APATOR METRA

CENTRAL READING SYSTEM

CRS 40 V2

Installation, operation and service manual

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1. INTRODUCTION

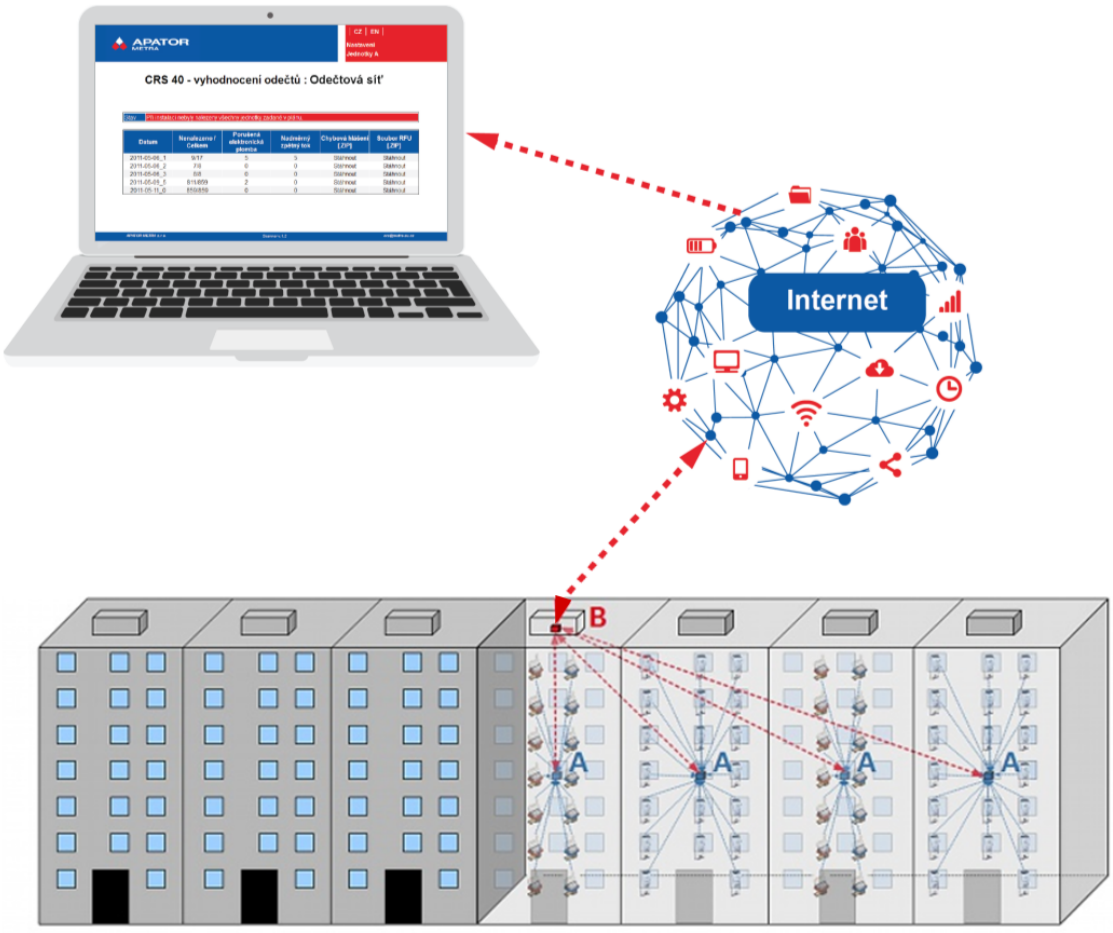
The central readings CRS 40 is used for wireless reading of data transmitted by radio heat cost indicators E-ITN 30 and radio modules for water meters E-RM 30. The system is wireless, so except for the power supply of 230 V (and possible connection to the Internet), its installation does not require any cables.

CRS 40 V2 is not compatible to CRS 40 V3! (Units V3 and V2 can not be combinet).

1.1. SYSTEM CONCEPTION

Our aim has always been to make the administration and service of the system as easy as possible. The system therefore requires minimum of user actions via graphic interface. During normal operation, the system itself processes and saves the data. Only when some problem occurs (broken electronic seal, excessive back-flow at water meter, or when heat cost allocator or radio module is not read), it automatically an nounces error by e-mail – and you can solve the situation immediately. You can also backup the data to your computer from time to time .If you are not happy with these options, you can use secured connection to SFTP server that you will run on your own or you use our services. On this SFTP you will have available daily data from you systems CRS 40 and you also gain another option to easily and en masse or individually reconfigure. All units can connect to server to upload new data and download config files that are used to reconfigure based on your requirements. No matter what mode of operation with data from CRS 40 units you select we provide fully automatic updates for our software and hardware manufacturer in order to adhere to security requirements.

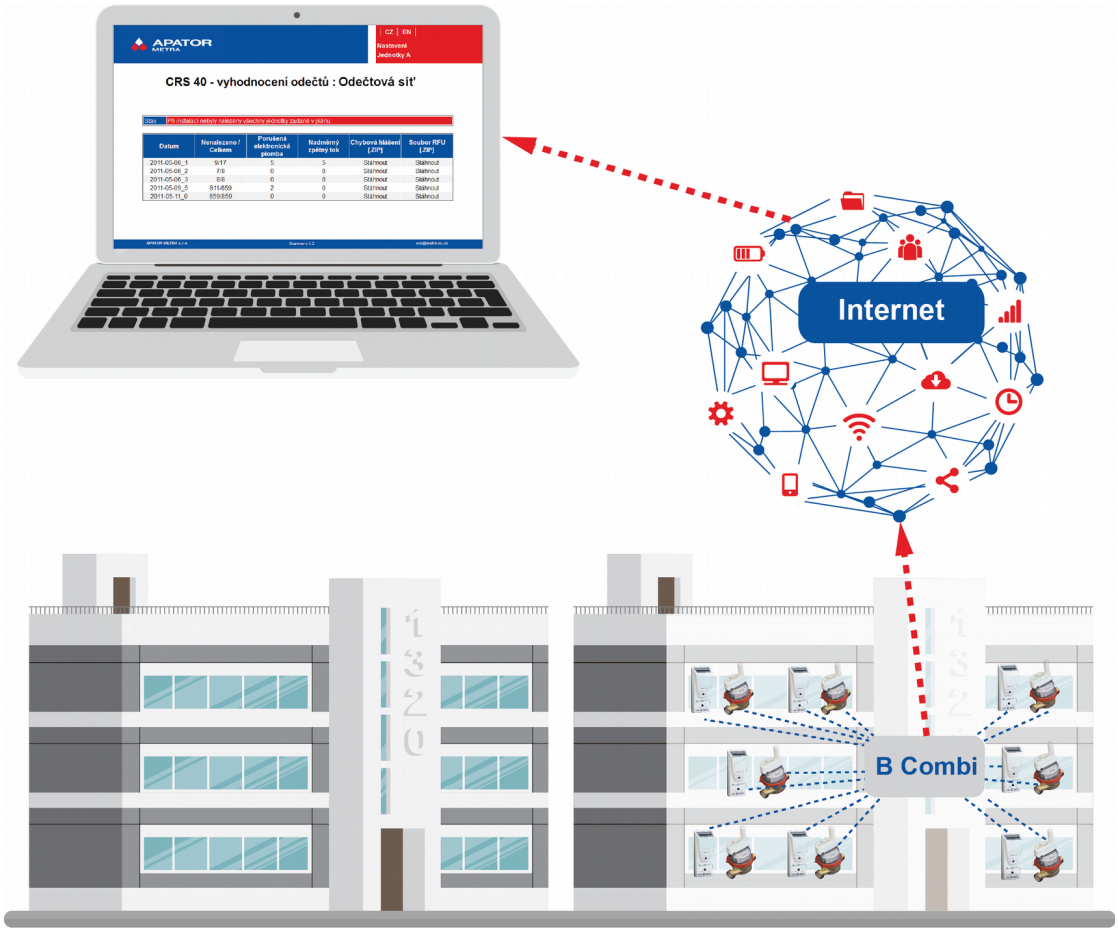
1.2. System topology



Picture 1: Diagram of the central readings CRS 40

Reading network consists of one control unit B and several collecting units A. These units are automatically configured to wireless network with star topology during installation. Every collecting unit A has direct radio contact with control unit B. Communication in the whole reading network is managed by control unit, where data are processed and stored. Control unit can be also connected to Internet. In this case it is possible to access the data from standard browser, or to gain reading results and possible error logs by e-mail.

When installing the system in smaller buildings where all read units E-ITN 30 and E-RM 30 can be covered only by one collecting unit, it is possible to use unit C (independent concentrator). This unit can read the data from heat cost allocators and radio modules, as well as to be connected to Internet.



Picture 2: Diagram of the central readings CRS 40 with B Combi unit

1.3. System for units V2 COMBI

Reading network consist only of one unit B Combi that does not use any collecting Units A. Its advantage are lower costs and faster installation. Biggest advantage is continuous readings compared to standard system CRS 40 V2 that utilizes Units A that has to adhere to limits for radio transmission in its radio range, that means they cannot transfer data to Unit B. Disadvantage of system Combi is a bit worse range - maximum of 1 entrance (6 - 8 floors) or 2 entrances (4 floors) considering it will be installed in the middle of radio area.

1.4. Advantages of the system

The biggest problem during the process of heat cost or water consumption billing can be incomplete data as ratio is calculated. This can be caused by meter or allocator manipulation, its intentional damage or failure. Situation is also complicated by changes in prices of energy or water during the year. Another problem can arise when people move and forget to record the consumption. Time consuming inter-readings or consumption estimation must be made from these reasons in order to determine the values at specified date. Billing company risks the reclamations and conflicts with flat users.

Thanks to the installation of Central reading system, you can get the information about heat and water consumption every day in a year. Any errors or manipulations is quickly identified and effective correction can be made. Also reduction of number of manipulations can be expected – tenants will learn that their unauthorized handling are quickly revealed and brings nothing to them, only payment of service cost to put heat cost allocators and water meters back to perfect condition.

You can also offer to your customers additional statistics and information about consumption due to big amount of actual data. Many problems (connected e.g. with excessive consumption) can be solved already during billing period .

2. Safety

2.1. Safety notice

This manual contains information important for proper and safe use of this equipment.

Read the manual carefully before you start working with the equipment. Above all, pay attention to the safety precautions mentioned in the manual. The manufacturer holds no responsibility for any damage caused by using the product in contradiction herewith.

2.2. Requirements for workers performing installation, maintenance and operation of the system

When working with the equipment, it must be discerned between the staff assigned to work directly with the device, either during assembly, installation or service, and between staff that only processes data from the device and accessing them via a remote connection. Before plugging in the charging cord to microprocessor, make sure to plug in backup battery first.

2.2.1. Personnel involved with installation and maintenance

During installation and maintenance of equipment, the workers come into contact with electrical equipment with voltages up to 230 V. Connecting to the electrical circuit or maintenance work may only be performed by a qualified electrician in accordance with § 6 of Decree no. 50/1978 (CR), or with relevant legislative in the respective country.

Installed elements are radio equipment in an industrial 868 MHz band. Staff should be familiar with the legislative and practical use of this band. Also, they should have at least basic understanding of the functioning of wireless devices.

Personnel performing the installation must be trained by the manufacturer in the installation and placement of elements of the central reading system CRS 40.

Staff must have a basic PC skills (setting IP addresses, work with Internet browsers) and familiar with the functioning of the Internet (IP addressing system, the operating principle of the private network connection settings via Ethernet, Wi-Fi, GSM / GPRS).

2.2.2. Operation of equipment

The operator is a person who processes the data and accesses the device from a remote computer over the Internet. Maintenance of equipment contributes significantly to the correct settings of the device, which is essential for trouble-free operation and proper collection and interpretation of data.

The operator must be able to work with the PC at least at the ordinary user level. Workers performing computer settings for working with distant reading network should also be familiar with the functioning of the Internet (IP addressing system, the operating principle of private networks, work with e-mail).

Operators should be trained in working with the system of central readings CRS 40.

INSTALLATION AND SERVICE

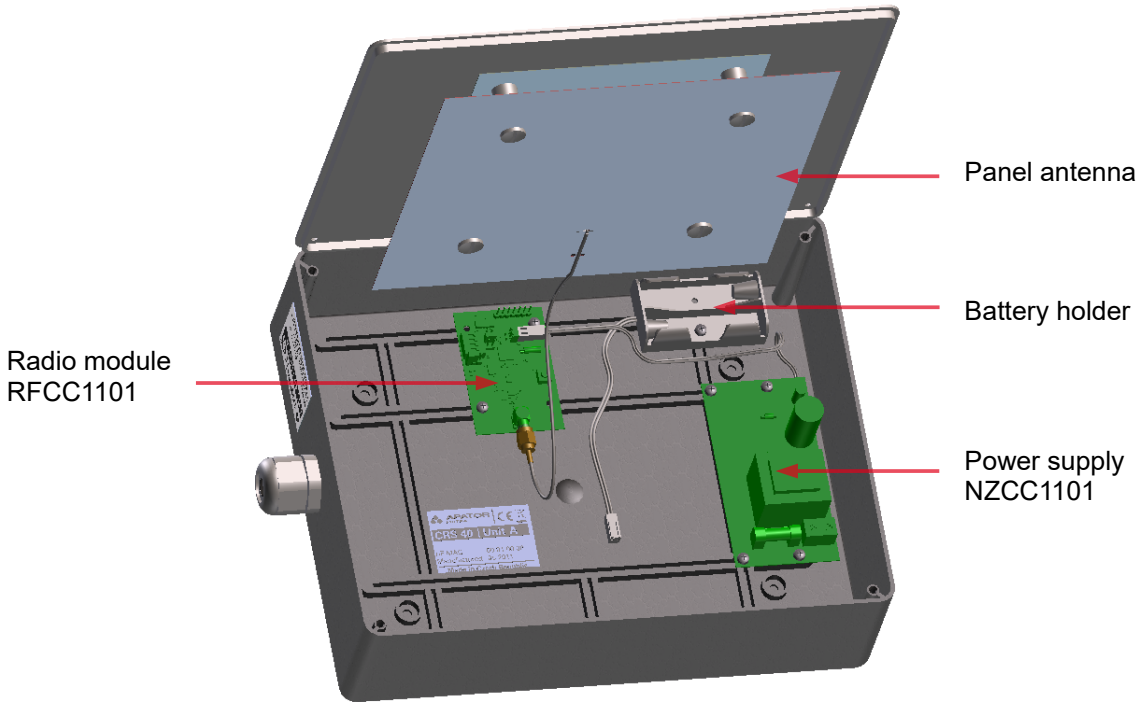
3. DESCRIPTION OF THE EQUIPMENT

3.1. GENERAL DESCRIPTION OF THE EQUIPMENT

CRS 40 is a system for centralized remote reading of radio heat cost allocators (E-30 ITN) and radio modules for water meters (E-RM 30) operating in the 868 MHz ISM band. Reading network consists of one or more collecting units A (concentrator) and one central unit B (coordinator) for coordinating meter reading networks and sending data over the Internet (Ethernet, optional WiFi or GSM) to the remote operator. The control unit B or B Combi also serves to adjust the readings (error messages, schedule of readings and possibly base plan). All elements of the meter reading networks communicate via wireless network. Units of the reading network are powered from the network of low voltage of 230 V. The readings of heat cost allocators and radio water meters are performed with daily periodicity. Users log into the system from personal computer or mobile device via an encrypted connection using a simple web GUI. The automatic transfer of data from the meter reading network can be done using e-mail, SFTP or a script. CRS 40 is designed for indoor environment (installation in residential buildings).

3.1.1. Unit type A (collecting unit, the concentrator)

A unit is designed to collect data from radio transmitting devices (heat cost allocators and radio modules) and have them forwarded to the control unit B. Unit B (coordinator) further evaluates the data, stores and transmits possibly over the Internet. Unit A consists of a plastic box, power supply (NZCC1101), radio module (RFCC1101) and panel antennas attached from the inner side to the cover box.

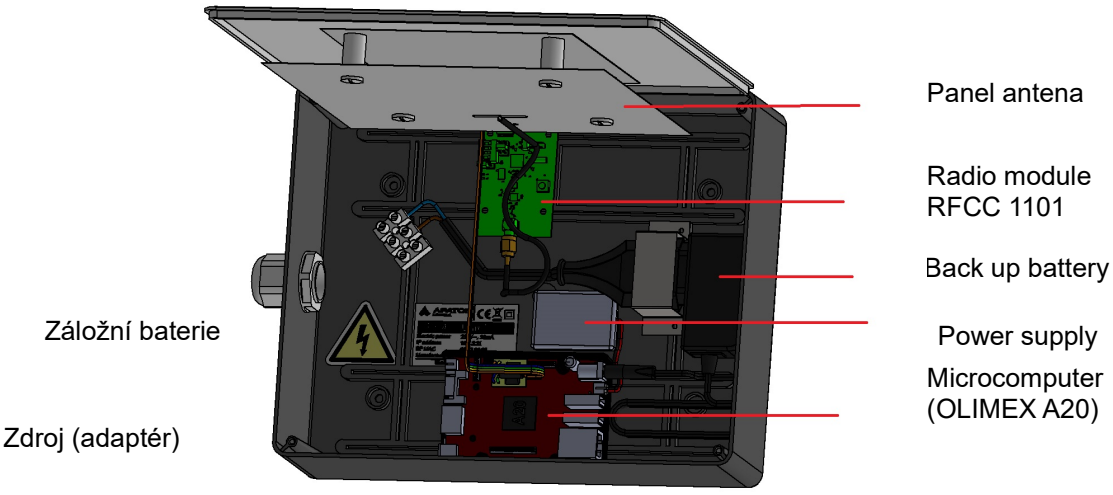


Pic. 3: Schematics of unit A

3.1.2. Unit B (Control Unit Coordinator)

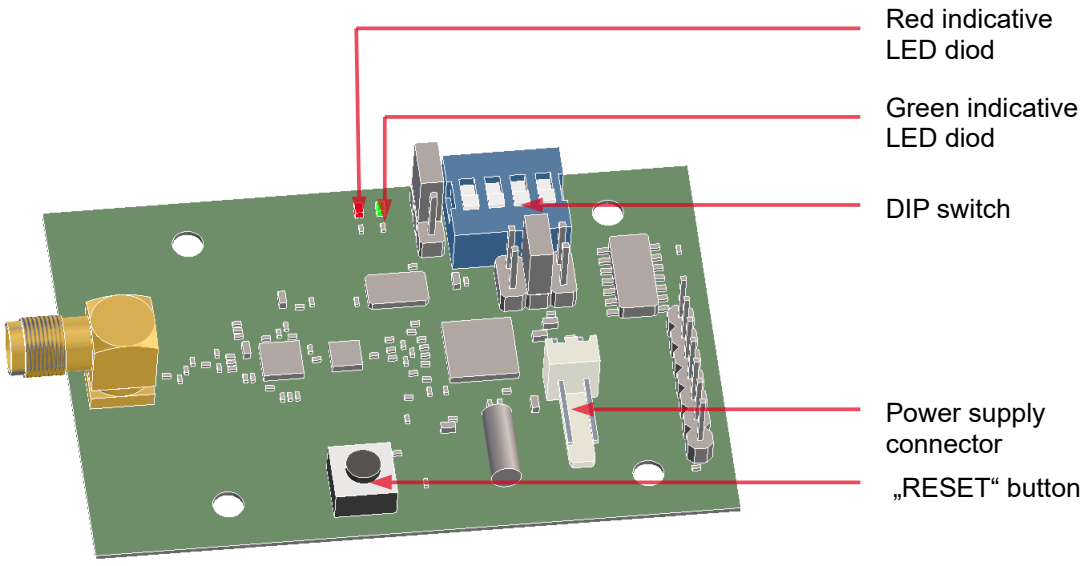
The control unit B manages a group of A units, receives data, evaluates, stores, and eventually sends via the Internet.

Unit B consists of a box, power supply (adapter), radio module (RFCC1101), panel antenna mounted on the inner side of the lid and the module box miniature computers (OLIMEX A20).



Picture 4: Schematics of CRS unit B

Schematics of the radio module RFCC1101



Picture 2: Schematics of the radio module RFCC1101

3.1.3. Type B combi

The B combi is a control unit that allows readings without auxiliary units A. It is therefore intended for smaller objects that can be read by a single unit. The unit can be remotely connected to the Internet in the same way as the standard unit B.

3.2. Technical information

Frequency range ISM 868 MHz: Frequency modulation Power Duty cycle	 869.525 MHz 18 dBm <5%
Antenna	integrated
Possible number of radio devices (E-ITN 30, E-RM 30) per one unit A	All in the radio range (approx 350 units)
Max. quantity of a Units in A in one reading network (per one unit B)	max. 10
Number of overlapping networks	max. 15
Power supply: Unit A Unit B Unit B COMBI	230 V / 30 mA / 50 Hz 230 V / 30 mA / 50 Hz 230 V / 30 mA / 50 Hz
Recommended power supply cable	Two-core H03VVH2-F 2X0,75 C Three-core H03VV-F 3G0,75 CE Note: connecting of the power supply NZCC1101 to the 230 V is protected with one fuse. Order of wires must be as on the label N, L (L is protected)
Recommended batteries (unit A – for installation)	Alkaline batteries, type AA, 1,5V Note.: batteries must be removed before connecting unit A to the mains 230 V power supply
IP code	IP 40
Environment	Intended for indoor use
Operation environment	0 – 40°C / rel. humidity <65%
Data output (unit type B)	RJ45 (Ethernet), or via Wi-Fi or GSM
Data quantity	Approx. 30 MB / month (only includes meter reading network connection and sending information via e-mail, direct access to the UI depends on the amount of data transferred)
Supported browsers (for work with GUI)	Mozilla Firefox 7.0 and higher Internet Explorer 8.0 and higher Google Chrome 15.0 and higher
Dimensions	255 x 205 x 68 mm

3.3. Package content

Before sending all units of central readings CRS 40 inspected at the factory. Upon receipt please check the integrity and completeness. In the event of damage to the units immediately contact the transport company or the manufacturer.

3.4. Internet connection options

To make of the advantages of central reading system CRS 40, it is necessary to connect the reading network to the Internet. The CRS unit B therefore contains an integrated standard RJ45 Ethernet interface. Using this interface, it can be connected directly into the domestic cabling structure (type CAT5 or higher - cable with RJ45 connector). It is also possible to use a Wi-Fi USB power adapter or GSM modem.

The control unit B waits for assignment of the dynamic IP address V4 through protocol DHCP, which is commonly used for this purpose. When the unit is required to use the address assigned by the Internet provider, it must be specified in the Settings (more in chapter 10.5 System parameters setting).

Possible means of connecting to the Internet:

- via Ethernet network
- via Wi-Fi network (Wi-Fi USB adaptor must be used)
- via mobile network (USB GSM modem must be used)

Using various connection methods depends on the circumstances of a particular apartment building. If in doubt, contact your Internet provider.
If the computer is correctly connected to the Internet and set up, it automatically initiates an encrypted connection and allows connection with the control computer.

For more information, see chapter 5.1. Installing the unit B.

Cooperation of unit B has been tested with following modems:

Huawei E3372

Huawei E303

Huawei E173

Huawei 3531

ZTE MF821D

Otestované USB Wi-Fi adaptéry:

MOD-WIFI-AR9271

MOD-WIFI-AR9271-ANT

MOD-WIFI-R5370

MOD-WIFI-R5370-ANT

MOD-WIFI-RTL8188

MOD-WIFI-RTL8188ETV

Note: These are USB adapters supplied by manufacturere of microcomputer Olimex (http://www.olimex.com)

Note: For connection CRS 40 with modem we recommend using SIM card supporting 4G/ LTE. Otherwise connection problems may occur.

3.5. Options of data transmission from reading networks

Readings is possible to download after sign in to web interface of B Unit. In addition, system allows following automatic data transmission:

1. **Sending to e-mail**. On you e-mail address you will receive info e-mail every day with results of readings. Data are saved in a TXT format. Readings in TXT format can be downloaded anytime from page with readings in ZIP archive. E-mail will be send also in case system detects some service information or an error. For service information or error are considered following states: unit has not been read for a given number of days, broken seal, back flow larger than set value. Error reports are send in standard HTML format for internet browser and in ZIP archive. We recommend to pay attention to these reports. It is advised to send these reports to another e-mail address than everyday readings. Error reports and service information can be viewed on page with readings results or download them in ZIP archive. To configuration tool was added option to add multiple e-mails (separated by a semicolon).
2. **Copy data to SFTP server:** Data are copied using secured connection to server. More information in section *10.5.1 Basic settings in setting up SFTP server.*

3. **Synchronization (downloading)** data using a script: In this case are data copied using secure connection to customer's computer. More information in *11.1 Synchronization (backup) of data from B units.*

3.6. Data files structure

In this subchapter is decribed structure of decoded data from central reading system for heat cost allocators and water meters with radio modules.

TAB Tabulator character (09 in hexadecimal), separates record items
END End of the record, character for move to next record (0D0A in hexadecimal)

E-ITN 30.2, 30.4

A	TAB	B	TAB	C	TAB	D	TAB	E	TAB	F	TAB	G	TAB	H	TAB	I	TAB	J	TAB	K	TAB	L	END

A Date of reading „day.month.year“ (date in the allocator at the time o reading)
B Serial number of the allocator (8 digit)
C Consumption value from the last billing period [-][2]
D Alphanumerical code for the consumption in C
E Validity of the alphanumerical code in D („0“ code valid, „1“ code invalid)
F Current consumption value [-]
G Electronic seal status („0“ intact, „1“ broken)
H Statistic value[1]
I Order of statistic value H
J Date of the billing period beginning
K Type of radiator temperature sensor („0“ built in, „1“ external)
L Electronic seal status - external sensor („0“ intact, „1“ broken)

E-RM 30.***

A	TAB	B	TAB	C	TAB	D	TAB	E	TAB	F	TAB	G	TAB	H	TAB	I	TAB	J	TAB	K	END

A Date of reading „day.month.year“ (date of radio module in reading period)
B Radio module serial number (9 digits)
C Forward consumption in last billing period [m^3]
D Alphanumerical code for consumption C
E Backward consumption in last billing period [m^3]
F Alphanumerical code for consumption E
G Current absolute forward consumption, cumulative from the time of activation [l]
H Current absolute backward consumption, cumulative from the time of activation [l]
I Electronic seal status („0“ intact, „1“ broken)
J Beginning of billing period „day.month.“
K Influencing of external magnetic field:
0, 2, 4, 6 radio module does not allow indication of magnetic field (E-RM 30.1**, E-RM 30.2**)
1,3 influencing by magnetic field was not detected
5,7 influencing by magnetic field was detected

E-RM 30.501

A	TAB	B	TAB	C	TAB	.....	R	TAB	S	TAB	T	TAB	U	END

A Date of reading „day.month.year“ (date of the radio module at the time of a reading)
B Serial number of the radio module (9 digits)
C Date of start of billing period „day.month.“ (0.0. - 31.12.)
D Number of impulses from sensor 1 for past annual billing period (0-16 777 216)
E Number of impulses from sensor 1 for past monthly billing period (0-4 194 304)

F Immediate total number of impulses from sensor 1, cumulatively since the beginning of the activation (0-268 435 455)

G Indication of loss of flow rate of sensor 1 (from the beginning of billing period to the data reading) (0-1)

H Number of impulses from sensor 2 for past annual billing period (0-16 777 216)

I Number of impulses from sensor 2 for past monthly billing period (0-4 194 304)

J Immediate total number of impulses from sensor 1, cumulatively since the beginning of the activation (0-268 435 455)

K Indication of loss of flow rate of sensor 2 (from the beginning of billing period to the data reading) (0-1)

3.7. Method of use or disposal

"This device is subject to a special waste handling regulation according to the Waste Act, as amended."

4. Spreading of radio waves

Central reading system 40 CRS works with wireless data transmission using radio waves. For proper installation and operation of the system it is helpful to learn at least the basics of radio wave spreading.

4.1. Propagation of electromagnetic fields

In physics, electromagnetic radiation (EM radiation or EMR) refers to the waves of the electromagnetic field, propagating (radiating) through space The speed of these waves in the air is close the speed of light. Characteristic quantity is wavelength, which is approx. 35 cm at 868 MHz frequency.

Wave can band around obstacles in its way only when its wavelength is much bigger that the size of the obstacle. Reflection and refraction happens Reflection and refraction of waves occurs at the interface between two dielectric permittivity different environments. Part of the waves reflects, part breaks. The angle of reflection equals to the angle of incidence. The reflection occurs even on perfectly conductive surface (metal) because the electromagnetic radiation does not propagates in it.

In the structure of the apartment house there is a large quantity of various obstacles that have negative effect on propagation of electromagnetic waves. It is especially any metals (arming, elevator shafts, railings, metal foils etc.) through which the electromagnetic waves do not pass, only reflects. Also, the construction of buldings (walls, ceilings) significantly dampens the electromagnetic waves. Therefore the propagation of the electromagnetic walls in such buildings is rather complicated and is individual for each building.

4.2. Possible obstacles to propagation of the electromagnetic waves in the apartment building

The number and placement of the repeater units must be adjusted individually for each object. Most common obstacles are the following:

- Wired elevator shafts
- Metal sheets
- Metallic layer on windows
- Aluminum blinds
- Metal furnishing
- Large parts of furniture
- Shielding caused by electrical appliances (TV, audio, washing machine, dishwasher …)
- Equipment working permanently in 868 MHz range (baby monitor, weather station)
- Radio hobbyist

5. INSTALLATION IN THE APARTMENT HOUSE

As the radio signal spreading inside the residential building depends on many factors (see chapter 4: Radio waves transmission), the radio contact with more distant devices is largely random and can not be predicted completely in advance. For this reason, we recommend to install the system in the period of more frequent transmission of read devices. It is the month following the beginning of billing period (once per year) in year versions, or first three days after beginning of billing period day (every month) in month versions.

The radio signal range of the radio modules for water meters is considerably larger than that of heat cost allocators.
If the billing period is different for radio modules and heat cost allocator, we recommend to follow the billing period of heat cost allocators.

When installing the system outside of the period of more frequent transmission, installation verification (i.e. receiving the data from all heat cost allocators / radio modules) will probably take a longer time.
Installation duration can not be calculated in advance. The best choice is to make a “test” installation for every building type where you can find out the best location of collecting units to cover the whole building.

The installation duration should be similar in similar buildings. For recommended installation positions in the most common types of buildings, see chapter 12. Installation methods.

5.1. Installation of control unit B

At first, find a suitable place for unit B installation (with connection to the Internet and power supply). As the unit B contains communication software and it is used also for the saving of read data, it is recommended to install it in the secured place (without the risk of theft). The control unit B must be also in the radio range of all collecting units A. For recommended installation positions in the most common types of buildings, see chapter 12. Installation methods.

Connect unit B via Ethernet cable to laptop. IP address of this laptop must be set to 169.254.123.x and the net mask to 255.255.255.0 (see your operating system manual for more information how to set it). Then connect to unit B using standard web browser – just enter IP address 169.254.123.123 to address line. Set the basic parameters for remote access in <Settings> - mainly the reading network name, login and password. It is recommended to load the reading plan (necessary for system work) also in this moment. For more information, see chapter 10. Description of graphic user interface.

Connect the unit B using Ethernet cable (RJ45 connector) directly to the Internet in residential building, to GPRS/3G router, Wi-Fi appliance or ADSL modem. **It is suitable to connect GSM modem to USB port closer to the ethernet port.** The unit B expects automatic allocation of IP address and other network configuration from local DHCP server. Allocated IP address may not be public. Static IP address – if used – must be entered in Settings (see chapter 10.5 Setting of system parameters). Connection to Internet is finished now. Contact your Internet provider for details of Internet access.

Mount the unit to desired place.

Warning!

Manipulate with open unit only (e.g. installation on ceiling) when the power supply is off. Otherwise the electronic components can be damaged.

Warning!

Before plugging in the charging cord to microprocessor, make sure to plug in backup battery first.

Connect the unit to electric. Connection of device to electrical power network or its maintenance can be done only by staff qualified in accordance with local legislation.

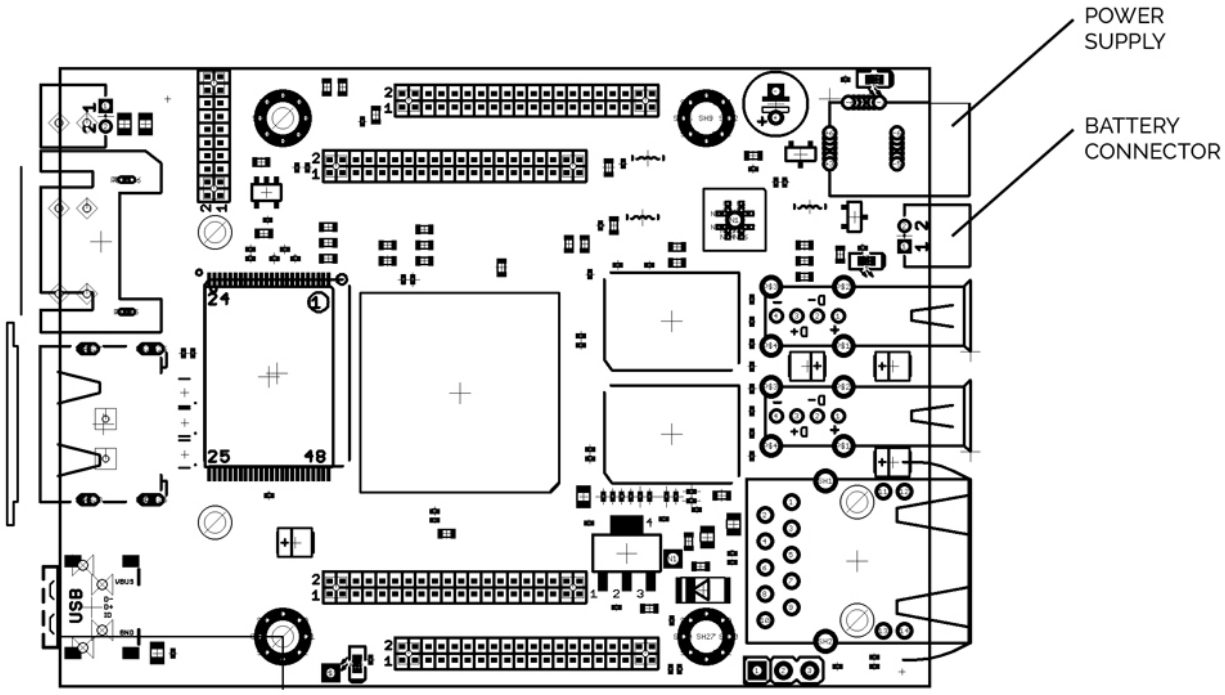


Table 1: LED signalization of operational states of control unit B

RED (OLIMEX A20)	shines	Unit B is connected to power supply
GREEN (OLIMEX A20)	flashes	Unit is working
YELLOW (OLIMEX A20)	shines	Charging of the backup battery
RED (radio module)	shines	Radio module RFCC1101 is on
GREEN (radio module)	flashes	Obtaining data from the units A

5.2. Installation of collecting units A

It is recommended to place one collecting unit A to every entrance of residential building. Theoretically, the building can be covered with smaller quantity of collecting units. There can be a problem to read the data from some read devices (radio modules for water meters and heat cost allocators) in such case. As a result, the read device can be interpreted as missing even when it is okay and functional.

For more information about recommended installation positions in the most common types of buildings, see chapter 13. Installation methods.

Connection of collecting unit A to control unit B must be verified at the installation site (indicated by red LED switching off on the radio module RFCC1101 after power supply connection). It is also recommended that unit A receives the data from read devices (radio modules, heat cost allocator). Data receiving is indicated by green LED blinking (approx. 1 min.).
If collecting unit A is not connected to control unit B after power supply connection, try to restart unit A using RESET button on the radio module printed circuit board (see Illustration 4: Layout of the radio module RFCC1101).
After the actual installation of units A, it is appropriate to connect to unit B and verify successful communication. Click to <Units A> link on main page. Here you can find the list of connected collecting units A ,including the time from last communication with control unit B, signal strength and number of connections. For more information, see chapter 10.4 List of units A connected to reading network.

Note:

Units A are equipped with battery supply for the installation purposes (finding the ideal location and coverage verification). Battery supply is only intended for installation and once the installation is finished, it should be connected to the mains. The time required for coverage verification may be different in each object and cannot be calculated in advanced.

Note:

Before the installation of the A units, please check that the DIP switch is set the same on the B unit and all A units in one reading network (see Picture 2: Schematics of the radio module RFCC1101) For more information, please check chapter 6.2. Configuration of multiple overlapping networks.

Table 2: LED signalization of the operation states of the receiving unit B (led on the radio module of the UNIT)

RED	shines	Unit switched on (after connecting the power supply or after restart) communication with control unit B is not established
RED	Switch off	communication with the control unit B established
GREEN	flashes	Reading data from the devices

5.3. Finishing and verifying of the installation

After finishing the installation of units A and B, it is necessary to verify the correct function or reading network. This can be done either at installation place using laptop connected directly to unit B or at office using Internet connection (if you have already set access rights during unit B installation).

First, you should finish the setting. Set the NTP server that serves for exact time acquiring. Then, it is essential to load the reading plan. If you upload a new plan to unit B, system is restarted automatically and starts to check the read devices readability. We recommend to load also base of plan for easier orientation in reports.

For more information about setting, see chapter Setting of system parameters

First step of system is reading network time synchronization. Control unit B tries to connect the set NTP server and to get the exact time. If the NTP server is not set or set incorrectly, the system tries to connect to some public NTP servers that are set in software by default. If the time is not obtained from NTP server (can be caused by disconnection of unit B from Internet, or by blocking of some ports by provider), unit B get the time from radio packets transmitted by heat cost allocators and radio modules. This way of time synchronization is less exact and it takes a longer time.

During the time synchronization you can get the exact information by clicking to <Log> link. The displayed messages are intended for service purpose only.

Illustration 5: Time synchronization of the reading network

When installation verification is finished, unit B starts to receiving via units A the data from heat cost allocators and radio modules for water meters. This data are compared with reading plan (i.e. list of devices installed in particular building). You can watch the installation progress in a table (Illustation 6: Installation progress). You can also open the list of devices that are already read or still not read by clicking to blue numbers.

Illustration 6: Installation progress

State	First reading in progress...

Status	83 %
Found:	323
Missing:	64
Total:	387

The time required for installation verification can be different based on the building type and its parameters and can not be calculated in advance. Generally, two different situations can occur:

1. Received data are complete, it means all allocators and radio modules for water meters were read. Units A can be fasten to the finally place using 4 screws and wall plugs. Disconnect the batteries and connect the unit A to electrical network 230 V. Note: connection of power supply NZCC1101 to electrical power network is secured by one fuse, connection of wires according to label (N, L) must be kept (L is secured). Connection of device to electrical power network or its maintenance can be done only by staff qualified in accordance with local legislation.
2. System does not find all read devices from reading plan. To solve the situation, proceed step by step and find the cause:
    a) Check the plan first, i.e. if all mentioned units are really installed and repair the reading plan if necessary. If some read devices should be removed from the reading plan, you can add them to “List of ignored read devices”.
    b) Check if the missing devices really transmit the data. The best way how to do it is to use mobile reading unit RFU 35 with panel antenna to make reading from another place. If you can read heat cost allocator or radio module for water meter using RFU 35, try to find new position for unit A. After change of unit A location, restart unit B (by new upload of reading plan). If heat cost allocators or radio modules for water meters can not be read even with mobile radio reading unit RFU 35, it is necessary to check it on site.

5.4. Diagnostics of connected untis

It is the most important tool to analyze and correctly install in a house. Using export of data to Excel and following analysis it is possible to optimalize unit placement in a house.

You can see unit in real time on page Network statistics. User has a possiblity to show read allocators up to 24 hours ago and to sort by serial number, unique number and signal strenght.

Statistika sítě (24 hours): Šumperk

Filtry

Pouze zařízení z plánu ☐

Řazení sloupců Sériové číslo ▾

Začátek před 24 hodin ▾

Odeslat

SN	ED00030013 184 -72.32 dBm 79 2019-11-07 16:16:27	ED0003001e 128 -83.01 dBm 73 2019-11-07 16:14:26
31664735		-100 dBm 2 2019-11-07 15:37:57
31664738		-98.56 dBm 34 2019-11-07 16:14:26
31664872		-92.26 dBm 39 2019-11-07 16:08:56
32317326	-100.8 dBm 7 2019-11-07 14:38:55	
32317327	-97.75 dBm 8 2019-11-07 16:12:05	
32317328	-101.5 dBm 1 2019-11-07 15:23:37	
32317330	-97.89 dBm 18 2019-11-07 16:16:28	

Figure 8: Network statistics

An example of analysis of network statistics in Excel

	ED000a0055			ED000a0056			ED000a0057			ED000a0058			ED000a0059			
	-48.45		285	-86.22		299	-78.95		308	-64.1		315	-74.59		326	
32203415	-98.81		43							-90.62		65	-100.1		19	32203415 Novák
32205018	-94.92		87				-95.5		1		-99	1				32205018 Svoboda
32210636		-95	1					-96	1	-96.78		76		-97	1	32210636 Novotný
32210637	-97.12		64	-96.84		74	-95.43		74	-84.54		75	-86.12		74	32210637 Dvořák
32210638				-97.34		68	-92.06		85	-91.5		1	-101.1		4	32210638 Kučera
32210639	-95.25		6	-80.34		82	-72.7		81	-92.41		39	-74.73		126	32210639 Černý
32210640		-92	1							-100.3		8				32210640 Procházka
32210641		-93	1				-100.8		16	-90.05		65	-94.41		70	32210641 Veselý
32210642											-101	23				32210642 Horák
32210643	-100.2		36				-102.5		1	-86.13		42		-101	1	32210643 Pokorný
32210644	-98.06		75							-86.68		54	-98.1		5	32210644 Němec
32210645	-94.94		86		-95	1		-93	1	-78.58		78				32210645 Fiala
32210646	-99.3		40		-97	1	-97.5		2	-95.29		77	-98.31		35	32210646 Marek
32210647	-99.25		2							-95.46		75				32210647 Pospíšil
32210648	-88.55		86	-90.93		75	-89.58		59	-80.74		41	-82.5		14	32210648 Hájek
32210649		-87	1	-87.72		80	-80.08		84	-93.38		4	-95.29		67	32210649 Jelínek
32210650	-70.72		92							-79.46		72	-91.39		47	32210650 Král
32210651				-100.6		11	-98.15		69	-98.5		1				32210651 Růžička
																32210652 Beneš

Serial numbers of allocators

Unit A

You can move this unit on order to receive signal from allocator in last row

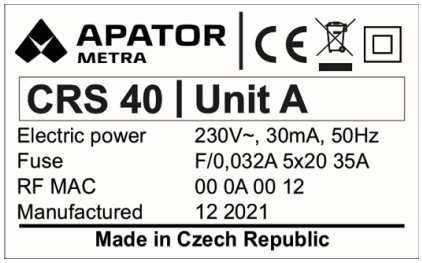
Unit A in this column has to stay at its place as it is the only unit receiving this allocator

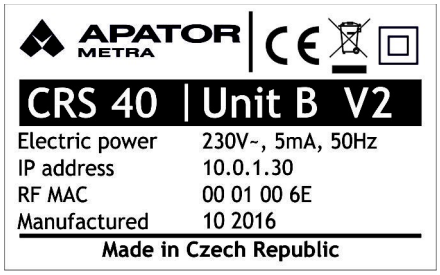
Signal from allocator has been received 47x times

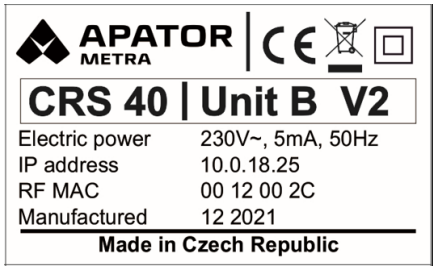
6. Reading network

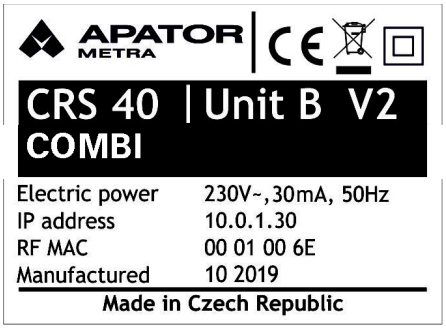
6.1. RF MAC Reading network address

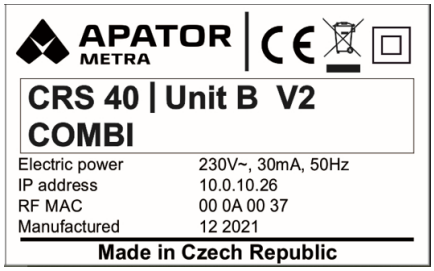
Every produced unit of Central reading system CRS 40 is equipped with unique identification number of radio module RFCC1101, so called RF MAC address. You can find this number on unit identification label. First two groups of digits are unique for particular customer, next two identify particular unit.











There can be situations, when more billing companies provide their services in one housing estate (or even in one large building). To avoid situations like that e.g. unit A of one billing company would connect to reading network of another one, sameness of first two groups of digits is checked during connection establishment.

Warning

Only units with the same first four digits from RF MAC address (see Chyba: zdroj odkazu nenalezen, Chyba: zdroj odkazu nenalezen) can be used in one reading network.

Units with different initial four digits of RF MAC address are not establish connection even when the setting of DIP switch is the same. For more information, see chapter Configuration of multiple overlapping network.

6.2. Configuration of multiple overlapping network

Mainly in the housing estate, it can happen that installation of more reading networks in close buildings (or even in one building) is necessary. Only installation of multiple reading networks of one billing company with the same first four digits of RF MAC address (see chapter 6.1. RF MAC Reading network address) is described in this chapter. Installation of more reading networks of more billing companies does not require any further setting (see Illustration 4: Overlapping networks of two billing companies).

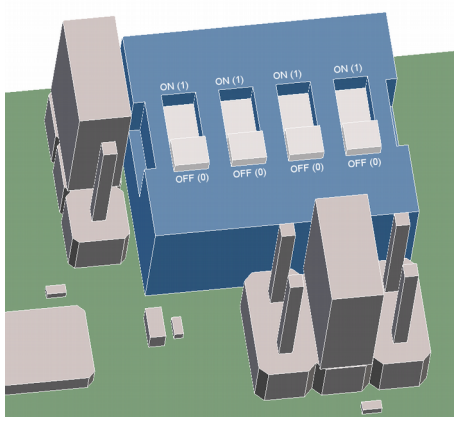


Illustration 3: Detail of the DIP switch

To avoid connection of unit A to another reading network (i.e. to another unit B), it is necessary to distinguish between such networks.

Distinguishing between reading networks is done by DIP switch on radio module RFCC1101 (see Picture 2: Schematics of the radio module RFCC1101 and Illustration 3: Detail of the DIP switch). DIP switches are set to position OFF-OFF-OFF-OFF (0-0-0-0) by default.

It is possible to use default configuration of DIP switch when installing the first reading network. When installing next reading network, it is necessary to change DIP switch to another configuration on both control unit B and all collecting units A. 15 combinations can be used, configuration ON-ON-ON-ON (1-1-1-1) is reserved by the manufacturer.

Warning! DIP switch configuration ON-ON-ON-ON is intended only for manufacturer test purpose. It must not be used in everyday operation. Such units are not functional.

The situation shown in Illustration 8: Overlapping networks of two billing companies is only illustrative. In practice, the range of radio equipment, especially in the building, has no circular shape (see chapter 4. Spreading of radio waves).

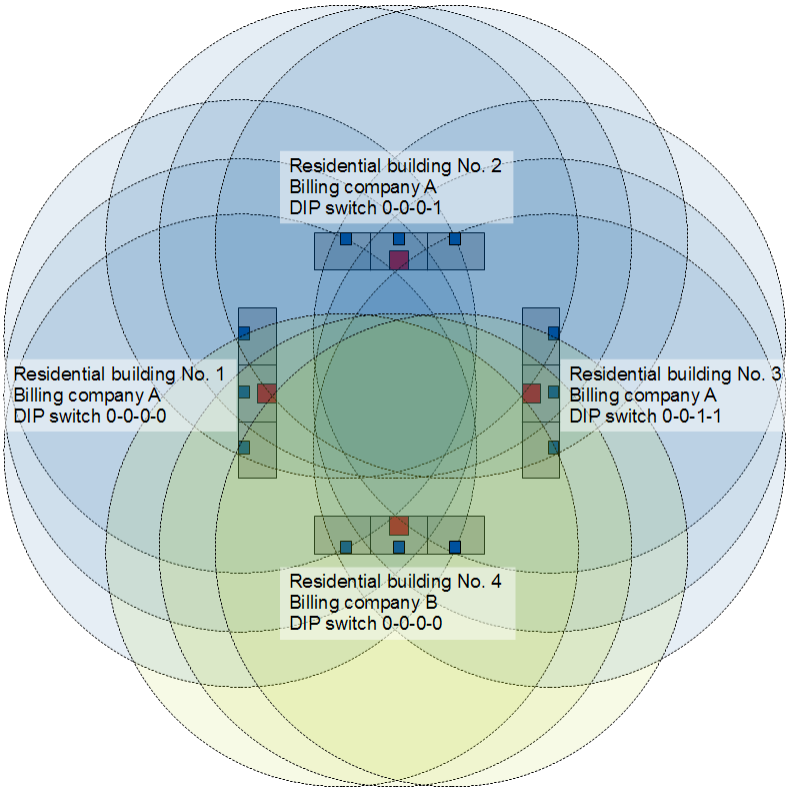


Illustration 4: Overlapping networks of two billing companies

Warning!

If two reading networks with the same first four digits of RF MAC address and the same configuration of DIP switches would be started up, newly installed network will not work. It will be necessary to restart units B of both reading networks after changing the DIP switches configuration

7. Firmware updates

Firmware is computer program specific for particular device and it is integral part of electronic appliance (Central reading system CRS 40). Firmware is programmed to internal memory of processor in radio module RFCC1101 and it is de facto part of the hardware.

It can be appropriate to update firmware in some cases (e.g. add a new read device or change of communication protocol used in reading network).

Warning!

Firmware update can be done by personnel trained by manufacturer using special programming device. Description of firmware update is provided to trained personnel as separate manual. Unit can be damaged by blackout during firmware actualization – we recommend to use laptop or computer equipped with UPS from this reason.

Modifications not authorized by manufacturer may be the reason for warranty void.

PNote: Changes involving e.g. read data interpretation do not require firmware update. Such changes are implemented using update files that can be load to control unit B via Internet. For more information, see chapter 10.5. Setting of system parameters.

7.1.1. Check / show of firmware version and firmware of radio module

Current version of firmware is shown on website in the footer.

7.2. Update/upgrade software jednotky B

Update of internal software of unit B (e.g. changes in interpretation of read data, adding new features to the system) is done using update files supplied by the manufacturer. Check and installation of update files is performed after writing readings is finished.

Units B connected to internet download update file automatically from manufacturer's server, or it can be updated manually over web interface of the unit (see chapter 10.5 Setting parameters of system).

8. TROUBLESHOOTING

DESCRIPTION	PROBLEM INDICATION	RECOMMENDED SOLUTION
Collecting unit A can not establish the radio contact with control unit B	Red LED on radio module of unit A lights even after restart	The system is designed for remote communication. If units A and B equipped with antenna are located in close proximity, receiver is “overload”. **Place the collecting unit A further from control unit B.**
		Collecting unit A is too far from control unit B or barrier impermeable for 868 MHz radio waves is located between them. **Place collecting unit A closer to the control unit B.**
		Check that DIP switch configuration is the same at both unit A and B. **If not, change DIP switch to the same configuration.** For more information, see chapter 6.2. Configuration of multiple overlapping network.
		Check that DIP switch configuration is the same at both unit A and B. **If not, change DIP switch to the same configuration.** For more information, see chapter 6.2. Configuration of multiple overlapping network.
		Check that DIP switch is not in ON-ON-ON-ON configuration neither at unit A not unit B. This layout is reserved for test mode and must not be used. **If configuration ON-ON-ON-ON is used, change it.** For more information, see chapter 6.2. Configuration of multiple overlapping network.
		Check that the B unit works correctly.
Connection of collecting unit A and control unit B is unstable	Red LED blinks irregularly at unit A	Connection is unstable if units are close to their limits (too far or too close). Solve it as described above. **Place collecting unit A closer (or further) to control unit B.**
	Red LED blinks regularly at unit A	Power supply is not sufficient. It can be caused by weak batteries or by power supply failure (unit is switched on but restarted when tried to transmit). **Change the batteries or check the connection to electrical network.**
Collecting unit A or control unit B does not work	Both LED on radio module are switched off even after disconnecting and connecting of power supply	Power supply malfunction. Battery voltage must be at least 2,2 V. **Change the batteries or check the connection to electrical network.**
		Unit malfunction. **Send it to manufacturer to repair.**
Control unit does not contain any data from read devices	There are no data on the main page	Verify that red LED is off in units A (units are connected) and green LED blinks in irregular interval of minutes (data receiving indication). If the unit A does not receive any data, there are displayed no data at unit B.
		Check that unit A is not connected to another reading network (see chapter 6.2. Configuration of multiple overlapping network).

USER GUIDE PART

9. Connection reading network

For remote work (such as from a computer in your office) with a central CRS 40 reading system, you need to connect to a so-called virtual private network that allows access to the reading network. A virtual private network (VPN) is a mean of interconnecting several devices through a public (untrusted) computer network, the Internet. The connected devices can communicate with each other as if they were connected within a single closed private (and therefore trusted) network. When establishing a connection, the identity of both parties is authenticated by digital certificates, authentication takes place, all communications are encrypted, and we can consider such as secured connection.

For the purpose of linking your computer to the reading network, a virtual private network is used. You will need to set up a connection to this VPN on the computer that you want to connect to the read-out network. Remote access is possible from both Microsoft Windows 7 and later operating systems, Linux, Mac OS from Apple or Android. The following describes how to install Microsoft Windows for PC and mobile devices. The Linux and Mac OS operating systems are not included in this manual - contact Apator Metra employees for the installation procedure on these operating systems.

The actual connection to the reading network is already running through any web browser (e.g. Mozilla Firefox, Internet Explorer, Google Chrome, etc.).

9.1. VPN network structure

As already mentioned, this is a virtual private network. This network looks like an isolated network from the outside without access to others without knowing the login name and password.

The central readings system CRS 40 is set in such way that the IP address (device identifier within the computer network) is defined as 10.Z1.Z2.X. The first group of digits (10) is invariant, the other two groups of digits (Z1.Z2) are designated by the manufacturer, and their specific combinations (e.g., 124.201) are for one customer only. Range X is divided according to the following key:

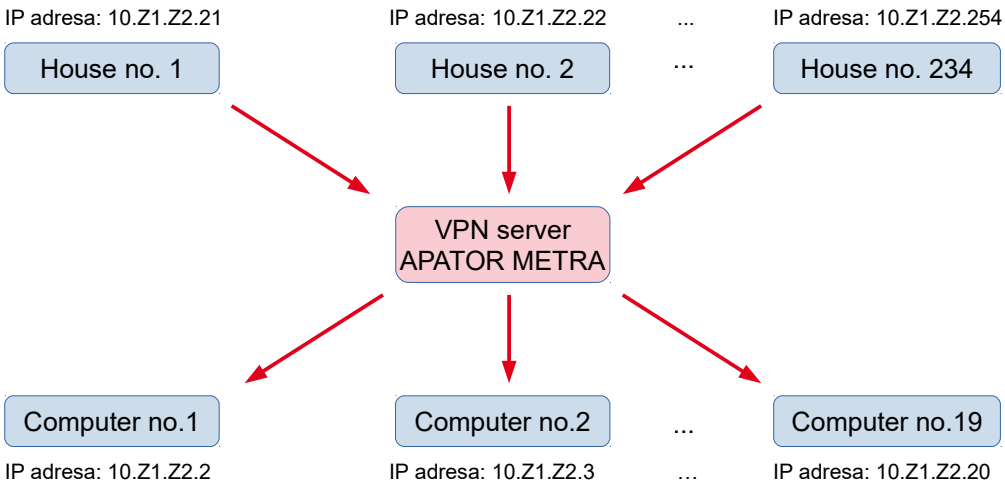
0.1 reserved

2-20 computers

21-254 reading networks (represented by control units B)

255 reserved

The IP address of the control unit B (and therefore the whole reading network) can be found on the identification label (see Illustration 8: I Identification label of the unit B). The address is specified by the manufacturer, it is unique for each B unit manufactured and can not be changed.



Pic. 5: VPN network illustration

The number of devices that can be simultaneously connected to a single network is limited to 253 for technical reasons. This means a maximum of 234 B units (representing read-only networks) and up to 19 computers that connect to read-out networks.

9.2. VPN CONNECTIVITY OPTIONS

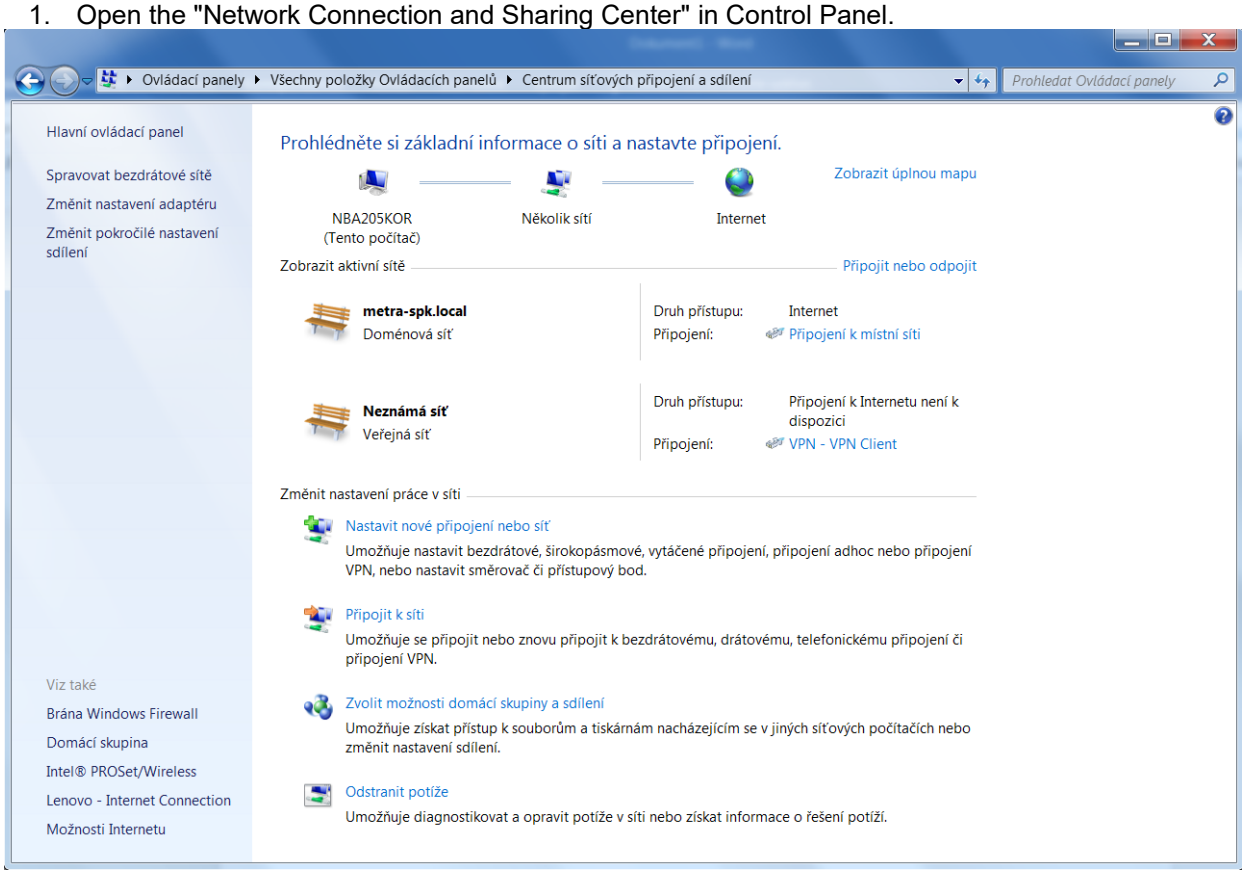
9.2.1. Connect via PC

Integrated Microsoft Windows client

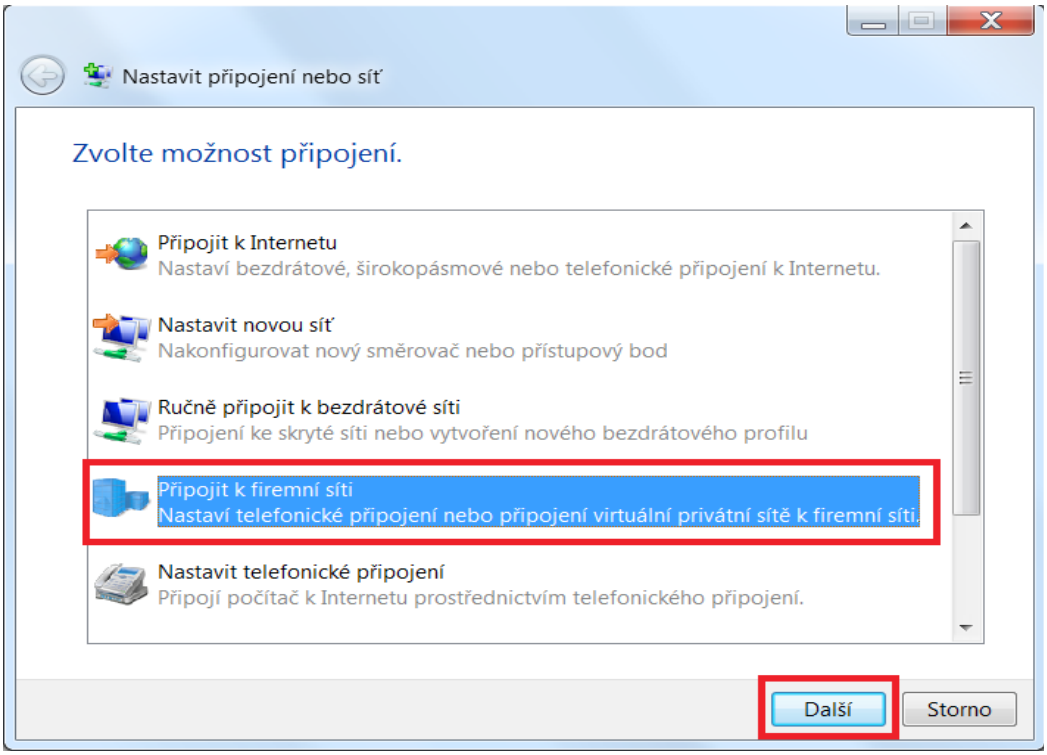
This method makes use of the integrated VPN client. The procedure has been tested on both Windows 7 and Windows 10.

Setting method:

1. Open the "Network Connection and Sharing Center" in Control Panel.

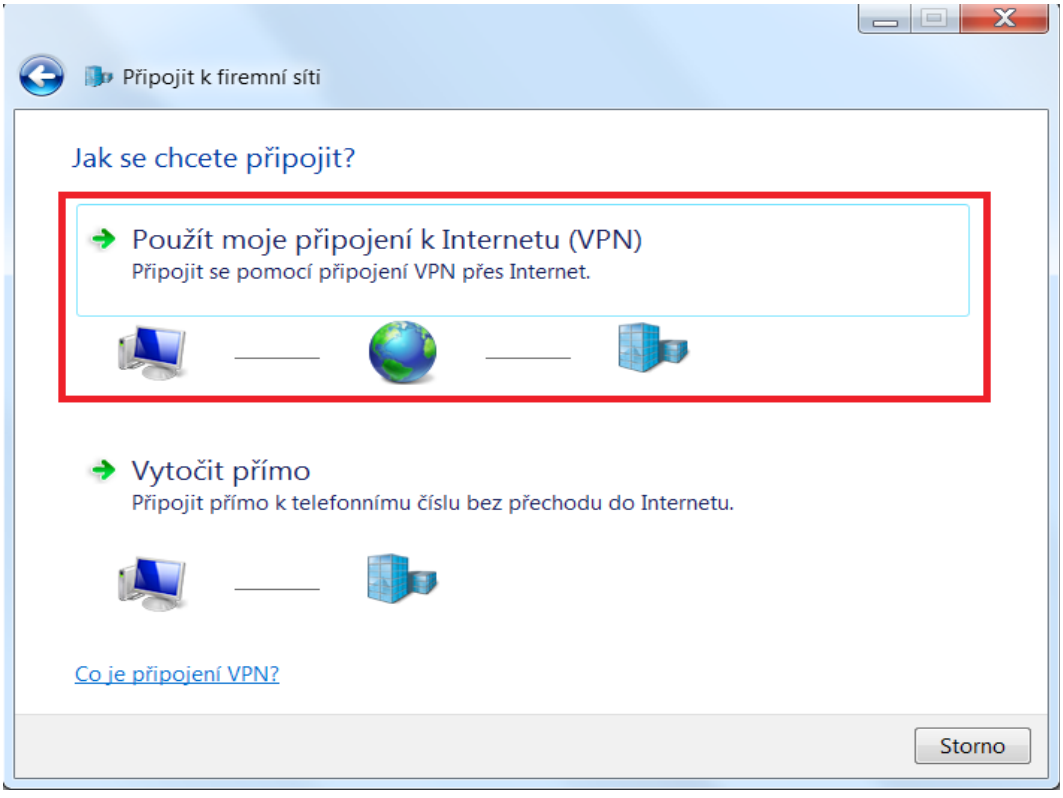


2. Click on the "Set up a new connection or network" icon. In the connection options, select "Connect to the corporate network" and confirm with "Next".

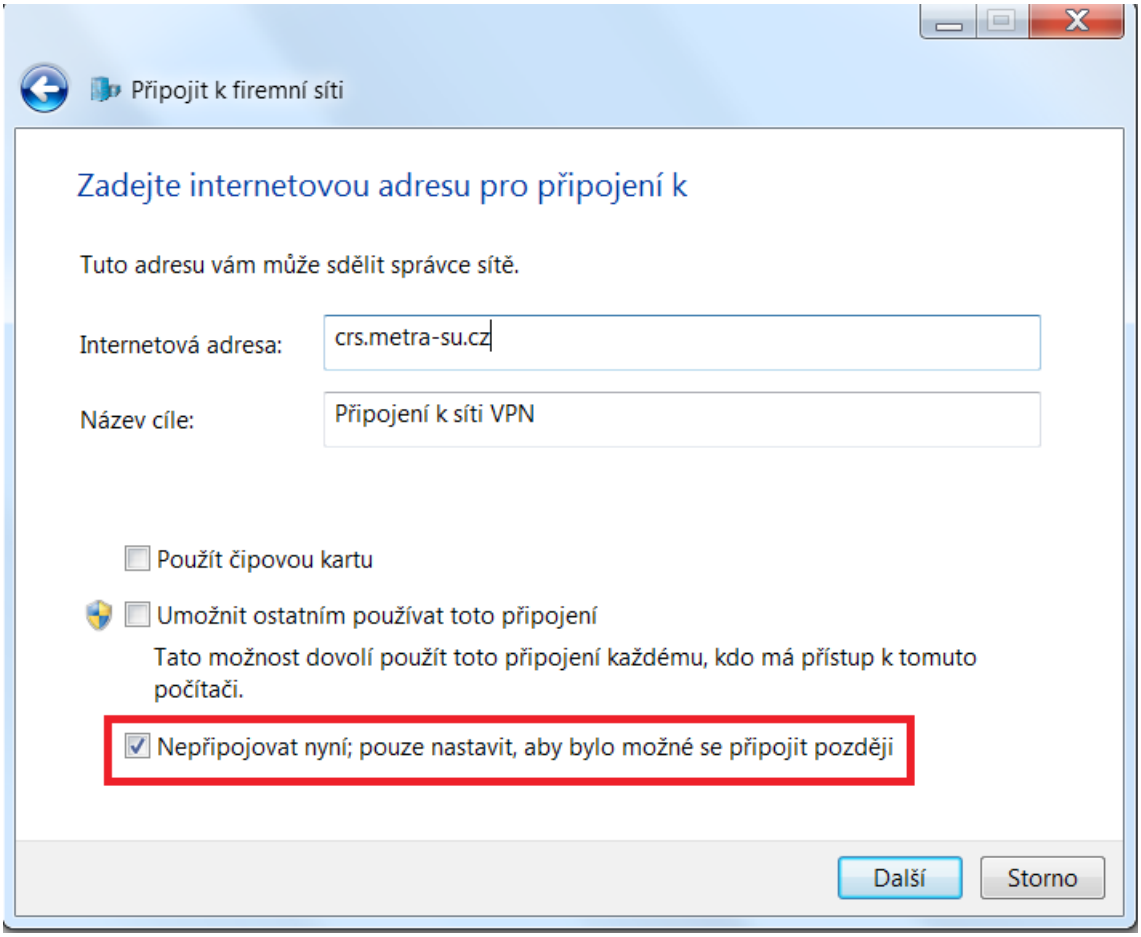


3. If the option to use an existing connection is displayed, select "No, create a new connection" and continue with the "Next" button.

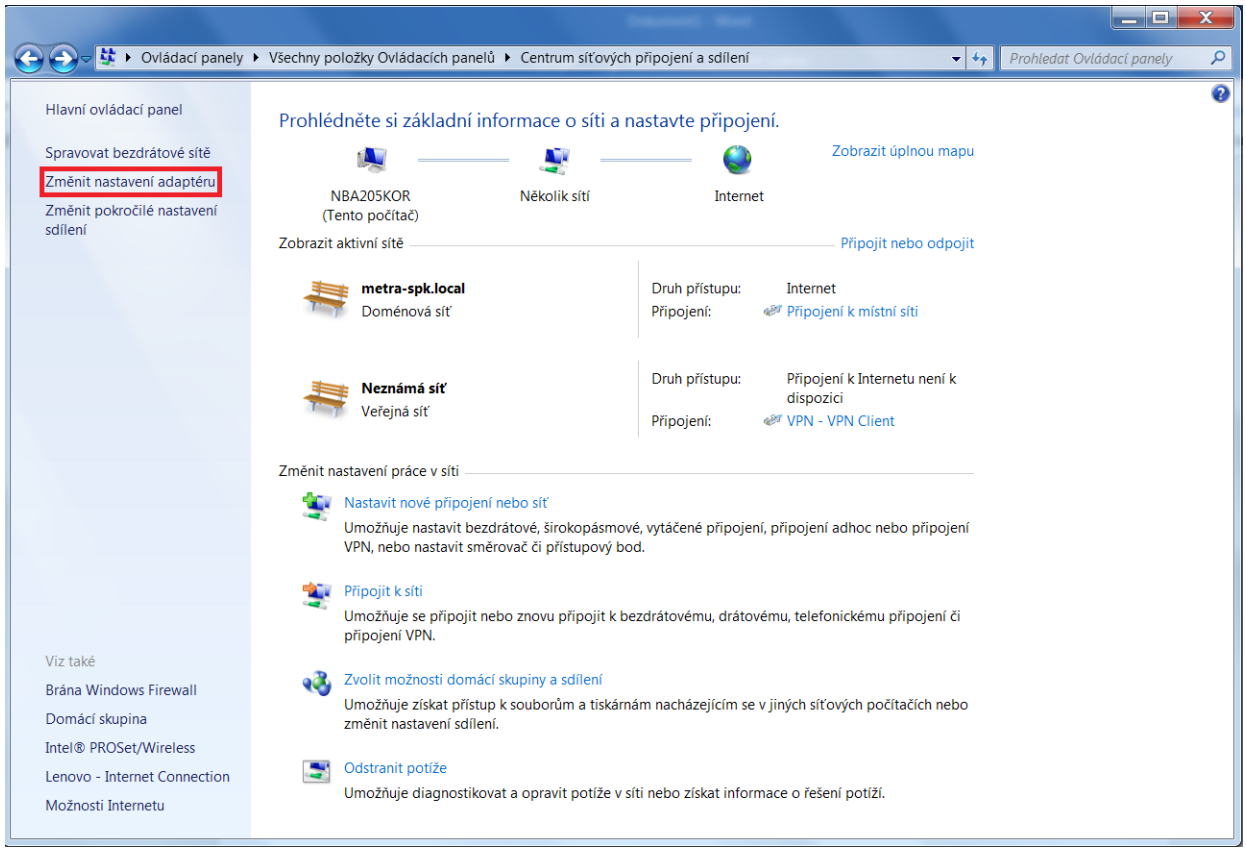
4. Select "Use my Internet Connection (VPN)"

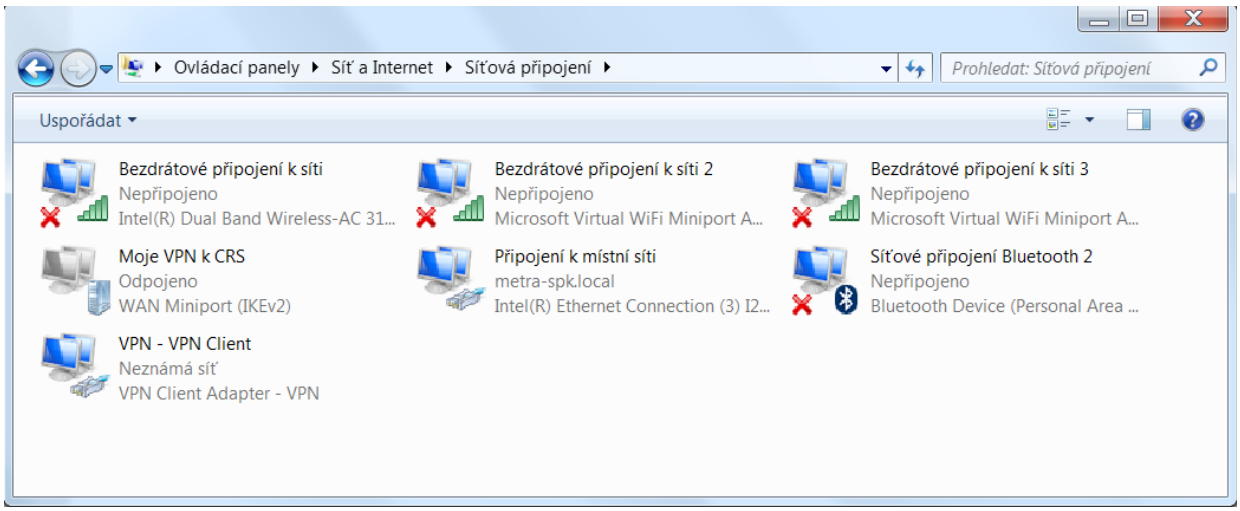


5. Enter the VPN server address "crs.metra-su.cz" VPN server address into the "Internet address" field, enter your VPN name (your ID) in the "Destination Name" field. In Windows 10, select the "Create" button, in Widows 7 check the "Do not Connect Now; Just set .. "and continue with "Next".

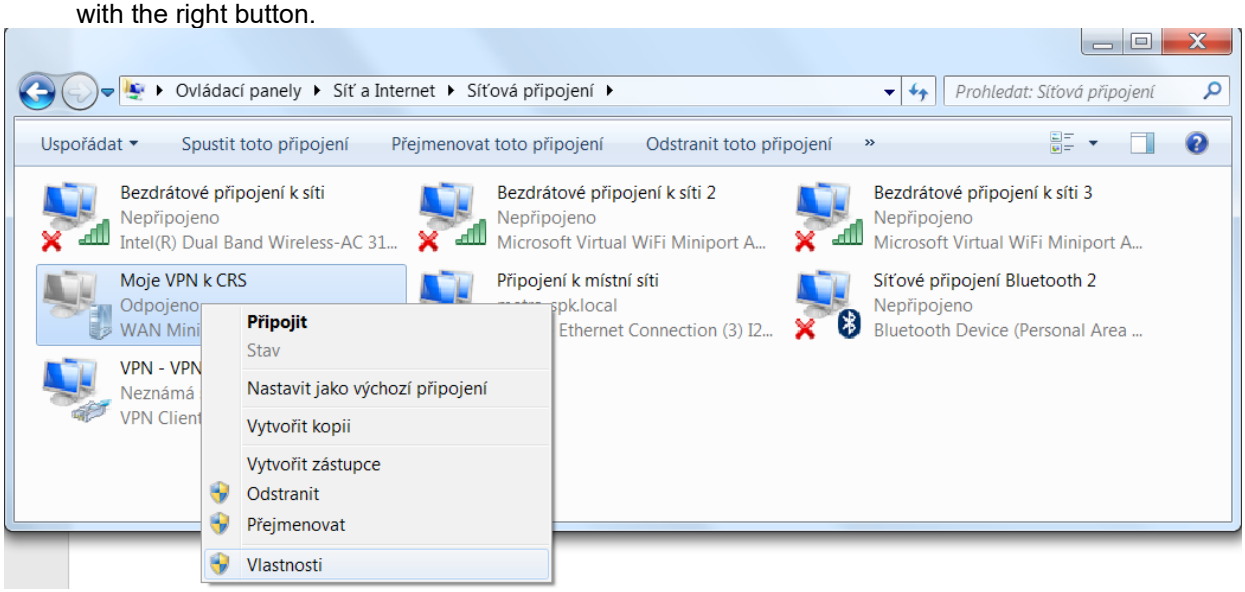


6. In the "Network and Sharing Center" dialog box, go to "Change Adapter Settings".

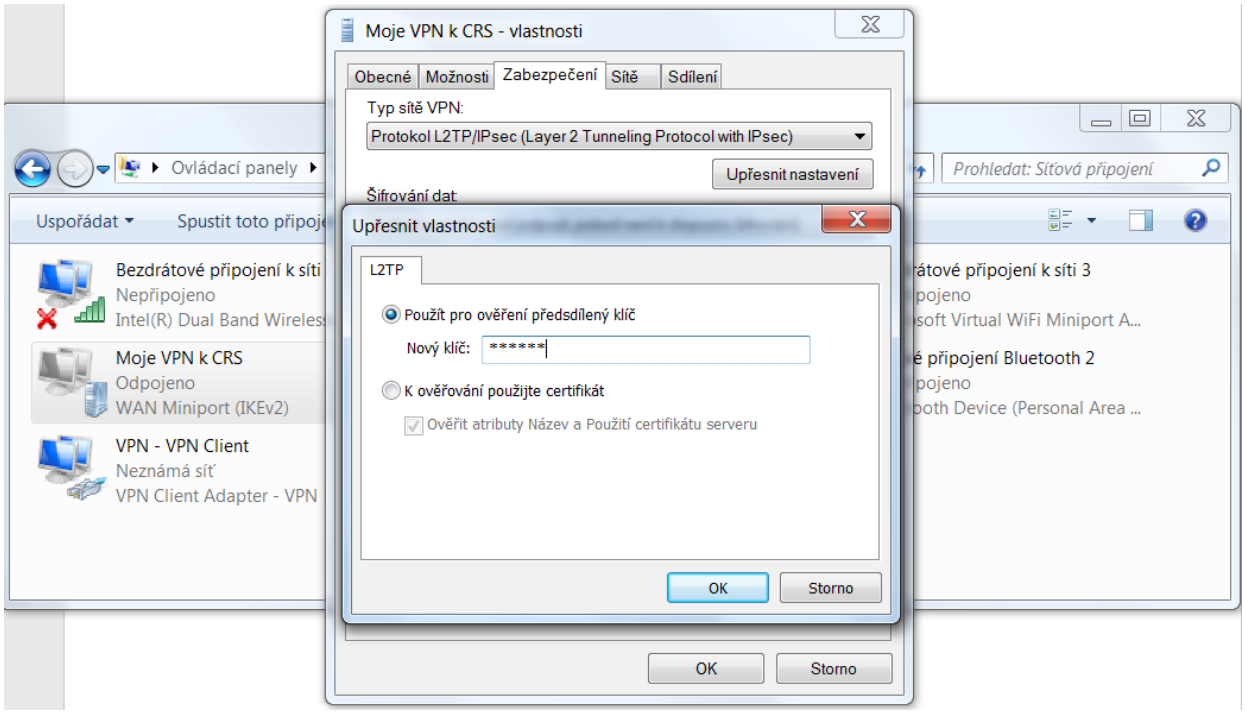




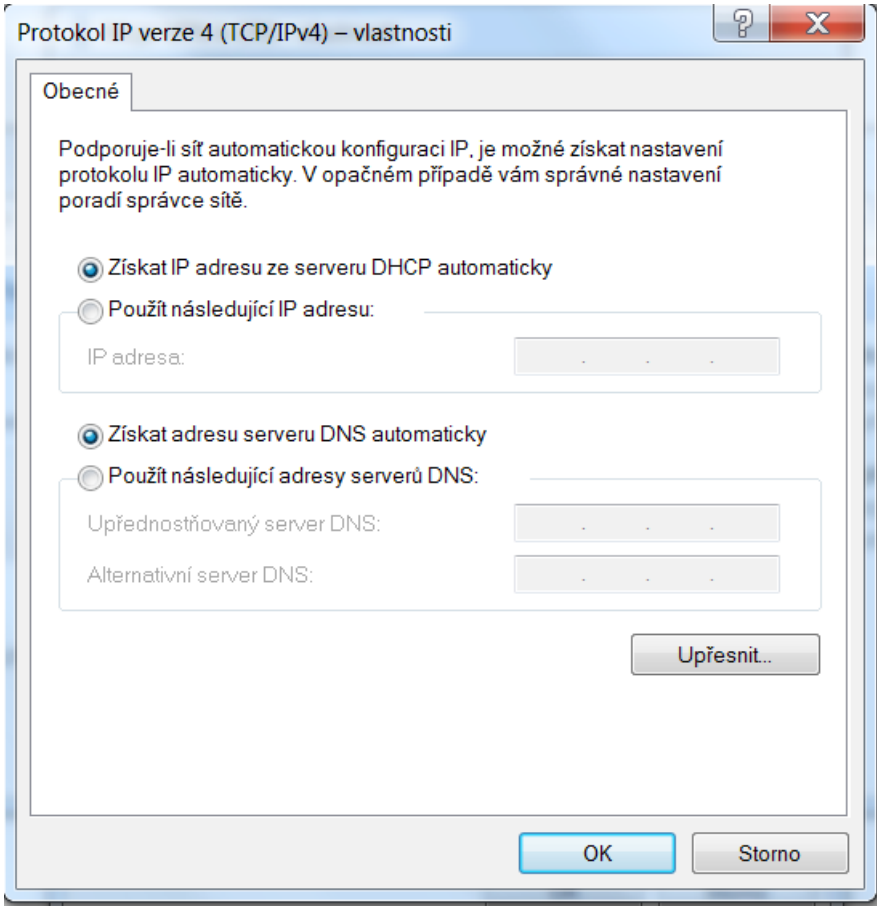
7. Select the adapter with the name that you typed when creating a VPN and select the "Properties" with the right button.



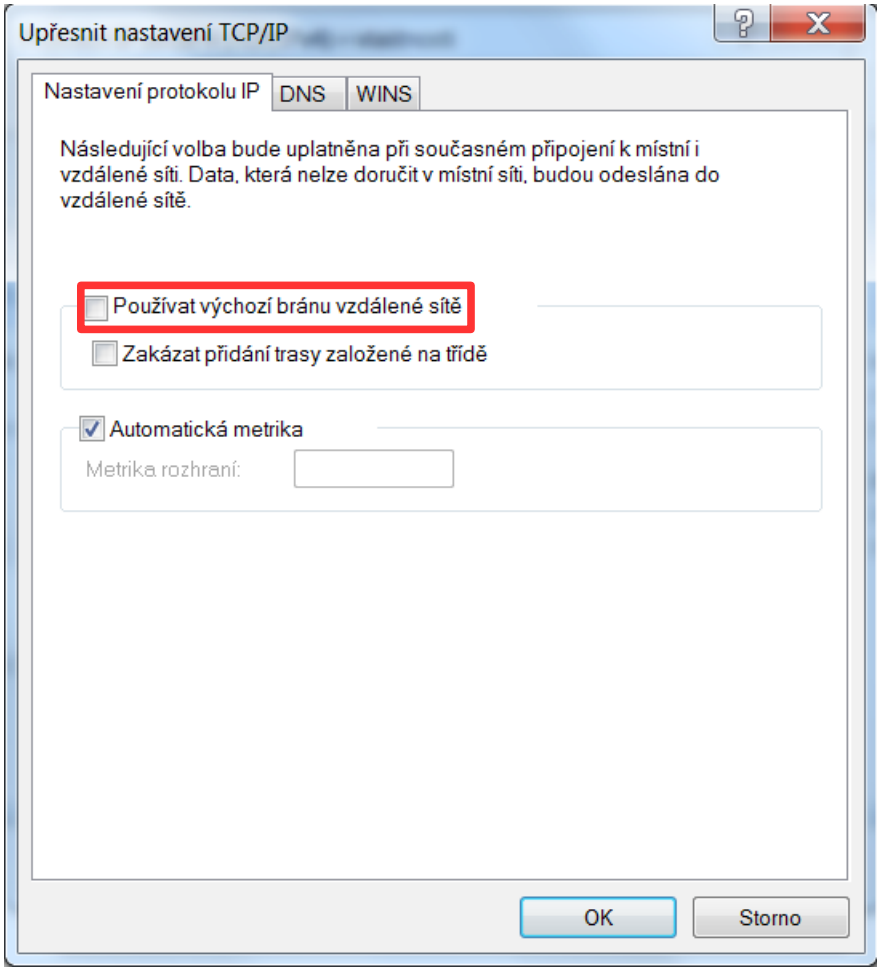
8. In the "Security" tab, select "VPN type" "L2TP / IPSec .." and enter the key in the "Advanced settings" provided by Apator Metra s.r.o. And confirm with OK.



9. On the "Networks" tab, uncheck "IP protocol version 6" and select Properties on the "IP protocol version 4".



10. Under "Advanced", uncheck "Apply default gateway to remote network".



11. Confirm by pressing „OK“.

12. Now you can connect.

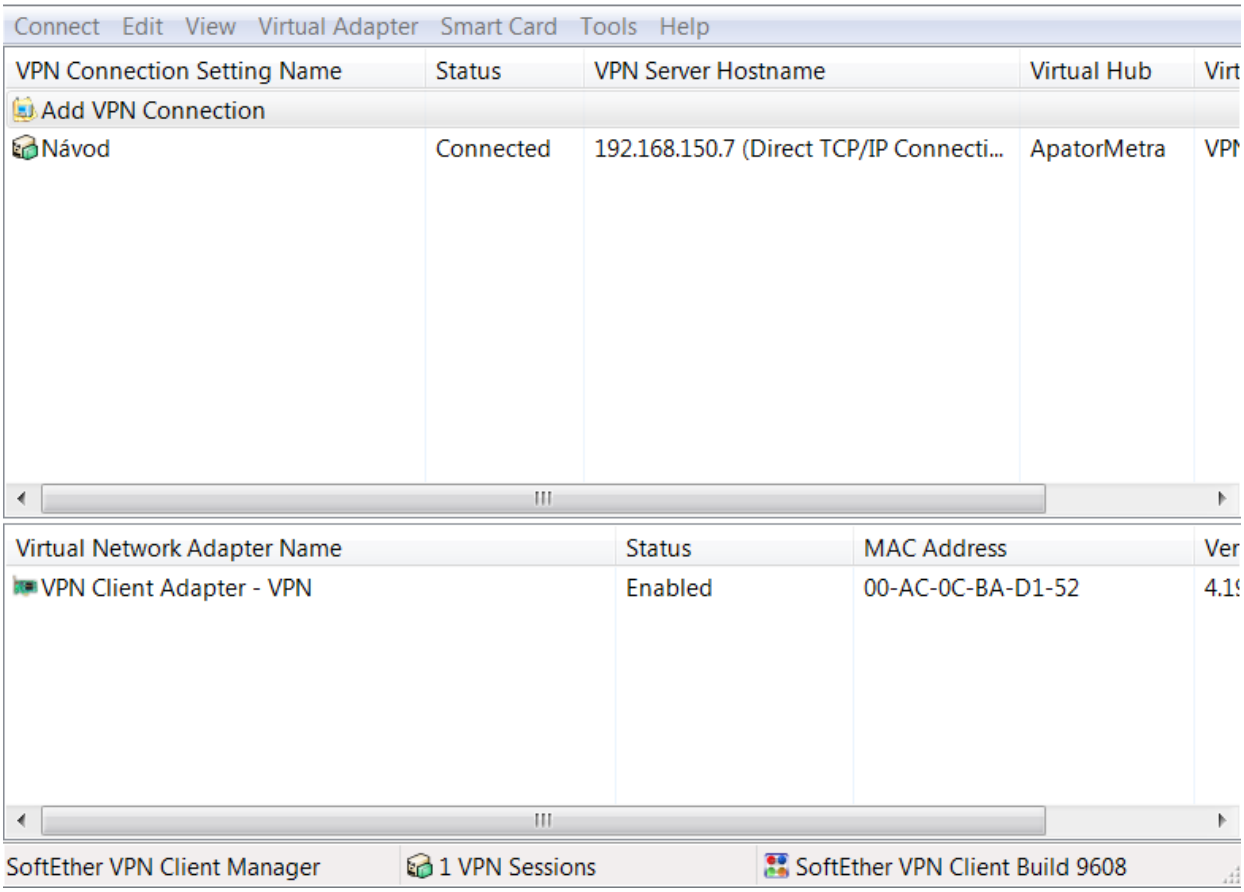
SoftEther Client Manager

To install a VPN client, download the appropriate installation file from the address http://www.softether-download.com/en.aspx?product=softether.

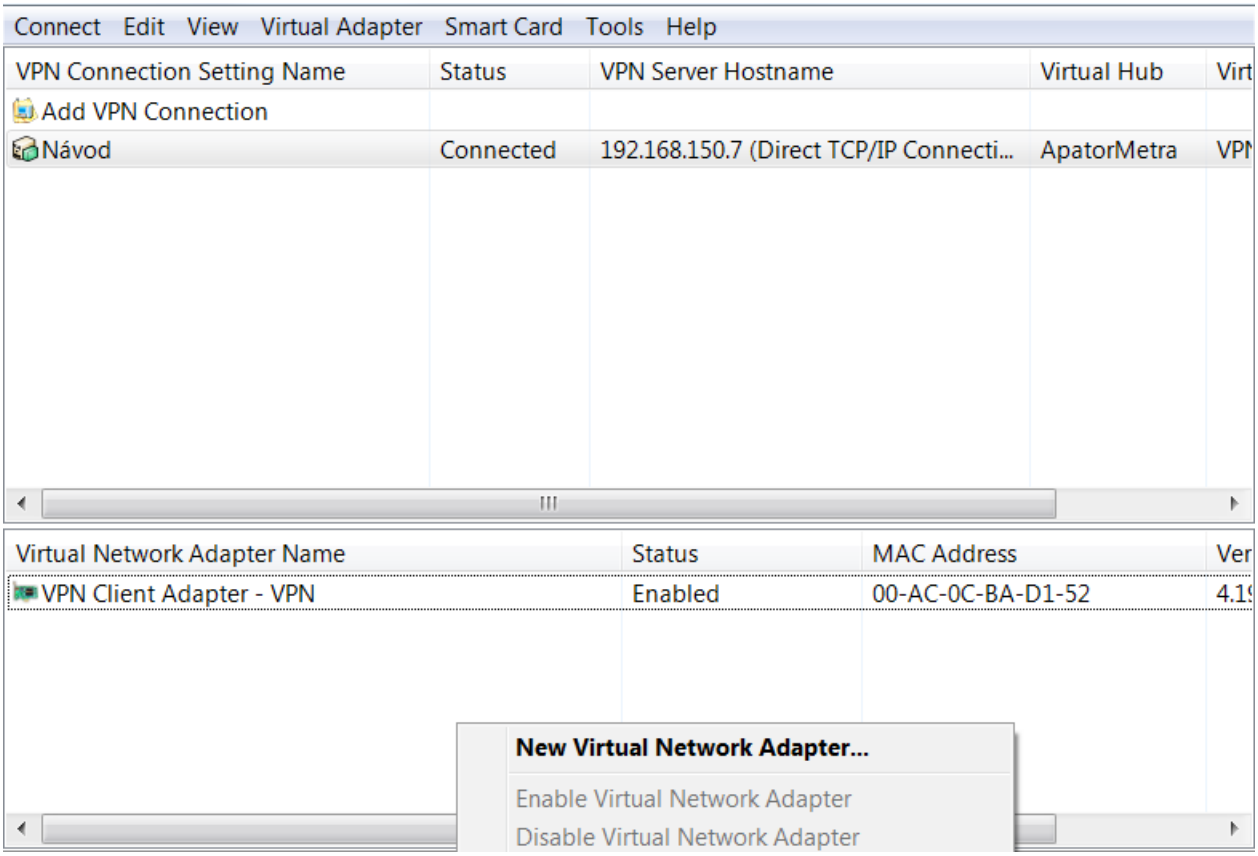
After download, you can install it - press the Next button, then check the license agreement on the third page).

Basic settings of the VPN client

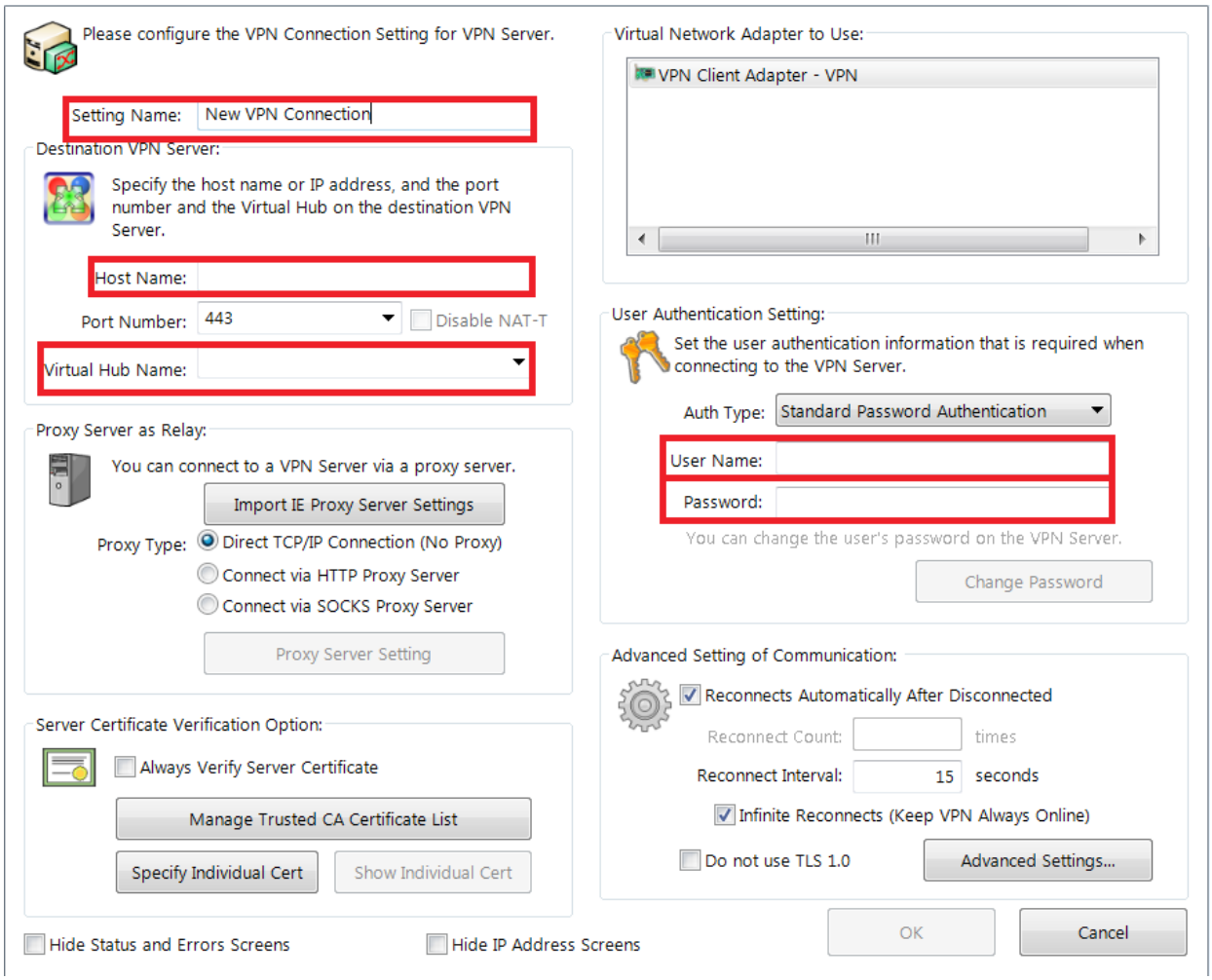
1. Start the program SoftEther Client Manager.



2. Right-click at the bottom of the window and select New Virtual Network Adapter and enter the name of the virtual network card, such as VPN.



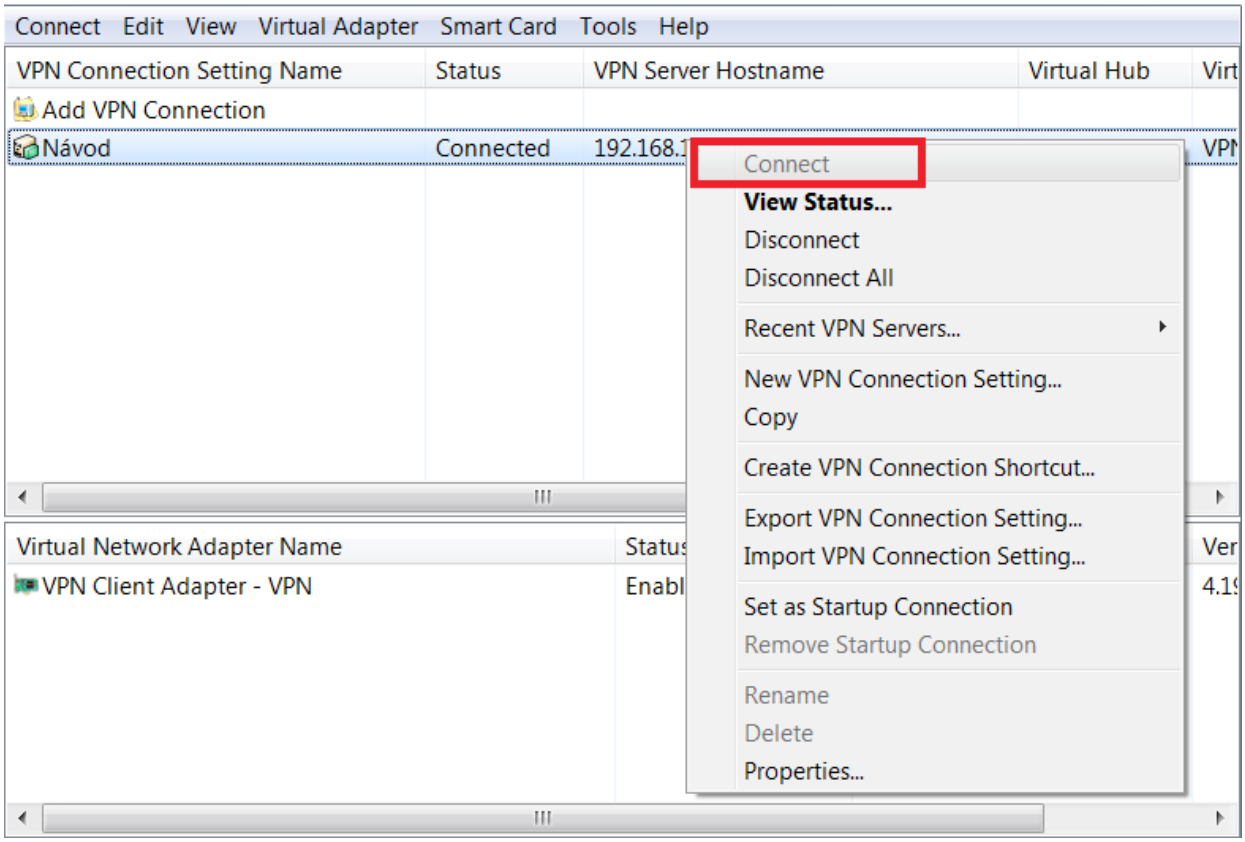
3. Click Add VPN Connection at the top



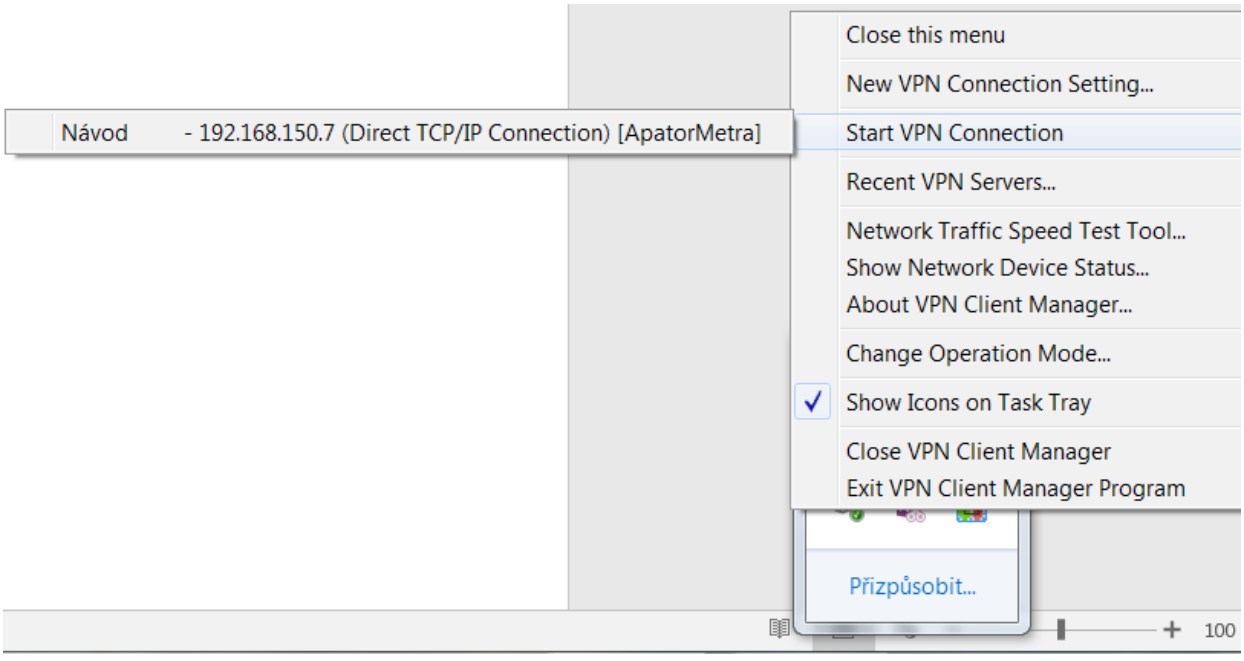
Fill in: Setting name (some name of the connection), Host name (crs.metra-su.cz), Virtual Hub Name (enter the name of Hub, which will be communicated to you Apator Metra s.r.o), User Name and Password (you will get this information from our Worker) and confirm with OK (you will get those from Apator Metra).

You can join in several ways:

1. Right-click the row in the manager and choose connect.



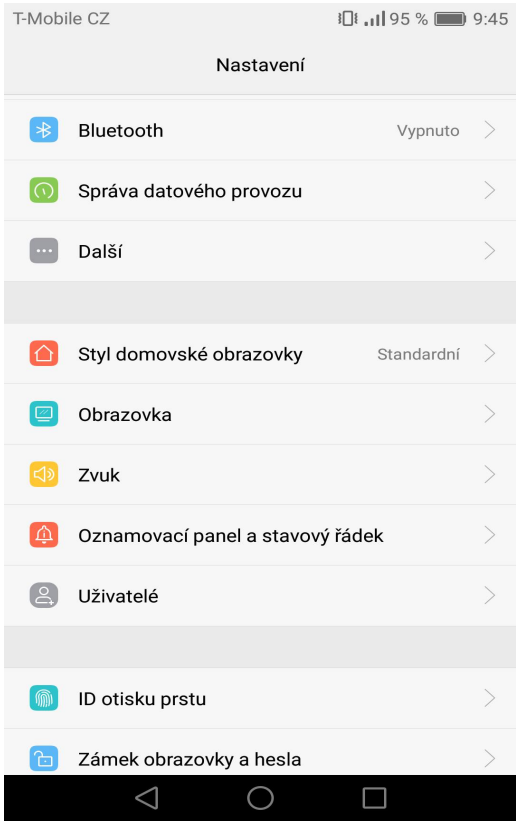
2. In the lower-right bar, click the arrow to display the hidden icons, then right-click the manager icon and select Start VPN Connection - select the connection you want. Such a connection to the Client Manager is always required when the computer is turned off and on, and it is recommended to connect only when needed.

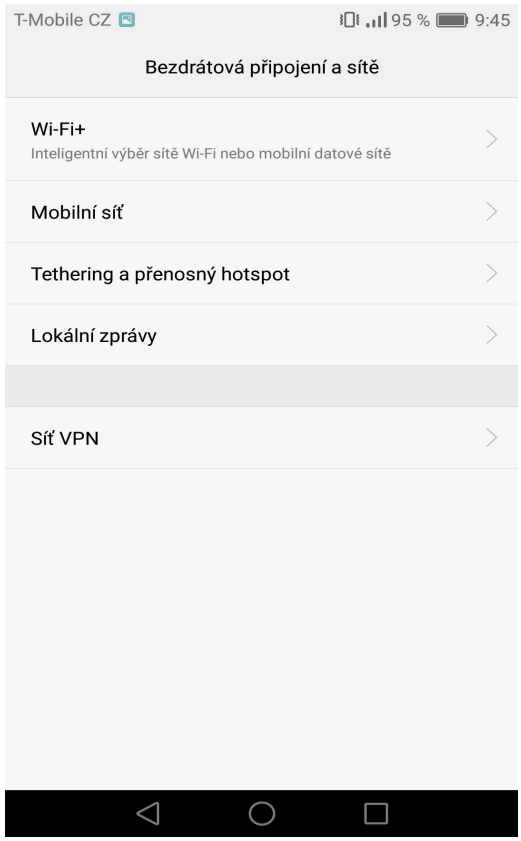


9.2.2. Connecting via mobile device

Android operating system

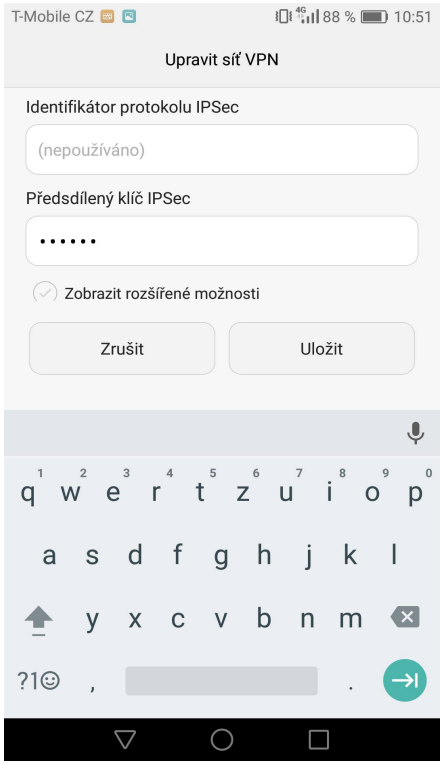
1. Open Settings on your mobile device

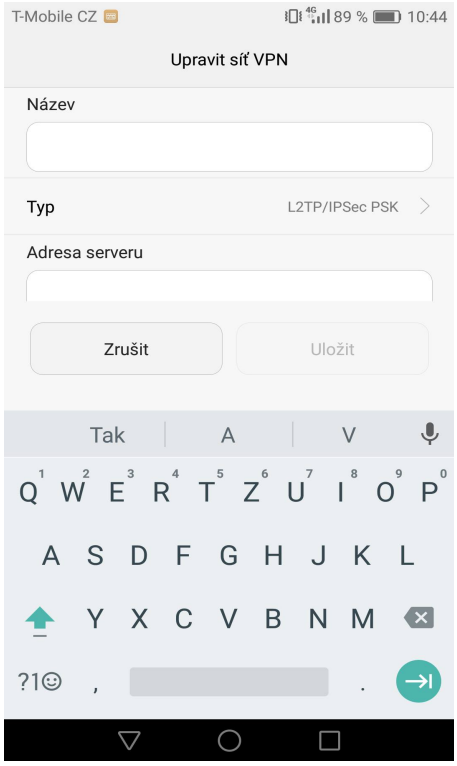




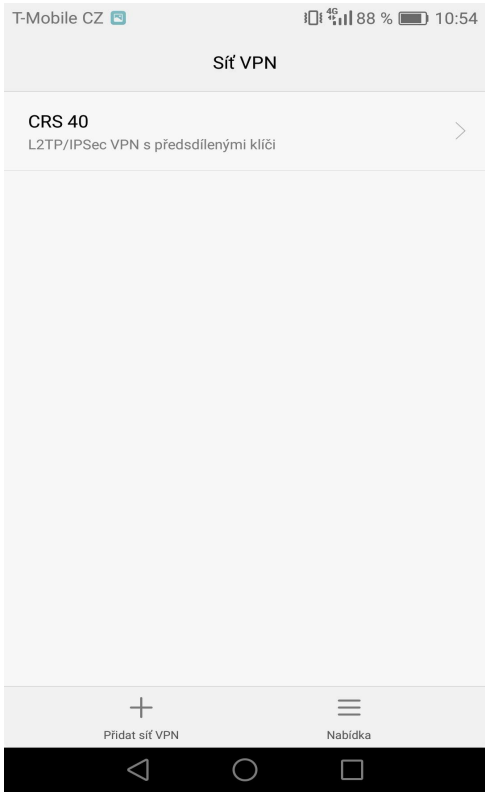
2. Click "Wireless & networks

3. Click on the VPN Network and then the "Add VPN" icon. Fill in the "Network Name" field, for example CRS 40, type L2TP / IPSec PSK into the network type. Fill in the server address and the pre-shared IPSec key, which will be provided to you by employees of Apator Metra s.r.o.

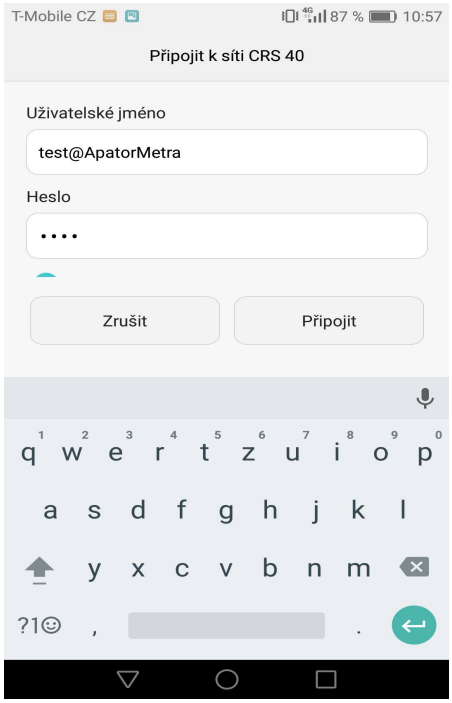


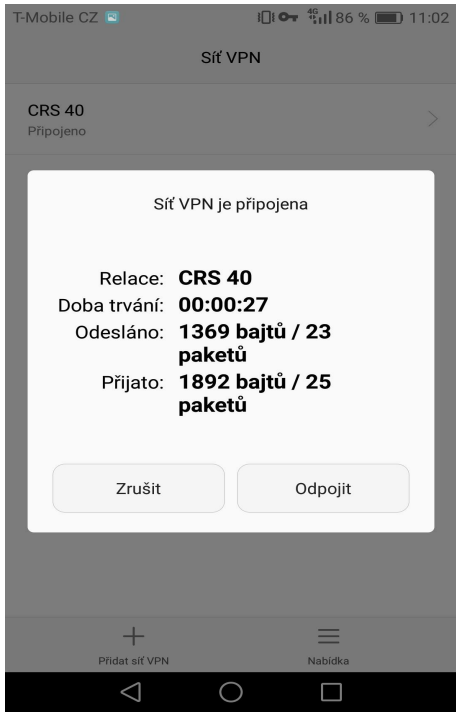


4. The VPN called CRS 40 was created

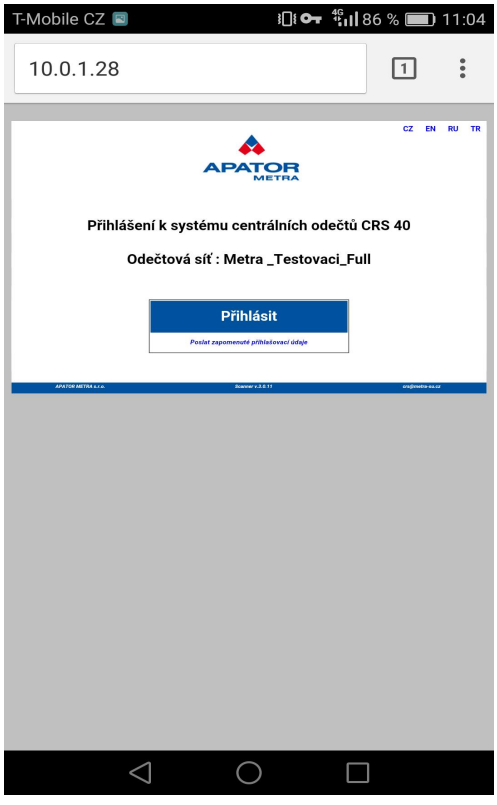


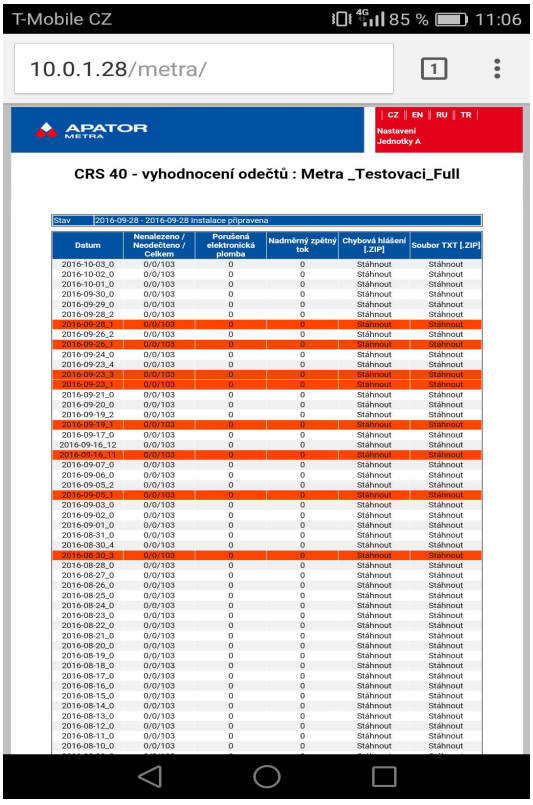
5. To make a connection to the CRS 40 network, you need to enter the user name and password, this information will be provided to you by Apator Metra s.r.o.





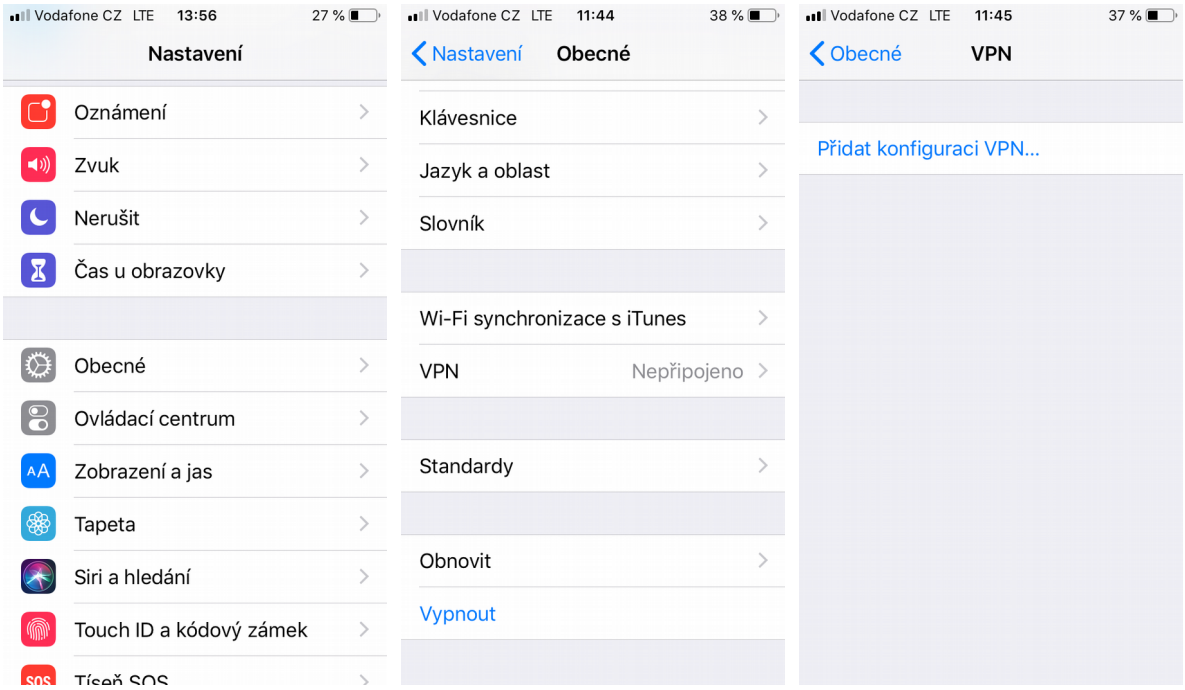
6. In the web browser visit CRS address, login then you get access to data reading overview.



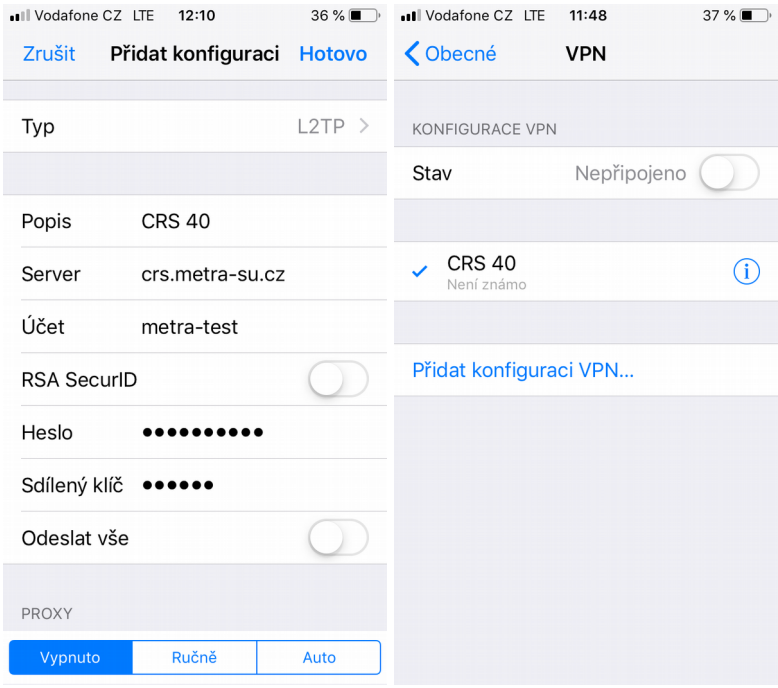


System iOS

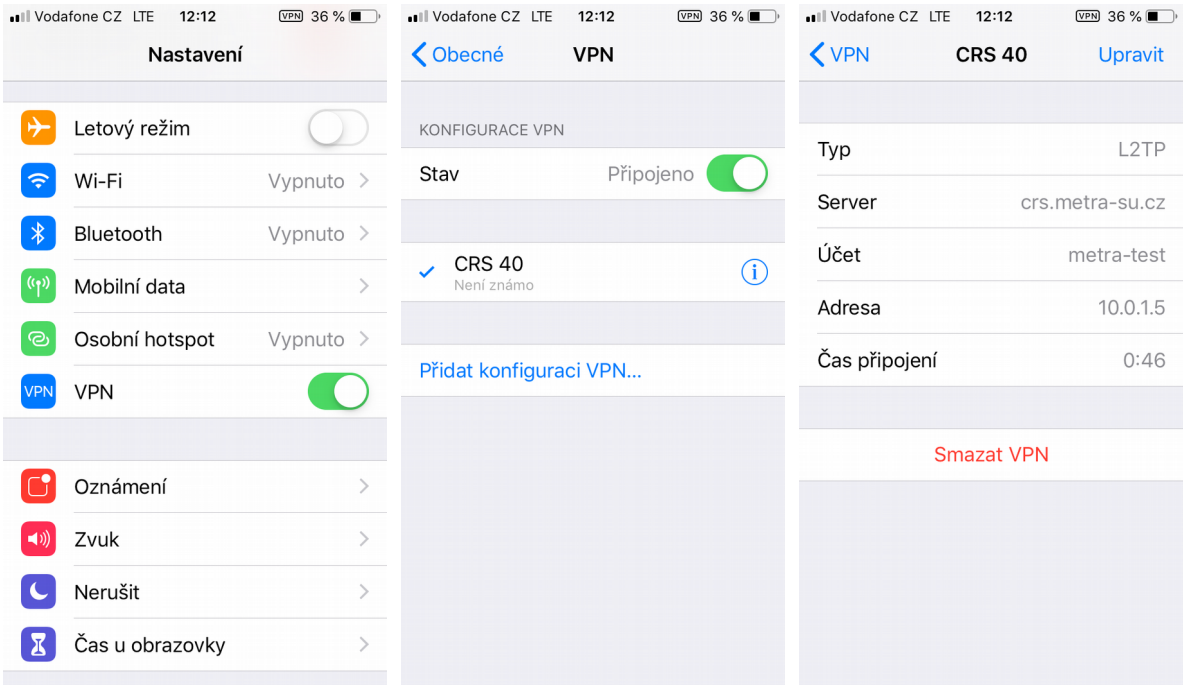
1. In you mobiel device open „Settings“ → „General“ → „VPN“ and click on „Add VPN Configuration...“



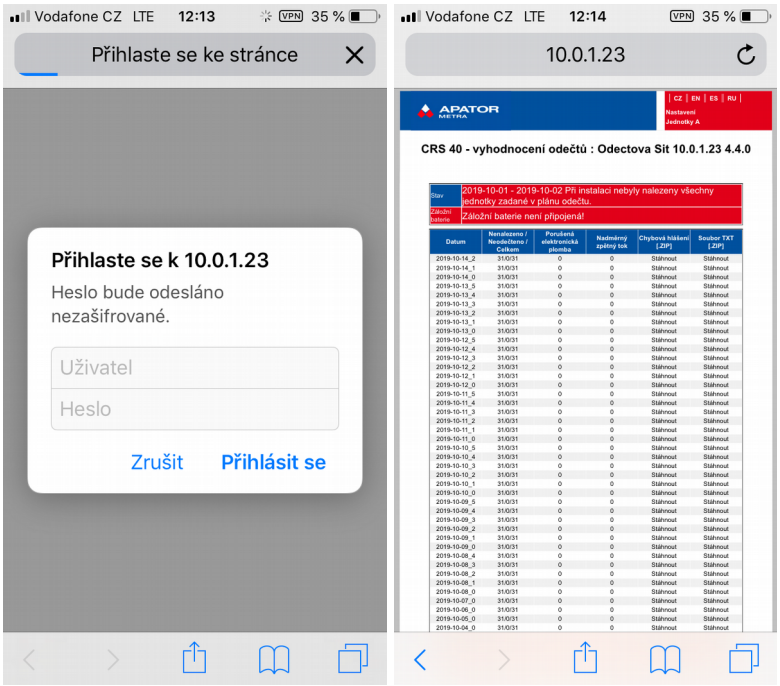
2. On configuration screen fill in these data: „Type“ set as„L2TP“, „Desription“ can be any name (in image is „CRS 40“). Further fill in „Server“, „Account“ and „Shared key“, these data will be shared by an Apator Metra employee. Switch „Send all“ turn off, proxy settings leave as is - turned off.. After you tap on "Done" new VPN connection is created.



3. Now you can connect to created VPN network. Use swich on first screen of "SettingsL or swich in list of VPN connections.



4. In internet browser fill in IP address of desired CRS.



10. Description of the graphical interface

10.1. Connecting to the reading network

Open a web browser, such as Google Chrome, Mozilla Firefox, Internet Explorer, etc. The list of browsers for which the software is tested can be found in the chapter Error: link source not found Error: link source not found. If some browser or an older version is used, some features may be unavailable. Enter the IP address of the reader network control unit B that you want to connect to in the address bar. The IP address can be found on the identification label of the unit (Illustration 6: I Identification label of the unit B). Do not forget to check that you have a VPN attached (see chapter 9. Connection to reading network).

10.2. Logging in to the reading network

After connecting to the reading network, the log in page opens first. For first login, the login name “admincrs” and password "159753 " (without quotation marks) are set by default. Once you've first logged in, change the data in Settings (Access Set Up for Readout Administration).

If you forget your login information, you can send it to the e-mail you entered in <Settings> in the <E-mail address for error messages> box.

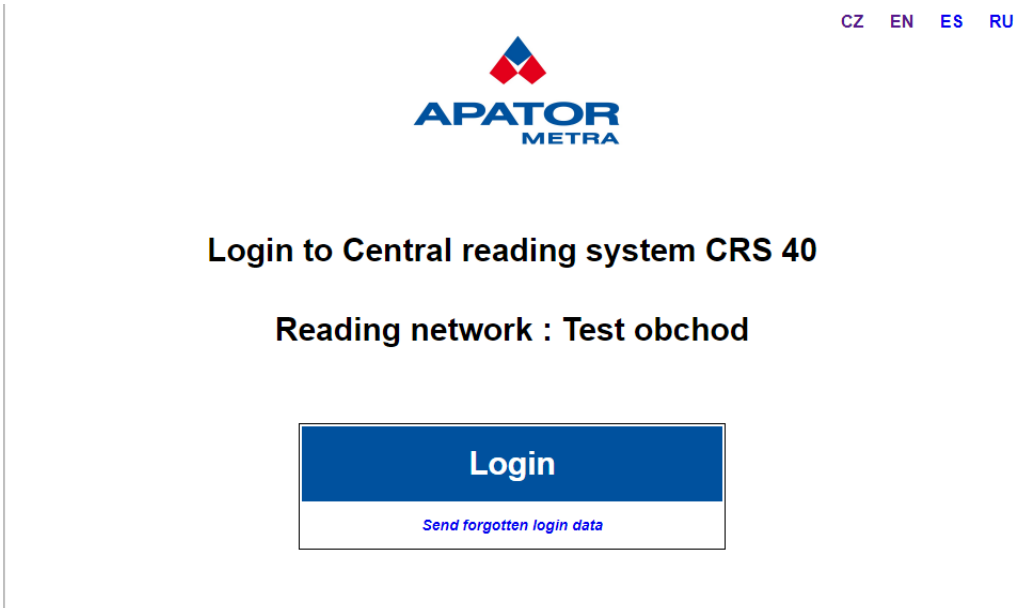


Illustration 10: Log in page in the reading network

10.3. Main page of the reading network

After a successful login, the main page of the reading network opens. On this page you will find the main readout data by date (in yyyy-dd-dd format):

- **Missing / Unread / Total** - the read-out device is considered to be Missing if it does not occur after a set period of time (default 7 days, more in Chapter 10.5 Setting System Parameters) to receive data from this unit. This may be due to a failure, dismounting, or shielding by material impenetrable for radio waves. A device is assigned as Missing if it has not been deducted by the system for at least 1 day but shorter than the set time. The rationale for classifying a unit between an unrecorded one may be only a temporary deterioration of the radio broadcasting conditions, so the system is not considered to be an error (no error message is sent). Clicking on a specific item opens a detailed list of non-found or unread units.
- **The electronic seal violation** - if the heat cost allocator from the radiator or radio module is removed from the water meter, or if the long-term presence of the magnetic field is detected near the radio module, the unit sends the radio signal in the radio signal. The module indicates magnetic field detection only after the presence exceeds several hours. The time at which the presence of the magnetic field occurs is set at the factory and can not be changed. Clicking the Broken Electronic

Seal opens a detailed list of units with broken electronic seal or, in the case of a radio module, on a water meter with a detected presence of a magnetic field near the module.

- **Excessive back flow** - If the back flow exceeds the limit defined in <Settings>, the radio module will be listed in this column. This may be a mistake when installing, or manipulation with the meter by a flat user. Clicking on this item opens a detailed list of radio modules where the set back flow has been exceeded, including the percentage of return flow as compared to the forward flow
- **Error Messages** - Here you can download the above described lists of missing devices, devices vith broken electronic seal, and modules with excessive back flow in the ZIP format.
- **TXT file** - here you can download data for a given day. The data is stored in a TXT file and packaged in ZIP format.

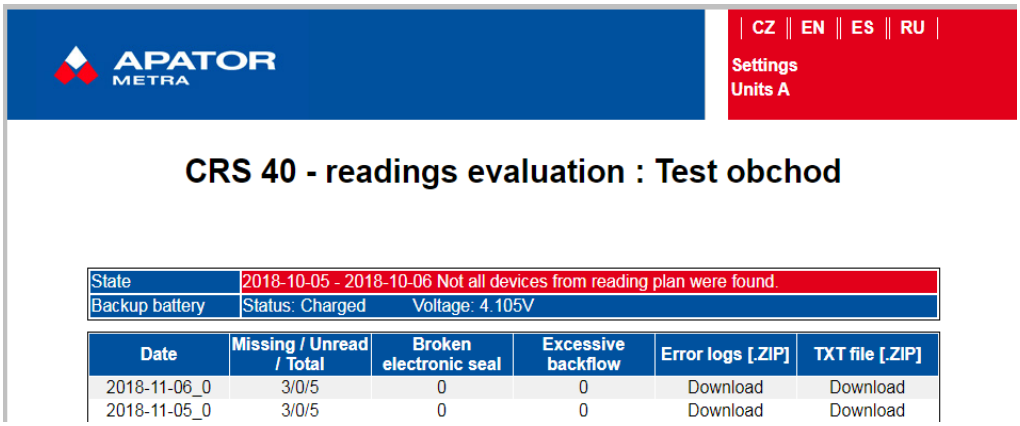


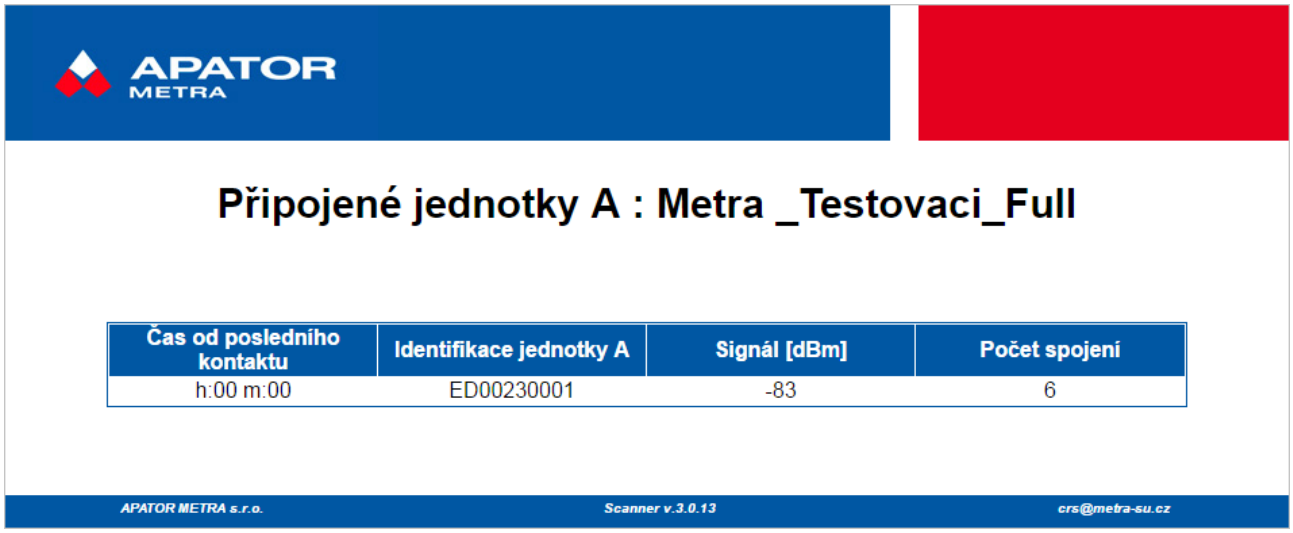
Illustration 10: Main page of the reading network

- **Units A** - Click on this link to see a detailed list of the connected A units, including the time since the last communication with the B control unit.
- **Settings -** Here you can set the system parameters

10.4. List of units A connected to the reading network

If you click the <Units A> link on the main page, a simple overview table with A collector units that are currently connected to the B control unit opens. The units are identified by the RF MAC address (see Chapter 6.1 RF RF Reading network address).

- **Time since the last contact** - time since the last connection between the collecting unit A and the control unit B
- **Signal [dBm]** - indicates the signal strength at the last connection between the collecting unit A and the control unit B. The number is always negative. The ideal value is between -25 and -90 dBm. With a stronger signal (eg -17 dBm), the B module's radio module is overwritten, the lower value (say -100 dBm) may not be sufficient to make a faultless connection.
- **Number of connections** - indicates the number of connections between the unit A and the control unit B since the last system restart.



Připojené jednotky A : Metra _Testovaci_Full

Čas od posledního kontaktu	Identifikace jednotky A	Signál [dBm]	Počet spojení
h:00 m:00	ED00230001	-83	6

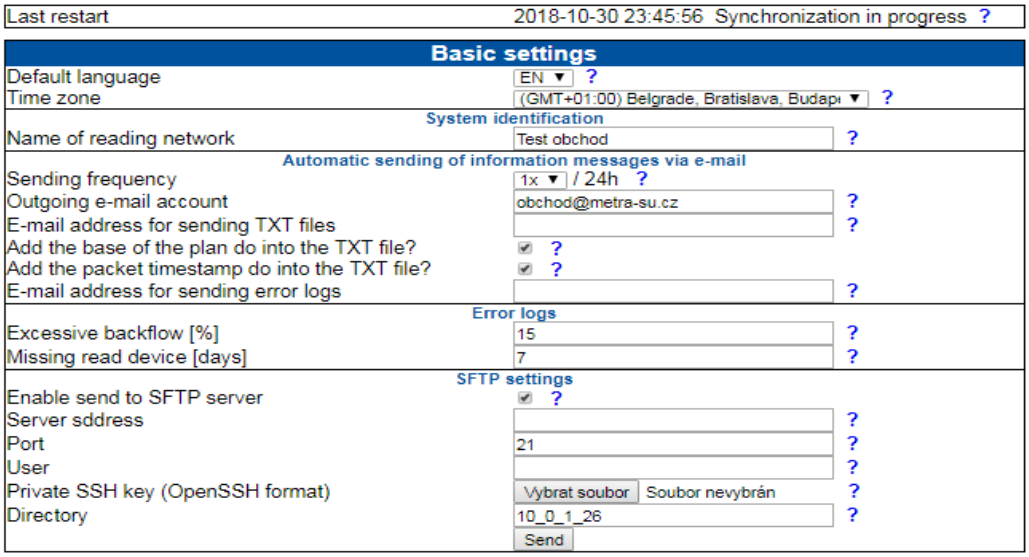
APATOR METRA s.r.o. Scanner v.3.0.13 crs@metra-su.cz

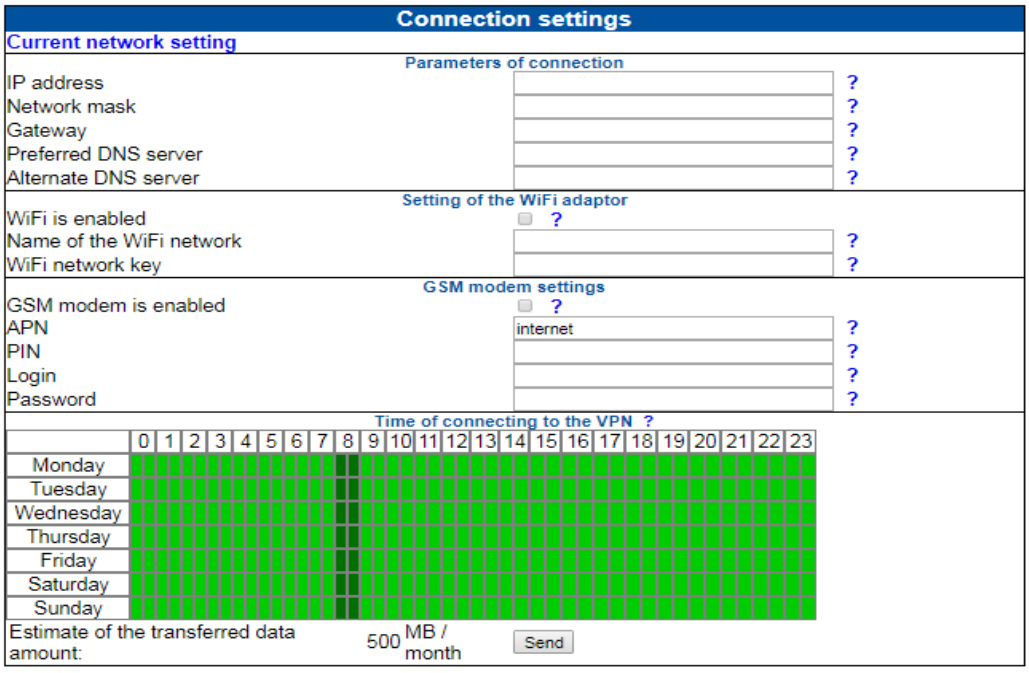
Illustration 11: A list of units A connected to the reading network

10.5. System parameters setting

On this page, you can set the parameters of the reading network. You can also get help by clicking the question mark icon for a specific item.

Warning! Unit B can be set only when online connected to Central reading system (direct connection or connection via Internet)!





Last System restart

Indicates time of the last system restart. can be caused by software update, new reading plan loading or by power failure. After restart, availability of devices are checked again (like during installation).

Time on the display is followed with a source upon which the unit time and date was set:

- Time by NTP – Time and date is synchronized from NTP server.
- Time by E-ITN / E-RM –Synchronization from NTP server failed. System is synchronized using date from read units (E-ITN and E-RM) radio packets.
- Synchronization in progress - System attempts to get current date and time

For more information see Setting: NTP server or manual.

Default Language

Language for viewing pages of the system, generating error logs and sending information e-mails.

Name of reading network

Text description of reading network - this reading network will be identified by given name in error logs and information e-mails. This setting does not affect functionality of the system.

Data sending frequency

Here you can choose how many times a day the CRS closes the reading and sends the data. By default, the unit closes once a day at 22 o'clock. If we choose a higher frequency, the unit divides the day by the number of readings, closes the data and sends data at these times.

Outgoing e-mail account

You will receive information e-mails from this e-mail address (address will be used as sender in information e-mails). You can set the rules for resending of information e-mails in your e-mail server or filter obtained e-mails in your e-mail client using this address.

If using SMTP server of APATOR METRA, e-mail address should use real existing domain (it depends also on setting of your e-mail server - e-mails from non-existing domains are usually ignored).

If using another SMTP server, Setting: SMTP server, contact your Internet provider fro detailed information. Additionally, if you do not fill this field, you will not be able to request forgotten login data to your e-mail.

E-mail address for sending TXT files

You will receive every day information e-mail with reading results to this e-mail address. Data are saved in TXT format. If you do not fill this field you will not receive any automatic information e-mails with actual readings. You can also download reading results from page with evaluation of readings packed in ZIP archive at any time.

Add base to TXT files?

If this option is checked, a location based on the plan base is also added to the readout file.

Add time of reading the packet into TXT files?

If this option is checked, the date and time that the data was received is added to the readout file.

SFTP server settings

Using the SFTP server will allow you to access data or unit settings via SFTP server, even if the drive is not currently connected to the VPN (see Times of connecting to the VPN). If you are interested in using this feature, select Send data to SFTP server.

Server configuration is done during production.In default settings (is allowed to use SFTP server and address is not filled in) unit sends data to SFTP server of manufacturer.

In the Folder window, you can define the folder where the drive will store the data (by default, the drive itself creates a folder named according to the VPN IP address of the CRS). If you make your own settings and need to return to the default setting for some reason, simply delete the name in the Folder window, and the unit restores the default settings when it closes the data.

The SFTP server also allows you to change the unit settings. The Config folder is located in the Drive folder. Save the settings text file in the “settings” file (the file specification is in Appendix 1 of this manual). If the setup file is located in the Config folder, the drive will use it, apply the settings, and delete the file.

NTP Server

NTP server serves for setting of exact time using NTP (Network Time Protocol). Exact setting of internal system clock is necessary for precise information about read devices. If you are not sure of NTP server address, please contact your Internet provider.

In case of unavailability of NTP server (e.g. problems when connecting to Internet, limitation of NTP by provider, etc.), control unit is synchronized using date in radio packet sending by read devices. This synchronization method is less precise and needs more time during installation. Control unit B must have radio contact with at least one collecting unit A.

During the installation, time is determined first, then follows the first reading. If you click on "Log" link during the synchronization phase, window with system messages about synchronization process opens. Later during routine system operation the synchronization mode can be found in settings: Last restart

IP address

Use static IP address only if dynamic addressing using DHCP protocol is not available (e.g. when provider does not support it). This is IP address inside your provider network and it is not related to the IP address on the label of control unit B. For exact setting please contact your Internet provider.

Attention: Unadvised change in this parameter can cause loss of possibility of remote access to reading network

Network Mask

Network mask setting. Fill only if you use static IP address (see above). For exact setting please contact your Internet provider.

Gateway

Network gateway setting. Fill only if you use static IP address (see above). For exact setting please contact your Internet provider.

DNS

Preferred and alternate DNS server setting. Fill only if you use static IP address (see above). For exact setting please contact your Internet provider. It is not necessary to fill the alternate DNS server (it let the system connected to the Internet even in the case of preferred DNS server troubles).

Wi-Fi is Enabled

Allow Wi-Fi access

Name of the Wi-Fi network

Ask your provider to get the Wi-Fi name

Wi-Fi Password

Ask your provider to get the password.

GSM Enabled

When checked, the use of GSM modem (connected to the USB) is enabled.

SMTP Server

SMTP server is used for transfer of electronic mails. If this field is left empty (standard option), SMTP server of APATOR METRA will be used for sending the information e-mails.

Fill this field only if you want to use SMTP server of your Internet provider. For exact setting please contact your Internet provider.

Saving data to SFTP from more units to one directory

Generated ZIP files that CRS sends via e-mail or to SFTP server, has prefix hostname of CRS unit. It is possible to have on SFTP server one directory that all CRS units can write into.

Name of send files (example): YYYY-MM-DD_N.rfu.txt.zip --> <CRS hostname>_YYYY-MM-DD_N.rfu.txt.zip (např. 10-0-1-23_2020-01-01_0.rfu.txt.zip)

E-mail address for sending error logs

You will receive information e-mail with error logs to this e-mail address. You will get e-mail only when system detects some error. Following events are considered as error:

- device was not detected by the system for the set number of days (typicaly 7 days),
- electronic seal in device was broken,
- backflow in water meter is bigger than set value.

Error logs are sent in standard HTML format for Internet browser and are compressed in ZIP archive. We recommend you to pay increased attention to these messages. It is better to use different e-mail address than for everyday readings. You can also view error logs in page with evaluation of readings or download them packed in ZIP archive at any time. If you forget your login credentials to the system, you can have it sent to this email address.Therefore we strongly recommend to fill this item.

Excessive backflow

Enter here limit for maximal backflow in percentage. In case that water meter backflow will exceed set value, system will interpret this situation as an error. This is indicated in page with evaluation of readings. If you set sending of information e-mails with error logs, you will also get e-mail notification.

For this purpose backflow is calculated as percentage ratio

backflow in past billing period / forward flow in past billing period.

In case that there is no forward consumption in past billing period (usually because no billing period is closed already), ratio is calculated from cumulative consumptions from moment of installation

current back-flow / current forward flow.

If water meter is installed in opposite direction (i.e. no forward flow and high back-flow), system interpret ratio as 100 %.

Missing read device

If the read device (heat cost allocator or radio module for water meter) is not found for set number of days, it will be consider as missing. So it will be mentioned in the main page and it will be put to the error log that is sent by e-mail to the operator. This setting will also affect the installation - after set time system finishes the installation and switch to the routine operation. If the field is let empty, system use standard setting (7 days).

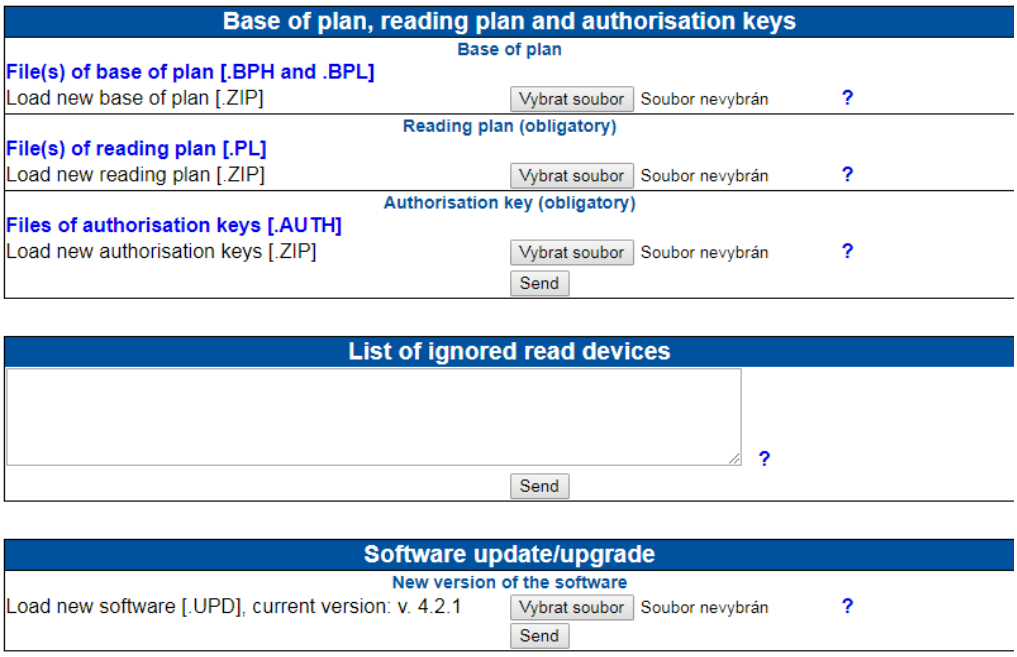


Illustration 7: Other settings of the reading network

Load new base paln

Using base of plan (files BPH and BPL) enable easier orientation in reports and error logs. Not only serial number of device but also text description of its location is mentioned. Using base of plan is optional, but without it only serial numbers without description will be used. To load base of plan files .BPH and .BPL must be packed in .ZIP archive without any directory structure, **files of current base of plan will be deleted.**

Load new reading plan

Reading plan (list of read devices) is essential for functionality of the system. Reading plan is required for comparing of planned situation (i.e. installed devices) with really detected devices. It is absolutely necessary to use up-to-date reading plan. If you change some device, etc., you have to make and load a new reading plan. To load a reading plan, file(s) .PL must be packed in .ZIP archive without any directory structure, file(s) of current reading plan will be deleted. System is restarted every time when reading plan is loaded. After restart, availability of devices are controlled again (like during installation).

Load new authorization keys

Authorization keys are necessary for decoding consumptions. In case of unit replacement, it is therefore necessary to upload new authorization keys. To load authorization keys, .AUTH file (s) must be packaged in a .ZIP file without a directory structure. **Files of existing authorization keys will be deleted when uploading new files!** After the authorization keys are uploaded, the system will be restarted. After restarting the system, unit availability check is performed (like during installation).

If in a reading plan are units which do not have loaded authorization keys, it is then displayed as reading units without authorization key: number. Click to see list of units with missing authorization keys.

.AUTH files can be found on the APATOR METRA website authdata.metra-su.cz. In case of troubles, please contact us.

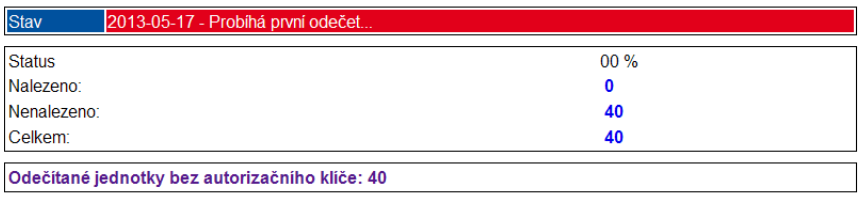


Illustration 8: Indication of missing AUTH files

List of ignored read devices

If you want to ignore some read devices (heat cost allocators or radio modules for water meters), despite they are used in reading plan, enter their serial numbers separated by comma.

Entry example: 111000214,101007016,32121399,32121398

System will not take into consideration these devices, e.g. Data will not be processed.

Load new software

When new version is issued, you can actualize system software. You can find actual version at our web pages www.metra-su.cz in section for authorized partners. In case of any doubt please contact manufacturer. File with new software must be in UPD format.

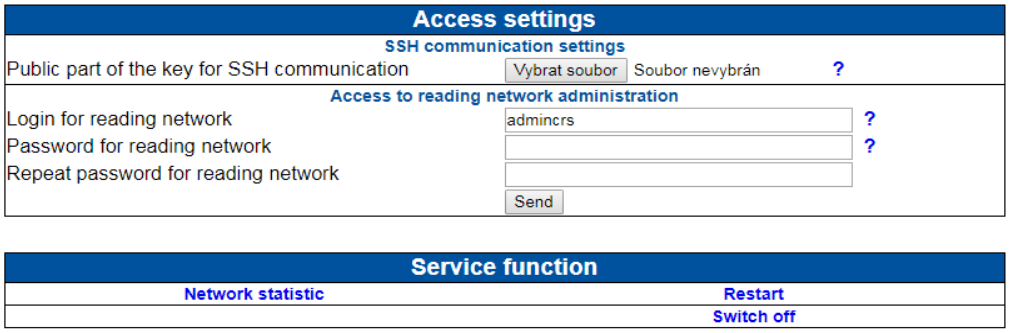


Illustration 9: Setting of access rights to reading network

Public key for SSH

There are two text SSH keys (private and public part of the key), which are needed to encrypt communication CRS and a computer (when backing up data). Please do not share the private key part with anyone. Public key part is uploaded in text format, click on “Select file” and choose upload file. **Private part of the key is for you only, do not upload it anywhere or send to anyanyone.**

Login for reading network

Login for access to administration of this reading network (i.e. one control unit B and one or more units A of CRS 40 system). If you forget login, it can be sent you together with password to e-mail you set in *E-mail address for sending error logs*.

Password for reading network

Password to access reading network (i.e. one control unit B and more units A in CRS 40 system). If you forget login, it can be sent you together with password to e-mail you set in *E-mail address for sending error logs*.

Unit restart

A complete restart of the unit, essentially turning it off and on again.

Unit shut down

A complete shut down of CRS unit, it can only be turned on by restoring unit B power supply.

11. For advanced users

It is reasonable to make backup of data from control units of reading network to your personal computer hard drive time to time (possibly burn it on CD/DVD). To avoid time consuming and boring download of data for every day from every unit B separately, automatic synchronization can be done. This is helpful especially if you manage large number of reading networks.

First, download the necessary files from manufacturer's website www.metra-su.cz

To increase security, you can only synchronize using a security key. This method also allows you to automate running a synchronization script (e.g. using a Task Scheduler) without entering a name and password.

Generating security key

Before starting the synchronization make sure you go through the steps listed below.

1. Generating files with keys for encrypted communication with CRS
Open file "metra_keygen.bat" then two files are created: "key_sync" and "key_sync.pub". In the first part, the private key is stored, the second part contains public key. Do not share, tell or disclose the private part of the key. Treat it like a password.

2. Copy public part to CRS
Sign in to CRS with username and password. On the settings page locate "Access Rights Settings" click on “Select file” in “SSH Public Key File" choose key_sync.pub file and confirm with the "Send" button.

11.1.1. Basic synchronization setting

Basic synchronization (i.e. automatic data downloading only from one unit B to your local computer) is described here. First create some folder (e.g. C:\crs40) where you copy downloaded files. Open ***apator_metra_sync.bat*** file in any text editor, e.g. Notepad.

Synchronization by encrypted key

Synchronizace pomocí šifrovacího klíče

```
@echo off

set IP=<Přidělená IP adresa>
set DESTDIR=<Jméno adresáře>
ping %IP%
mkdir %DESTDIR%
rsync -e "./ssh -i ./key_sync -o UserKnownHostsFile=./KnownHosts -o StrictHostKeyChecking=no" -avz --delete %LOGIN%@%IP%:/metra/ %DESTDIR%
pause
```

Edit the file accordingly:

- *<Assigned IP address>* – replace it with unit B IP address. It can be found on identification label (Chyba: zdroj odkazu nenalezen).
- *<Folder name>* – replace it with folder name where you want to save the data downloaded from control unit B. The best solution is to choose folder name same as name of reading network (e.g. C:\crs40\prazska12). Folder name can not contain spaces. It is not necessary to create this folder manually, it is created automatically during the synchronization.

Save edited file – name the file as you wish (it is important to leave appendix .BAT). To perform synchronization open the file. Before you launch script make sure VPN is connected.

If the encryption keys are set correctly, the synchronization is performed automatically. Only new data is downloaded (since the last synchronization).

Downloading data will take longer when you do it for the first time (or after a long time). Next synchronization will download only new data. Do not close window with text while synchronization is in progress – it will be closed automatically once the downloading is finished.

To work with the data, open a folder where it was saved (C:\crs40\metra) and launch file ***index.html***

11.1.2. Advanced synchronization setting

You can make synchronization of more units using one synchronization script. It is in fact synchronization script copied multiple times in one file and each script copy has different IP address and different download folder for data.

The control units B you want to synchronize simultaneously must also belong to one network (for more information, see chapter 9.1. VPN network structure) and a file with public key has to be loaded on them (Copy the public key to the CRS).

Synchronization script will looks as follow:

```
@echo off

set LOGIN=<login 1>
set IP=<Přidělená IP adresa 1>
set DESTDIR=<Jméno adresáře 1>
ping %IP%
mkdir %DESTDIR%
rsync -e "./ssh -i ./key_sync -o UserKnownHostsFile=./KnownHosts -o StrictHostKeyChecking=no" -avz
--delete %LOGIN%@%IP%:/metra/ %DESTDIR%

set LOGIN=<login 2>
set IP=<Přidělená IP adresa 2>
set DESTDIR=<Jméno adresáře 2>
ping %IP%
mkdir %DESTDIR%
rsync -e "./ssh -i ./key_sync -o UserKnownHostsFile=./KnownHosts -o StrictHostKeyChecking=no" -avz
--delete %LOGIN%@%IP%:/metra/ %DESTDIR%
...
set LOGIN=<login n>
set IP=<Přidělená IP adresa n>
set DESTDIR=<Jméno adresáře n>
```

```
ping %IP%
mkdir %DESTDIR%
rsync -e "./ssh -i ./key_sync -o UserKnownHostsFile=./KnownHosts -o StrictHostKeyChecking=no" -avz
--delete %LOGIN%@%IP%:/metra/ %DESTDIR%


pause
```

Use recommendations from previous chapter to edit and run the script.

11.2. Configuration of unit B over SFTP server

For configuration of many reading networks it is possible to use automatic configuration of unit B over SFTP server.

12. The most common user problems

Problem description	Recommended solution
Connection to Central reading system does not work	Functional remote connection of computer to Central reading system depends on simultaneous function of several chain links. Properly set computer, functional connection to virtual private network, a properly operating and set control unit B. First check if you Internet connection is functional. Then check if your setting of n2n Gui is correct. Login data must be the same as in control unit B. You can also check the functionality of server – open command line and use command ping (*ping CRS 40*). The functionality of your connection can be checked similarly connection of unit B (*ping [IP address of unit B]*). You must be connected to VPN.
I do not get information e-mails from reading networks	Check that the e-mail addresses for sending information e-mails (Settings: E-mail address for sending TXT files; Settings: E-mail address for sending error logs).
	Check the e-mail account for outgoing mail (Settings: Outgoing e-mail account). If using SMTP server of APATOR METRA, e-mail address should use real existing domain (it depends also on setting of your e-mail server – e-mails from non-existing domains are usually ignored). If using another SMTP server (Settings: SMTP server), contact your Internet provider for detailed information.
	If you do not use SMTP server of APATOR METRA (item Settings: SMTP server is not empty), check the setting. It is SMTP server for sending the e-mails – this server must be determined by Internet provider. It is not SMTP server you have set in your e-mail client.
Synchronization does not work	Check the functionality of connection to reading network (see above). If connection is set properly, check the syntax of synchronisation script in rsync application. When SSH key is used, check if its correctly typed or generate a new one.

13. Instalation methods

13.1. General recommendations

Some recommendations are valid for all types of installations. Installation can be problematic if you would not follow them.

1. Do not place unit B to basement. Radio signal between collecting units A and control unit B spreads mainly through free space via reflections (especially in multi-entrance buildings).

2. Place units of CRS 40 closer to the windows. This location is better for both contact between collecting units A and control unit B and getting the signal from read devices.

3. Installation in single tower building can be exception. Installation of CRS 40 units near central shaft (if such shaft exists and not used for e.g. elevator) is more appropriate.

13.2. Construction system T0xB (Czech Republic)

Recommended positioning of unit A is in the stairwell, vertically one floor above the half of the building height. Vertical reach of control units is approximately 6-7 floors. Positioning of control unit B is limited mainly by reach of the Internet connection, suitable position can be in an elevator machine room. Maximum distance A ↔ B is roughly 4 entrances to buildings, minimum distance should not be less than 5 meters. Conditions may vary from building to building.

14. APPENDIX 1A: CONFIGURATION OF CRS40 VIA SETTING FILE ON SFTP SERVER

GENERAL INSTRUCTION

Settings.txt file must be placed on the SFTP server in the folder accociated with the respective CRS unit, in subfolder config

When the file has been applied it will be deleted (this wil be the indication whether the file has been applied).

File structure:

- coding UTF-8
- styl of the end of line UNIX (end of line = <LF>)
- one line for each parameter
- line format must be: <parameter to change>=<new value>
- the file needs to contain only the parameters that need to be changed
- the order of parameters in the file is optional

PARAMETERS AND THEIR MEANING:

GSM connection

- EnableGSM
  - turns on and off GSM modem
  - values 0, 1
- GSMAPN
  - setting APN
- GSMPIN
  - setting of PIN code
- GSMLogin
  - username
- GSMPassword
  - password

Data consumption check

- GSMDataChekEnable
  - Turns on or off data consumption check
  - Can be values of 0, 1; 0 = turns of check, 1 = turns on check
- GSMDataLimit
  - Sets monthly data quota, value in megabytes (MB)
  - Values from 1 to 100 000
- GSMDataStartDay
  - Sets first day of billing period
  - Values from 1 to 28
- GSMDataMailLimit
  - Sets limit in percentage of data limi after info mail is send
  - Values from 0 to 100. Value turns off alert
- GSMDataVPNLimit
  - Sets limit (in percentage of monthly data plan) after going over it VPN connection is limited (unit will be connected only to VPN in service windows between 8:00 - 9:00 hod.).

- Values from 0 to 100. Value 0 turns off VPN limit.

Síťové parametry (eth0)

- IPAddress
  - IP address
  1. only valid IP address can be entered (= in correct format, it is checked agains regular expression) or empty string
  - if empty string is entered, eth0 is set to DHCP
- NetMask
  - network mask
  - valid IP address or empty string
- Gateway
  - gateway
  - valid IP address or empty string
- DNSServer1
  - primary DNS server
  - valid IP address or empty string
- DNSServer2
  - secondary DNS server
  - valid IP address or empty string

Reading settings

- BaseToDataFile
  - Add baseplan to TXT files?
  - Values of 0,1 (0 = no, 1 = yes)
- DateTimeToDataFile
  - Add time of reading packet to TXT files?
  - Values of 0,1 (0 = no, 1 = yes)
- ExpiredLimit
  - Not found unit [days]
  - Values of 0-30
- IgnoredDevices
  - List of ignored devices
  - Serial number of allocators or radio modules that should be ignored separated by a comma
- InstallMode
  - Sets unit to installaction mode
  - Value of 1
- OverflowLimit
  - Too high back flow [%]
  - Values of 0-100
- ReadAllUnits
  - turns on/off reading all authorised allocators
  - Values of 0,1
- SendFreq
  - Frequency of sending data (end of data reading)
  - Parameter can has values of 1,2,3,4,6

Mail setup

- CurEmail
  - E-mail for sending
  - string is checked against regular expression
- DataEmail
  - E-mail address for sending TXT files, can be a list of addressed separated by a semicolon
  - string is checked against regular expression
- ErrEmail

- E-mail address for sending error reports, can be a list of addressed separated by a semicolon
- string is checked against regular expression

Settings of SFTP server

- EnableSFTP
  - turn on/off of SFTP
  - values of 0, 1
- SFTPServer
  - address of SFTP server
- SFTPPort
  - SFTP port
- SFTPUser
  - user on SFTP server
- SFTPSSHKey
  - private SSH key – name of file with a key
  - soubor has to have priv extension and has to be in a same directory as file settings.txt
- SFTPFolder
  - directory on SFTP server

System settings

- CRSSSHKey
  - public SSH key for CRS unit - name of file with key
  - soubor has to have pub extension and has to be in a same directory as file settings.txt
- CRSLogin
  - login name for reading newtork
  - cannot be an empty string
- CRSPassword
  - password for reading netwrok
  - cannot be an empty string
- DefaultLanguage
  - Default interface language
  - Can be values of CZ,ES,EN,RU
- NetworkName
  - Name of reading network
- TimeZone
  - time zone
  - check of name of time zone in /usr/share/zoneinfo

VPN time settings

- VpnSchedule1..7 (1=Monday.. 7=Sunday)
  - Setting of time of connecting to VPN
  - line has to have 48 values (half hours)
  - each value can be values of 0,1 0=not connected, 1=connected
  - example:
    - VpnSchedule3=000000000000001111111111111111000000000000000000
    - explanation in Wenesday VPN will be connected from 7:00 to 15:30

Wi-fi settings

- EnableWifi
  - turn on/off wifi
  - can be values of 0, 1
- WifiKey
  - wi-fi network key
- WifiSSID

- wifi network name

15. Appendix 1B: Example of a configuration file

```
DefaultLanguage=CZ
NetworkName=TEST
SendFreq=2
CurEmail=CRSB@metra-su.cz
DataEmail=ston@metra-su.cz
ErrEmail=ston@metra-su.cz
BaseToDataFile=0
DateTimeToDataFile=1
OverflowLimit=15
ExpiredLimit=1
IgnoredDevices=31000001,32000001
InstallMode=1
VpnSchedule1=000000000000001111111111111111000000000000000000
VpnSchedule2=000000000000001111111111111111000000000000000000
VpnSchedule3=000000000000001111111111111111000000000000000000
VpnSchedule4=000000000000001111111111111111000000000000000000
VpnSchedule5=000000000000001111111111111111000000000000000000
VpnSchedule6=000000000000000000000000000000000000000000000000
VpnSchedule7=000000000000000000000000000000000000000000000000
GSMDataChekEnable=1
GSMDataLimit=100
GSMDataStartDay=1
GSMDataMailLimit=80
GSMDataVPNLimit=90
```