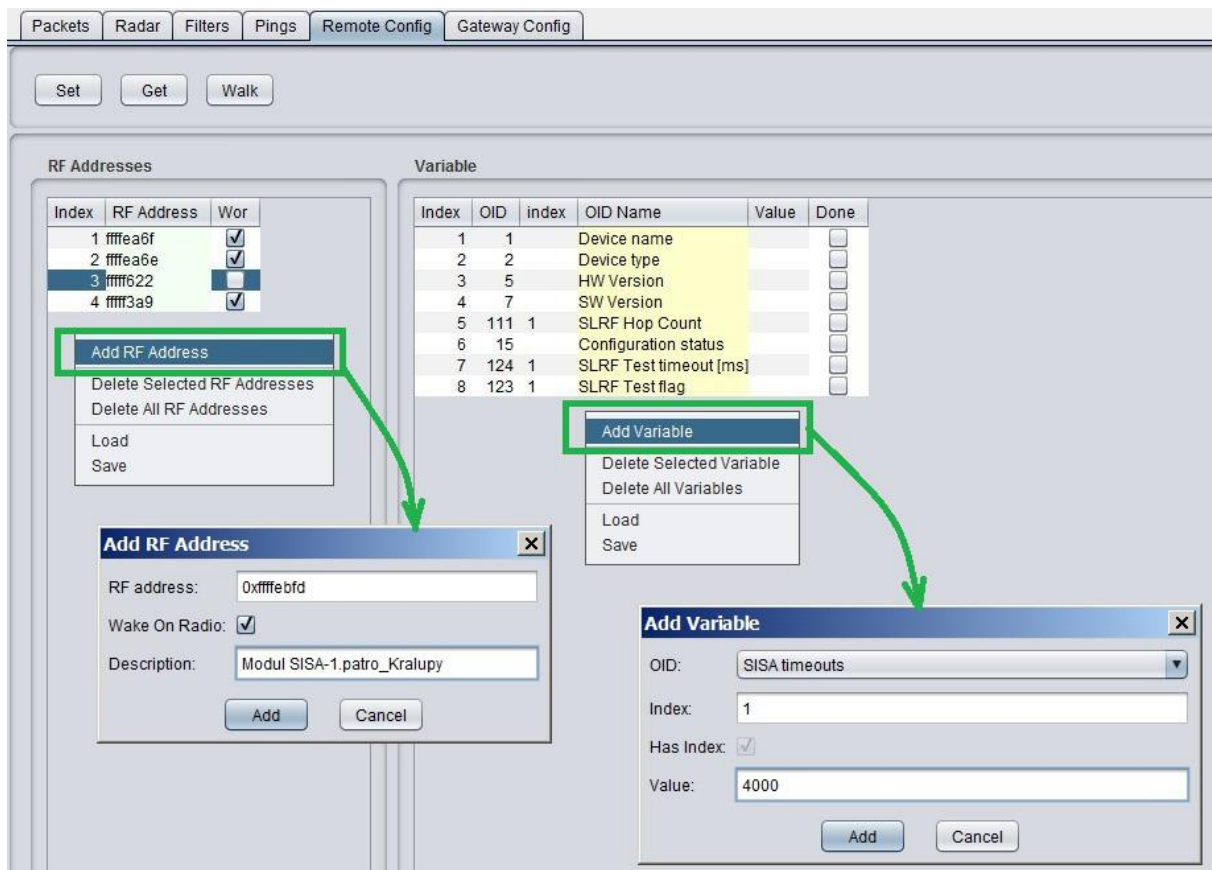

Figure 17: Entering of devices and variables into the remote configuration window

Create the sequence of variables that should be configured (query or set) by clicking on „Add Variable" option in the right section context menu. The new „Add Variable" window (form) will open, where there it is necessary to edit following fields:

- into OID field (Object ID) select a name of variable that should be added in the sequence
- in case the variable has an index, put the index number in (information box „Has Index" is ticked and „Index" box is editable);
- set up required value of the variable into the „Value" field. If the variable will be just read (checked its current value), leave the field blank. Those variables, that have „Read only" status (invariable constants, measured values) will have the „Value" box non-editable;
- by clicking on „Add" button add a variable to the sequence of variables used for configuration.

Entering of a variable into the „Variables" window is depicted in the right part of the figure 17.

Command **GET** (reading the current variable value), **SET** (setting up the required variable value), or **WALK** (reading the current status of all variables) will be done only for one chosen device from the list of devices in **„RF Address"** tab. Run the required command by clicking on relevant button in the top of the screen. After the click, there will appear an information window in which a progress of getting/setting process of will be displayed. As the individual settings are performed, the „tick" symbols in the „Done" box appear item-by-item. The „Getting/Setting"

window will disappear after the all commands of the sequence are being accomplished, or after the expiration of the preset time limit (TimeOut). The current variable values are listed in the field „Value" in the relevant row.

Figure 18: Progress of getting values of preselected variables of the module by using of „GET" command

To avoid serious mistakes that can bring the module into paralyzed condition, numb for further communication, it is necessary to know the meaning of all modified variables of the device, including their mutual relations.

Example: *If value of „SLRF Test Flag" variable is set to "1", the module will be preset to send test messages in period which is set up by variable „SLRF Test Timeout [ms]". In this case the period is just 1 millisecond. The trouble will occur if the test broadcasting would be switch on. It is necessary to set some reasonable period (e.g. 5 second) first and just then switch test broadcasting "on", otherwise the module would broadcast permanently and never be able to receive any other command.*

When configuring battery powered modules, always use the „Wake-On-Radio" (WOR) function. The function enables to „wake up" the module with a special „waking" radio signal from „hibernation" mode (that means the mode in which the module is almost permanently) to the mode of active signal reception. Keep in mind that by „waking up" of the particular required module the other modules, that are placed within the GateWay current radio range, will also be activated. Excessive activating of the module can cause the reduction of its battery life. To avoid the excessive „waking" of many modules around the GateWay it is recommended to follow these instructions:

- do not change the parameters if it is not necessary for the module's functionality;   - consider the succession of the configuration commands (or prepare them as a „template");   - do not use command „WALK" if not necessary - (reading of all module variables);   - find suitable place for the configuration, that is in a good reach of configured device.

We also recommend keeping the modules in closed boxes, shielded with aluminum foil (or in metal boxes) so the modules are protected from the excessive „waking up" and their batteries won't be damaged. When you do the preliminary configuration before mounting, always take out from the shielded box only the necessary number of modules. After their configuration, the modules should be placed back in the shielded box.

5 Installation of drivers for converters and gateways

When configuring of modules from common PC there is necessary to use several types of converters, that convert signal from computer's USB interface to the required type of output, namely:

- in „USB-CMOS" converter - to serial interface with CMOS signal level
- in „USB-IRDA" converter - to infrared optical modulation IRDA
- in „USB-RF Gateway"- to WACO RF-modulation

In all above described cases there is some external device connected to the computer's USB port and the computer needs a software module („driver") for communication with that device. Given computer can either use its own driver (generic driver, that is a part of OS), or find convenient driver installed before, or automatically find (on local disk, Internet) and promptly install a driver during the process of device activation.

If the computer's operating system failed in finding or automatic installing of the driver during the process of device activation, it is necessary to install the driver „manually" - by user's activity.

Procedure of installation of "VCP" driver (issued by FTDI) for **„USB-CMOS"** converter is described in paragraph 5.1 „USB-CMOS converter driver installation".

Procedure of installation of SOFTLINK drivers "irdaconf.inf" for **„USB-IRDA"** converter and "ugw3" for **„USB-RF Gateway"** device is described in paragraph 5.2 „USB GateWay" and „USB-IRDA" driver installation".

5.1 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 20 left).
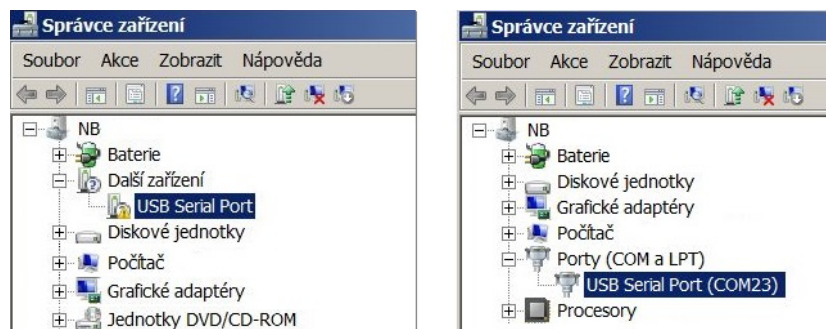

Figure 19: Appearance of converter without driver in the Windows „Device Manager" table

Click by right mouse button on „USB Serial Port" and choose „Update Driver Software" option in the context menu. Choose „Find Driver in this computer" option in the „Update Driver Software" window. Use „Browse" button to set up the path to the driver's folder (directory) and then click on the „Next" button. The driver installation process will launch. After the driver installation is completed, the standard „Installation Completed" message will appear. After the installation the converter will appear in the „Ports (COM and LPT)" section of the „Device Manager" window (see figure 20 right).

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

The "ugw3.inf" and "irdaconf.inf" drivers are intended for support of 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 the 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 20 left).
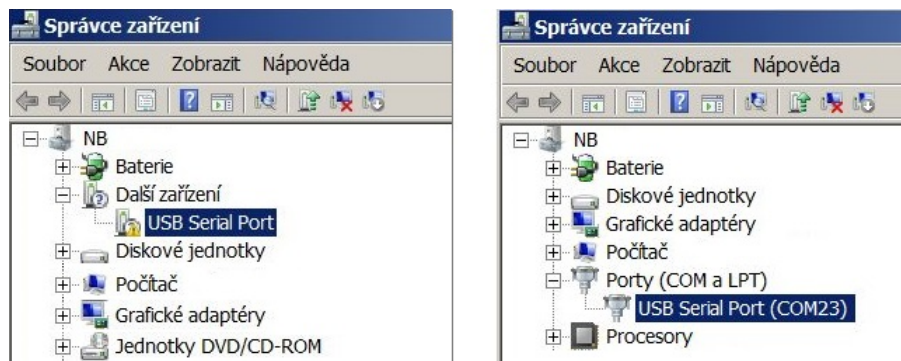

Figure 20: Displaying of the device without driver in "Device Manager" window

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 21 left). Choose „From disc" in the next „Choose driver which you want to install" window (figure 21 right).
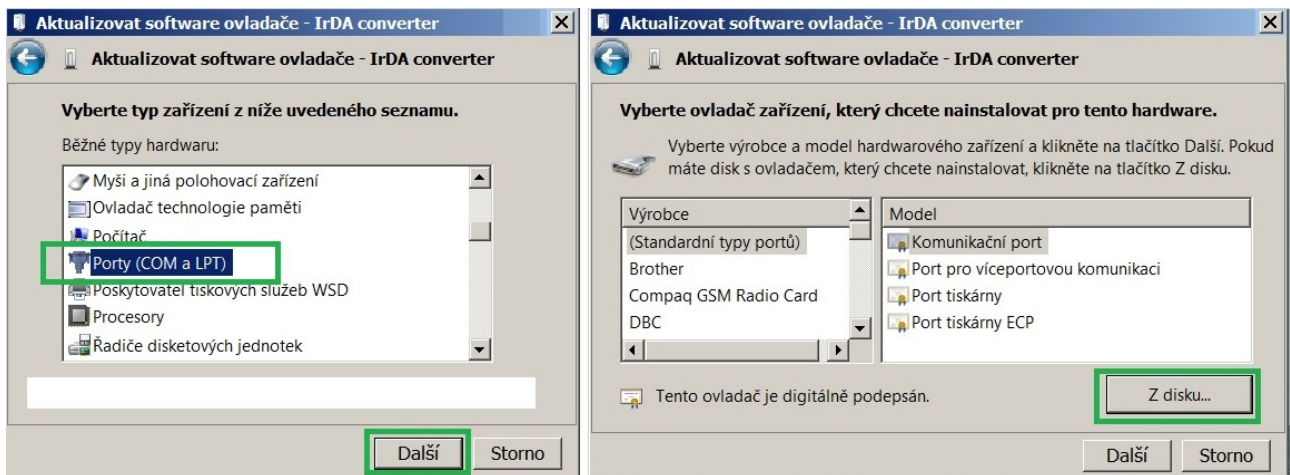

Figure 21: Manual selection of the driver file from a folder

After that a new „Find file" window appears. Set the folder with driver file in the „Browse" tool, select "ugw3.inf" file (for USB GateWay) or "irdaconf.inf" file (for USB-IRDA converter) that will appear in the window and click to „Open" button (see figure 22 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 22 right).
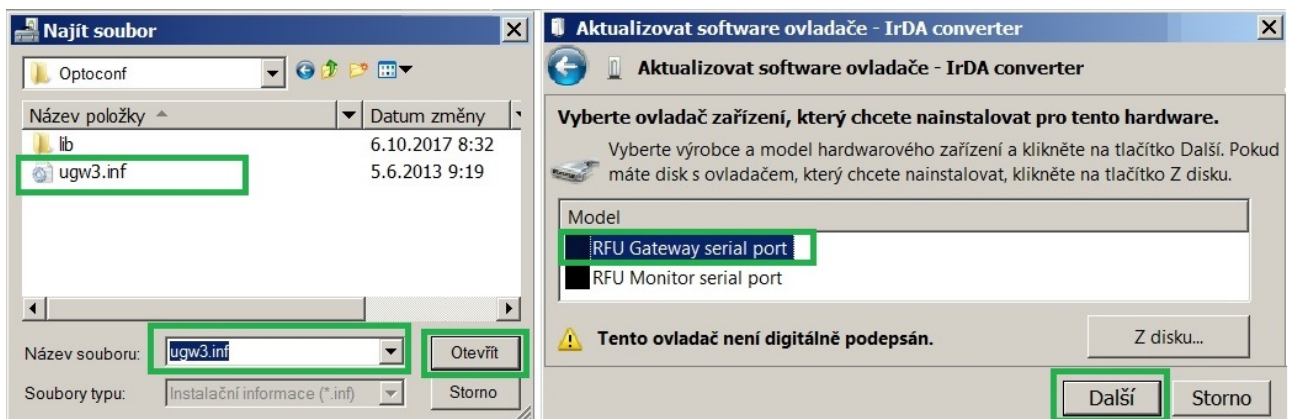

Figure 22: USB driver installation

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 20 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.

5.2.1   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.

5.2.2   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.

5.2.3   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.