

RADIO READING UNIT

Installation and service manual

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1. INTRODUCTION

Radio reading unit RFU 35 is used for data reading from the electronic heat cost allocators E-ITN 30 and radio modules for water meters E-RM 30. This manual describes the operation and function of RFU 35 and also of control software RFU PC.

1.1. RFU 35 DESCRIPTION

The radio reading unit RFU 35 in its basic version is supplied with omni-directional antenna capable of receiving radio signal. CD with installation file for RFU PC software and RFU30.sts file with application number (licence file) are also included.

Directional panel antenna ZZ P-868 can be ordered as optional accessories. Antenna allows better signal receiving from heat cost allocators and radio modules for water meters.



Illustration 1: RFU 35



Illustration 2: Panel antenna ZZ P-868

For work with RFU 35 any computer with installed Microsoft Windows XP / Vista / 7 is required (notebook / netbook) (in the text refereed as "computer"). RFU 35 is connected via standard USB port.

Warning!

License file [.STS] is provided by manufacturer and intended for use in one installation of the RFU PC control software on one computer only.

Regular backup is recommended. The manufacturer assumes no liability for any loss of data.

1.2. TECHNICAL SPECIFICATION

Power supply	via UBS connector
PC connection	USB port 1.1 and higher
Antenna	omni-directional SMA antenna (1 dB) – included
	panel antenna ZZ P-868 (8,7 d Bi) – optional accessory
Supported OS	Windows XP, Windows Vista, Windows 7 (including Windows 7 Starter)



1.3. CONTENTS OF THE PACKAGE

The manufacturer thoroughly inspects and tests all RFU 35 units before shipping. After receiving please check their integrity and completeness. In case of units damage, contact manufacturer or transport company immediately.

Package includes::

- RFU 35 unit
- omni-directional 1 d Bi antenna
- CD with software and licence file





2. CONTROL SOFTWARE INSTALLATION

2.1. RFU PC INSTALLATION

Before starting work with RFU 35 unit, RFU PC application need to be installed. Installation data for RFU PC can be found on the CD in the folder:

- *RFU PC V0.0 INSTALLER* all Windows versions (XP, Vista, 7, Server) except W7 Starter
 RFU PC V0.0 INSTALLER WINDOWS 7 STARTER Windows 7 Starter

(Illustration 3: RFU PC installer location on CD), authorized partners can download installation file from the manufacturer's website.



Illustration 3: RFU PC installer location on CD

1. Run executable file **setup.exe**. It performs setup initialization.







2. After a successful initialization, select installation folder.

Destination Directory Select the primary installation directory. All software will be installed in the following location(s). To install software into a different location(s), click the Browse button and select another directory. Directory for RFU PC V0.0 C:\Program Files\RFU PC\ Browse Directory for National Instruments products C:\Program Files\National Instruments\ Browse	¥0.0		
different location(s), click the Browse button and select another directory. Directory for RFU PC V0.0 C:\Program Files\RFU PC\ Browse Directory for National Instruments products			
C:\Program Files\RFU PC\ Browse Directory for National Instruments products			
Directory for National Instruments products			
		1	
		Brow	wse
	C:\Program Files\RFU PC\ Directory for National Instruments products		
	C:\Program Files\RFU PC\ Directory for National Instruments products	Brow	

Warning!

Administrator rights are required for software installation. If unit will be operated by other user than administrator, we recommend in Windows Vista and higher, not to install the software to Program Files folder, but e.g. to C:\RFU. *Program Files folder has high security level, that would make difficult to use RFU 35 unit (normal user does not have write permission).*

3. Select the option *"I accept the License Agreement(s)"* in the License Agreement and confirm it by <Next>.

RFU PC VO.O			
License Agreement You must accept the license(s) displayed	d below to proceed.		
NATIONAL INSTRUMENTS S	OFTWARE LICE	NSE AGREE	MENT
INSTALLATION NOTICE: THIS IS A CONTRAC AND/OR COMPLETE THE INSTALLATION PR DOWNLOADING THE SOFTWARE AND/OR C COMPLETE THE INSTALLATION PROCESS, AGREEMENT AND YOU AGREE TO BE BOUN BECOME A PARTY TO THIS AGREEMENT AN CONDITIONS, CLICK THE APPROPRIATE BL DO NOT INSTALL OR USE THE SOFTWARE, (30) DAYS OF RECEIPT OF THE SOFTWARE, MATERIALS, ALONG WITH THEIR CONTAINE RETURNS SHALL BE SUBJECT TO NI'S THE 1. Definitions. As used in this Agreeme	COCESS, CAREFULLY I CLICKING THE APPLIC/ YOU CONSENT TO TH ND BY THIS AGREEME ID BE BOUND BY ALL DI BE BOUND BY ALL DI TON TO CANCEL TH AND RETURN THE SC (INCLUDING ALL ACC CRS) TO THE PLACE YO IN CURRENT RETURN	READ THIS AGRE ABLE BUTTON TH IE TERMS OF TH NT. IF YOU DO TH OF ITS TERMS AN IE INSTALLATION OFTWARE WITHIN OMPANYING WE DU OBTAINED TH OPOLICY.	EEMENT. BY O IS OT WISH TO ND N PROCESS, N THIRTY N THIRTY NTTEN HEM. ALL
		License Agreement	
	 I do not acce 	ept the License Agre	eement(sj.
	<< Back	Next >>	Cancel





4. In the next window confirm the list of available components and click on <Next>.

RFU PC ¥0.0				<u>_ </u> >
Start Installation Review the following summary	u before continuina	6		
neview the following summary	y berore continuing.			
Adding or Changing				
•RFU PC V0.0 Files				
ck the Next button to begin installation.	Click the Back but	ton to change the	installation settings.	e.
	Save File	<< Back	Next>>	Cancel

5. Then you will be informed about the successful installation, confirm by <Finish> button.

🥫 RFU PC ¥0.0			
Installation Complete			
The installer has finished updating your system.			
	<< <u>B</u> ack	<u>N</u> ext>>	<u>F</u> inish

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2.2. DRIVER INSTALLATION

A device driver is a program that controls a particular type of device that is attached to your computer. A device driver essentially converts the more general input/output instructions of the operating system to messages that the device type can understand and that is why RFU 35 driver need to be installed.

For device driver installation, administrator rights will be required.

2.2.1. Windows XP

1. Connect the RFU 35 unit to a USB port on your computer. Windows will automatically detect that you have plugged in a new device.

Found New Hardware RFU35	
I ? CQ CREBA	2:47 PM

2. If connected to the Internet, you can choose "Yes, this time only" or "Yes, now and every time I connect a device" in "Found New Hardware Wizard" and click on <Next> button. Operation system will try to find the right driver.

Found New Hardware Wize	ard
	Welcome to the Found New Hardware Wizard Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission). Read our privacy policy Can Windows connect to Windows Update to search for software? Yes, this time only Yes, now and every time I connect a device No, not this time
	< Back Next > Cancel
Your new hardware is installe	

図 『 《 × ● Q Q 載 型 の 国会 3:17 PM



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3. If you do not have an Internet connection, install driver manually. Hardware wizard have to pop up automatically, if not click on the notification "New hardware found" – 1. Select *"No, not this time"* and click on <Next>.



4. Select "Don't search. I will choose the driver to install" and click on <Next>.

Hardware Update Wizard
Please choose your search and installation options.
<u>Search for the best driver in these locations.</u>
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM)
Include this location in the search:
F:\ Browse
Don't search. I will choose the driver to install. Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< <u>B</u> ack <u>N</u> ext > Cancel





5. You have some drivers listed in this screen, but simply click <Have Disk> and continue with the next dialogue.



6. Click on <Browse>.

Select the	device driver you want to install for this hardware.
<mark>Install</mark>	From Disk
	Insert the manufacturer's installation disk, and then make sure that the correct drive is selected below. Cancel
ð	Copy manufacturer's files from:
	< Back Next > Cancel



7. In folder where RFU PC is installed (Program Files\RFU PC\FTDI data by default) choose a file *ftdibus.inf* and click on <Open>.

Choose any INI	F file from a driv	ver folder you wis	h to integrate:	:	? 🛛
Look in:	🚞 FTDI data		✓ G) 🏚 🖻 🖽	.
My Recent Documents	Carl adm64 Carl 386 Carl ftdibus.inf				
My Documents					
My Computer					
	File <u>n</u> ame:	ftdibus.inf		~	<u>O</u> pen
My Network	Files of type:	Inf files (*.inf)		~	Cancel

8. Select the driver file and confirm by <OK>.

	pdate Wizard device driver you want to install for this hardware.
🥳 Install	From Disk
	Insert the manufacturer's installation disk, and then make sure that the correct drive is selected below. Cancel
B	Copy manufacturer's files from: C:\Program Files\RFU PC\FTDI data
	< <u>B</u> ack Next > Cancel



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9. Now just click on <Next>.



10. Windows XP will warn you that the driver is not certified, so click on <Continue anyway>.

Hardwa	re Installation
1	The software you are installing for this hardware: USB Serial Converter has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.) Continuing your installation of this software may impair or destabilize the correct operation of your system either in the past or in the future. Microsoft strongly recommends that you stop this installation now or you may not get the free Linux software that Microsoft may pass out for testing in the future.
	Continue Anyway STOP Installation





11. Wait while Windows installs the driver.

ound New Hardware Wizard				
Please wait while the wizard installs th	e software			
USB Serial Converter				
ŝ				
Ď	>			
usbser.sys To C:\WINDOWS\system3	2\DRIVERS			
	< Back Next > Cancel			

12. Confirm successful installation by <Finish>.







2.2.2. Windows 7

1. Connect the RFU 35 unit to a USB port on your computer. Windows will automatically detect that you plugged in a new device.



2. If you have internet connection and Windows Update is not switched off, system will install all required drivers automatically.

USB Serial	Converter software installed su	∢ × uccessfully.		
	EN .	5	()	8:51 25.7.2012

3. If internet connection and Windows Update is not available, installation error will be announced.



4. In this case you need to install driver manually. Click the Start button, and than click Control panel and select "Devices and Printers".







5. Click on "RFU35".



6. Window will pop up, click "Hardware" and than < Properties>.

RFU35 Properties	RFU35 Properties	X
Genera Hardware	General Hardware	
RFU35	RFU35	
Device Information	Device Functions:	
Manufacturer: Unavailable	Name	Туре
Model: RFU35	RFU35	Other devices
Model number: Unavailable		
Categories: Unknown		
Description: Unavailable		
Device Tasks		
To view tasks for this device, right-click the icon for the device in Devices and Printers.	Device Function Summary	
Devices and Finiters.	Manufacturer: Unknown	
	Location: Port_#0002.Hub_#0001	
	Device status: This device is working properly	<i>f</i> .
		Properties
OK Cancel Apply	ОК	Cancel Apply
OK Cancel Apply	Device status: This device is working properly	Properties





7. Choose "Driver". And in next window click < Update driver>.

RFU35 Properties	RFU35 Properties
General Driver Details	General Driver Details
RFU35	RFU35
Device type: Other devices	Driver Provider: Unknown
Manufacturer: Unknown	Driver Date: Not available
Location: Port_#0002.Hub_#0001	Driver Version: Not available
Device status	Digital Signer: Not digitally signed
No drivers are installed for this device.	Driver Details To view details about the driver files.
	Update Driver To update the driver software for this device.
*	Roll Back Driver If the device fails after updating the driver, roll back to the previously installed driver.
	Disable Disables the selected device.
	Uninstall To uninstall the driver (Advanced).
OK Cancel	OK Cancel

8. Than select "Browse my computer for driver software" option.

•	Search automatically for updated driver software Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.
•	Browse my computer for driver software Locate and install driver software manually.





9. Click on <Browse>, and select folder *"FTDI DRIVERS FOR 32bit AND 64bit WINDOWS (XP, Vista, 7, Server)"* located on manufacturer's CD in the window "Choose file", confirm <OK> and click <Next> in the window "Update driver software – RFU 35".

G	Update Driver Software - RFU35
	Browse for driver software on your computer
	Search for driver software in this location: FTDI DRIVERS FOR 32bit AND 64bit WINDOWS (XP, Vista, 7, Server) Browse Browse Include subfolders
	Let me pick from a list of device drivers on my computer This list will show installed driver software compatible with the device, and all driver software in the same category as the device.
	Next Cancel







10. System will find necessary drivers.

G	Aktualizovat software ovladače - RFU35
	Probíhá vyhledání softwaru v E:\FTDI DRIVERS FOR 32bit AND 64bit WINDOWS (XP, Vista, 7, Server)
	Storno

11. And perform installation.

🕞 🗓 Update Driver Software - RFU35	×
Installing driver software	

12. Close the window using button <Close>.





3. How to use control software

3.1. FIRST START

Copy the license file RFU30.STS before starting the program into the folder: [Your folder]\RFU30, e.g.: C:\RFU PC\RFU30. File is supplied on CD shipped with RFU 35 unit.

When starting RFU PC program, RFU35 unit must be connected with PC. Find folder RFU PC V0.0 in Start --> Programs. Click and run the RFU PC V0.0 program.

Note: The exact location of the link may vary depending on your operation system.



Warning!

If RFU PC application is installed in Program Files folder in operation systems Windows Vista and higher, you need to run a program as an Administrator (right click on the icon and choose "Run as administrator". Only users with administrator rights can do this.



If you have not copied the license file RFU30.STS, application window will prompt you.



License file RFU30.sts can be found on attached CD together with installation files. Copy file first e.g. on Desktop. Then select the path to the file and press <OK>.





If the RFU 35 unit is not connected to USB port, error message is displayed. Try to reconnect RFU 35 unit and run the program again.



connected to USB port

3.2. User interface description



Illustration 5: Graphical user interface of RFU PC





- 1. Status bar informing about the status of the reading unit and receive data mode:
 - BASIC: Mode to receive data without reading plan and base of plan
 - PLAN: Mode to receive data with reading plan and without base of plan
 - PLAN + BASE: Mode to receive data with reading plan as well as with base of plan.
- 2. List of all properly received devices (eight-digit number E-ITN 30, nine-digit number E-RM 30). Switch among lists using the button (18).
- 3. List of devices waiting to be received (eight-digit number E-ITN 30, nine-digit number E-RM 30).
- 4. List of devices received incorrectly (incorrect CRC).
- 5. Graphic information about number of received devices from total number of devices in the reading plan.
- 6. Information window displays informations about a particular read device (description belongs to the active field of the read device in one of the above lists), if PLAN + BASE option is selected..
- 7. Receiving unit status:
 - green OK
 - red failure
- 8. RFU 35 firmware version and serial number.
- 9. Last received packet status:
 - green CRC is correct
 - red CRC is incorrect.
- 10. Signal strength of the last received device.
- 11. Current loaded reading plan.
- 12. Start / stop data receiving.
- 13. Switching among the columns (2), (3), (4).
- 14. Inactive in current version.
- 15. Inactive in current version.
- 16. Load plan.
- 17. RFU 35 configuration.
- 18. Exit.

3.3. READING

- 1. Connect RFU 35 unit to USB port
- 2. Start the control software RFU PC. there is sign "Ready" in the status bar (Illustration 5: Graphical user interface of RFU PC, item (1)).
- 3. Click on <Load Plan> (14), select desired plan (if you don't want to use a plan, select *"NONE PLAN"*).
- 4. Click on switch (12) and start reading switch must be in "ON" position.
- 5. Reading is finished when you click on Exit (18). You will be asked if you really want to close data file. (Illustration 6: End of data file). If you select <OK>, file is closed and the next time the data will be saved in a new file (in this case 70-114.RFU). If <Cancel> is selected, next time data will be saved into file with last saved data (in this case 70-113.RFU).

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Finish data file "70-113.RFU" ?		
ОК	CANCEL	

Illustration 6: End of data file

Reading unit save data from all available devices (heat cost allocators and water meter radio modules). Read data are immediately saved and coded into the .RFU file on the hard drive. For decoding use software EITN-10 (for more informations, see EITN-10 manual).

If you choose receiving mode with reading plan (with or without base of plan) – there is displayed MODE: PLAN or MODE: PLAN + BASE in status bar (1) – you can check if reading was successful for all units. So if there is no item displayed in the yellow column (3), reading of all read devices was successful. At this time you can finish reading using switch (12).

3.4. STRUCTURE OF THE PROGRAM FOLDERS

Program is installed in selected folder (more in chapter 2.1. RFU PC installation) (standard C:\Program Files\RFU PC). This folder contains another folders with the following meanings:

- [program folder]\RFU30\DATA
 - contains data files with the readings in the format "X-Y.RFU"
 - "X" software identification number
 - "Y" order number of the data file
 - $^{\circ}\,$ all read data must be decoded then using decoding software EITN-10 (see more in the appropriate manual).
- [program folder]\RFU30\PLAN
 - upload .PL files with reading plans
- [program folder]\RFU30\BP\BPL
 upload .BPL files for 3 lower levels of the base of plan (level 3, 2, 1)
- [program folder]\RFU30\BP\BPH
 - upload .BPH files for 3 higher levels of the base of plan levels (level 6, 5, 4)



4. PLANNING OF THE READINGS

Radio reading unit saves data from all available devices (heat cost allocators and water meter radio modules) in the radio range. In order to make the work easier we recommend you to use reading plan and base of plan.

4.1. READING PLAN

The plan has a tree structure, which defines the path to individual read devices. This structure contains 6 levels, which can be used as needed. 1^{St} level is the lowest one ("closest" to read device, tree branch), 6^{th} level is the highest one ("furthest" from the read device, tree trunk) – see Illustration 7: Graphical presentation of the reading plan example.

Example of levels in the reading plan:

- 1. level Room
- 2. level Flat
- 3. level House
- 4. level Street
- 5. level Part of tcity
- 6. level City

4.1.1. Plan Matrix P

Plan matrix P defines a group of allocators chosen for reading (reading plan). Object numbers in six-level hierarchy are used for identification (see chapter 4.1.1.3. Meaning of matrix P columns).

p 00	p 01	p ₀₂	p 03	p ₀₄	p 05	\mathbf{p}_{06}	p 07	 p _{on}
p ₁₀	p ₁₁	p ₁₂	p ₁₃	p ₁₄	p 15	p ₁₆	p ₁₇	 p_{1N}
p ₂₀	p ₂₁	p ₂₂	p ₂₃	p ₂₄	p ₂₅	p ₂₆	p ₂₇	 p_{2N}
p ₃₀	p ₃₁	p ₃₂	p ₃₃	p ₃₄	p 35	\mathbf{p}_{36}	p ₃₇	 р _{зN}
p ₄₀	p ₄₁	p ₄₂	p ₄₃	p ₄₄	p 45	p ₄₆	p ₄₇	 p_{4N}
p ₅₀	p ₅₁	p ₅₂	p ₅₃	p ₅₄	p ₅₅	p_{56}	p ₅₇	 р _{5N}
p ₆₀	p ₆₁	p ₆₂	p_{63}	p ₆₄	p 65	p_{66}	р ₆₇	 р _{6N}

Table 1: Structure of plan matrix P

Plan matrix P consists of elements p_{ij} i = 0, 1, 2, ... 6

j = 0, 1, 2, ... N, where $(N+1) \in <1$; 10000> is total number of the devices in plan (can be any number of plans).

4.1.1.1. Definition of matrix P elements

$p_{0j} \! \in \! <\!\! 02030001; 999999999 \!\!>$	j = 0, 1, 2, N
p _{ij} ∈<1; 255>	i = 1, 2, 3, 6; j = 0, 1, 2, N

4.1.1.2. Meaning of matrix P zero-row

Zero-row values are serial numbers of read devices used in a reading plan:

 $p_{0j} = SN_j$, j = 0, 1, 2, ... N, where SN_j is device serial number

In every matrix P the uniqueness of each individual serial number must be ensured:

 $p_{0j} \neq p_{0k} \qquad \qquad \text{for } j \neq k \ j, \ k = 0, \ 1, \ 2, \ \ldots \ N$



4.1.1.3. Meaning of matrix P columns

Elements of each matrix P column represent the sequence of the object numbers in the six-level hierarchy, belonging to given serial number. Each element on the sixth - highest level determines by its value 1 of 255 objects in this level and is unique.

 $\begin{array}{ll} p_{6j} \neq p_{6k} \; pro \; j \neq k & \qquad j, \; k = 0, \; 1, \; 2, \; \ldots \; N \\ p_{6j} \in <1; \; 255 > & \end{array}$

Elements of the remaining levels (5, 4, 3, 2, 1) determine object numbers in given level, belonging to the object from his immediate higher level.

 $p_{ij} \to p_{(i^{+1})j}$

To each object from level 1, any number of serial numbers (SN_i, j = 0, 1, 2, ... N) can be assigned.

p _{0j}	Serial number	32100207
p _{1j}	Object number in level 1	25
p _{2j}	Object number in level 2	126
p _{3j}	Object number in level 3	20
p _{4j}	Object number in level 4	3
p _{5j}	Object number in level 5	2
p _{6j}	Object number in level 6	4

Table 2: Example of one matrix P column, allocator with serial number 32100207

For example if each level will have a meaning as mentioned bellow:

- Level 6 = region
- Level 5 = city
- Level 4 = area (housing estates),
- Level 3 = street
- Level 2 = house,
- Level 1 = flat

then allocator with serial number 32100207 is placed in a flat with a number 25, in the house with the number 126, on the street with number 20, in area number 3, in a town number 2 and in area number 4.

4.1.2. How to save reading plan into file

Plan matrices P are saved into binary file with *.PL extension

- elements from the zero-row of plan matrix P (serial numbers) are represented as 4 byte value, the first is treated as a least significant byte (LSB),
- other elements of plan matrix are 1 byte values,
- plan matrix Pn is saved into the file sequentially by particular columns.

4.1.2.1. Plan matrix P – example

Have a plan matrix P (Šumperk, house 1804/6 only) defined in chapter 4.3. Example of the reading plan as:

32002518	32002519	32002520	32002521	32002522	32002523	32002524	32002525	32002526	32002527
1	2	3	4	1	2	2	3	4	5
1	1	1	1	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1



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When zero-row of plan matrix P (serial number) is written as 4 Byte (the least important Byte is written as first), matrix will look as mentioned bellow (1 Byte values are written in hexadecimal):

D6	D7	D8	D9	DA	DB	DC	DD	DE	DF
51	51	51	51	51	51	51	51	51	51
E8									
01	01	01	01	01	01	01	01	01	01
01	02	03	04	01	02	02	03	04	05
01	01	01	01	02	02	02	02	02	02
02	02	02	02	02	02	02	02	02	02
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01

1B values of matrix are saved sequentially by each column into binary file. The final binary file P_SPK_1804.PL will therefore contain (in hexadecimal):

Dokum	enty\Z	právy∖	RFU30	\Soft_R	FU30\	RFU30'	\plan_o	dectu\	maticeP	_Spk_1804.PL]
t Násl	troje S	kripty ł	HTML I	Nastaver	ní Okn	o Náp	ověda			
1	O A-	5 👩 (99 🗐			14	of I		× 🖶	1 🖬 🍪 📰 🤷 🗯 - 🛤
					- 11 - S.					
Г		0001	0203	0405	0607	0809	OAOB	OCOD	OEOF	0123456789ABCDEF
	00	D 651	E801	0101	0201	0101	D751	E801	0201	ĞQč×Qč
-11	10	0201	0101	D851	E801	0301	0201	0101	D951	ŘQčůQ
- 11	20	E801	0401	0201	0101	DA51	E801	0102	0201	čÚQč
- 11	30	0101	DB51	E801	0202	0201	0101	DC51	E801	ŰQčÜQč.
- 11	40	0202	0201	0101	DD51	E801	0302	0201	0101	ÝQč
- 11	50	DE51	E801	0402	0201	0101	DF51	E801	0502	ŢQČBQČ
- 11	60	0201	0101							
- 11									12	

Note: The final binary file has size exactly according the number of saved Bytes, i.e. 10B per each column of plan matrix P (one allocator). The above file P_SPK_1804.PL has a size 100B.

4.2. BASE OF PLAN

ш

Alphanumeric description allowing better identification is assigned to the individual nodes in a tree with the base of plan. These names (descriptions) can be arbitrary. The meaning of each level can be also arbitrary.

Base of plan may be common for multiple reading plans if limits defined in chapter 4.1.1.1. Definition of matrix P elements are respected. It is therefore appropriate to prepare and use only one base of plan for all reading plans.

4.2.1. How to save base of plan

Base of plan, that assigns for each object number in matrix plan their names, is saved in two steps:

- the upper three levels (levels 6, 5, 4) are saved in binary files *.BPH, contain description of object numbers in these levels; file names must be identical with elements p_{6j} (object number is level 6) of plan matrix P (see chapter 4.1.1. Plan Matrix P),
- the lower three levels (levels 3, 2, 1) are saved in binary files *.BPL, contain description of object numbers in these levels; each file name must consist from object numbers in levels 6-5-4 immediately preceding the described level 3 and from the object number in this level 3. Object numbers are separated with dashes. See more in chapter 4.2.1. How to save base of plan.



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Way how to save three upper and three lower levels of base of plan is identical.

When saving the base of plan, each level must be arranged into following structure (table):

	Y – number of	columns	_			
	PO _{6j} (or PO _{3j})					
SW	PO _{5jk} (or PO _{2jk})	PO _{4jkl} (or PO _{1jkl})	PO _{4jk(l+1)} (or PO _{1jk(l+1)})	$PO_{4jk(l+2)}$ (or $PO_{1jk(l+2)}$)	$PO_{4jk(l+3)}$ (or $PO_{1jk(l+3)}$)	
er of rows	$\begin{array}{c} PO_{5j(k+1)} \\ \text{(or } PO_{2j(k+1)} \end{array} \end{array}$	$\begin{array}{c} PO_{4j(k+1)i} \\ (or \ PO_{1j(k+1)i}) \end{array}$	$\begin{array}{c} PO_{4j(k+1)(l+1)} \\ (or \ PO_{1j(k+1)(l+1)}) \end{array}$	$\begin{array}{c} PO_{4j(k+1)(l+2)} \\ (or \ PO_{1j(k+1)(l+2)}) \end{array}$	$\begin{array}{c} PO_{4j(k+1)(l+3)} \\ \text{(or } PO_{1j(k+1)(l+3)} \end{array} \end{array}$	
number	$\begin{array}{c} PO_{5j(k+2)} \\ \text{(or } PO_{2j(k+2)} \end{array}$	$\begin{array}{c} PO_{4j(k+2)l} \\ (or \ PO_{1j(k+2)l}) \end{array}$	$\begin{array}{c} PO_{4j(k+2)(l+1)} \\ (or \ PO_{1j(k+2)(l+1)}) \end{array}$	$\begin{array}{c} PO_{4j(k+2)(l+2)} \\ \text{(or PO}_{1j(k+2)(l+2)} \end{array} \right)$	$\begin{array}{c} PO_{4j(k+2)(l+3)} \\ \text{(or PO}_{1j(k+2)(l+3)} \end{array} \right)$	
×	$\begin{array}{c} PO_{5j(k+3)} \\ \text{(or } PO_{2j(k+3)}) \end{array}$	$\begin{array}{c} PO_{4j(k+3)^l} \\ (\text{or } PO_{1j(k+3)^l}) \end{array}$	$\begin{array}{c} PO_{4j(k+3)(l+1)} \\ (or \ PO_{1j(k+3)(l+1)}) \end{array}$	$\begin{array}{c} PO_{4j(k+3)(l+2)} \\ (or \ PO_{1j(k+3)(l+2)}) \end{array}$	$\begin{array}{c} PO_{4j(k+3)(l+3)} \\ (or \ PO_{1j(k+3)(l+3)}) \end{array}$	

where:

- PO_{6j} (or PO_{3j}) is description of object *j* in level 6 (or 3),
- PO_{5jk} (or PO_{2jk}) are descriptions of objects *k* in level 5 (or 2) immediately subordinate to object *j* in level 6 (or 3), row index (the first row with description PO_{6j} (or PO_{3j}) has index 0) must match with described object numbers k (*k*+1, *k*+2, etc.)
- PO_{4jkl} (or PO_{1jkl}) are description of objects *I* in level 4 (or 1) immediately subordinate to object *k* in level 5 (or 2), row index (the first row with description PO_{6j} (or PO_{3j}), PO_{5jk} (or PO_{2jk}), etc. has index 0) must match with described object numbers I (I+1, I+2, etc.).

Base of plan is saved sequentially by each column into the binary file

- first written value is number of rows *X* (4 Byte)
- followed by number of columns Y (4 Byte), then followed by descriptions in rows
- each description is preceded with 4 Byte value that indicate the number of characters in the description
- descriptions are saved as a hexadecimal codes in particular code chart
- Note: if length of description is zero (description does not exist), record will contain only 4B description length (00 00 00 displayed in hexadecimal)

Binary file describing base of plan looks like:

 $\begin{array}{l} (X)_{1B} \ (X)_{2B} \ (X)_{3B} \ (X)_{4B} \ (Y)_{1B} \ (Y)_{2B} \ (Y)_{3B} \ (Y)_{4B} \ (L(N_{11}))_{1B} \ (L(N_{11}))_{2B} \ (L(N_{11}))_{3B} \ (L(N_{11}))_{4B} \ (KZ(N_{11}))_{NB} \ (L(N_{12}))_{1B} \ (L(N_{12}))$

where:

- $(X)_{1B}$ to $(X)_{4B}$ are 4 Bytes indicating the number of rows
- $(Y)_{1B}$ to $(Y)_{4B}$ are 4 Bytes indicating the number of columns
- $(L(N_{11}))1B$ to $(L(N_{11}))_{4B}$ are 4 Bytes indicating number of characters in description in the first row and first column (description PO6j (or PO_{3j}))
- (KZ(N₁₁))_{NB} is N Bytes of character codes in description in the first row and first column
- $(L(N_{12}))_{1B}$ to $(L(N_{12}))_{4B}$ are 4 Bytes indicating the number of characters in description in the first row and second column
- $(KZ(N_{12}))_{NB}$ is N Bytes of character codes in description in the first row and second column

to...





- $(L(N_{XY}))_{1B}$ to $(L(N_{XY}))_{4B}$ are 4 Bytes indicating the number of characters in description of X-th row and Y- th column
- $(KZ(N_{XY}))_{NB}$ is N Bytes of character codes in description of X-th row and Y-th column

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4.3. Example of the reading plan

For better understanding, example of reading plan is presented.



Illustration 7: Graphical presentation of the reading plan example

- Reading plan consist of 58 allocators with serial numbers 32002511 to 32002550 and 34013731 to 34013748.
- Meaning of individual levels was chosen as follows:
 - 1. level 6 = municipality
 - 2. level 5 = part of the municipality (housing estates)
 - 3. level 4 = street
 - 4. level 3 = house





- 5. level 2 = flat
- 6. level 1 = room
- The object numbers in each level was chosen arbitrarily, but conditions for ranges of values (see chapter 4.1.1.1. Definition of matrix P elements), uniqueness of the numbers of objects in the level 6 and serial numbers must be respected.
- Maximally 2 serial numbers are assigned in level 1 for simplicity, generally there is no limit (see chapter 4.1.1.3. Meaning of matrix P columns).
- In Zábřeh na Moravě city (object with number 2 on level 6) segmentation of municipality (housing estates) is not used. There is only one object with number 1 and without description in level 5 in the base of plan.

1 – Šumperk	1 – Česká čtvrť	1 – Blanická	1 – 2787/10	1 – Novákovi	1 – kitchen 2 – liv. room 3 – bedroom
				2 – Bílkovi	1 – kitchen 2 – room
				3 – Hrubá	1 – kitchen 2 – room
			2 – 1804/6	1 – Plašilovi	1 – kitchen 2 – liv. room 3 – bedroom 4 – room 2
				2 – Horváthovi	1 – kitchen 2 – liv. room 3 – bedroom 4 – corridor 5 – room 2
	2 – Temenice	1 – Sokolská	1 – 1451/8	1 – Švecovi	1 – kitchen 2 – liv. room 3 – bedroom
				2 – Novákovi	1 – kitchen 2 – liv. room 3 – bedroom
				3 – Čech	1 – kitchen 2 – liv. room
			2 – 2110/12	1 – Jánský	1 – kitchen 2 – liv. room 3 – bedroom
				2 – Fojtovi	1 – kitchen 2 – liv. room 3 – bedroom 4 – bathroom
		2 – Finská	1 – 2715/10	1 – Tuhá	1 – kitchen 2 – room
				2 – Malý	1 – kitchen 2 – room
				3 – Kutil	1 – kitchen 2 – room
				4 – Snášel	1 – kitchen 2 – room

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2 – Zábřeh na Moravě	1 –	1 – Sokolská	1 – 1853/10	1 – Chudobovi	1 – kitchen 2 – liv. room 3 – bedroom
				2 – Abrhám	1 – kitchen 2 – room
			2 – 1672/8	1 – Konečná	1 – kitchen 2 – room
				2 – Brzobohatý	1 – kitchen 2 – room
		2 – Jiráskova	1 – 2805/14	1 – Tomáškovi	1 – kitchen 2 – liv. room 3 – bedroom
				2 – Ondráčkovi	1 – kitchen 2 – liv. room 3 – bedroom
			2 – 2248/6	1 – Šebestovi	1 – kitchen 2 – liv. room 3 – bedroom

Table 3: Example of reading plan

Serial No.	32002511	32002512	32002513	32002514	32002515	32002516	32002517	32002518	32002519	32002520
Level 1	1	2	3	1	2	1	2	1	2	3
Level 2	1	1	1	2	2	3	3	1	1	1
Level 3	1	1	1	1	1	1	1	2	2	2
Level 4	1	1	1	1	1	1	1	1	1	1
Level 5	1	1	1	1	1	1	1	1	1	1
Level 6	1	1	1	1	1	1	1	1	1	1

32002521	32002522	32002523	32002524	32002525	32002526		34013744	34013745	34013746	34013747	34013748
4	1	2	2	3	4		2	3	1	2	3
1	2	2	2	2	2		2	2	1	1	1
2	2	2	2	2	2		1	1	2	2	2
1	1	1	1	1	1		2	2	2	2	2
1	1	1	1	1	1		1	1	1	1	1
1	1	1	1	1	1		2	2	2	2	2

Table 4: Plan matrix for example of reading plan

Serial No.	32002518	32002519	32002520	32002521	32002522	32002523	32002524	32002525	32002526	32002527
Level 1	1	2	3	4	1	2	2	3	4	5
Level 2	1	1	1	1	2	2	2	2	2	2
Level 3	2	2	2	2	2	2	2	2	2	2
Level 4	1	1	1	1	1	1	1	1	1	1
Level 5	1	1	1	1	1	1	1	1	1	1
Level 6	1	1	1	1	1	1	1	1	1	1

Table 5: Plan matrix for house 1804/6 on Blanicka street, Šumperk



4.3.1. How to save base of plan - example

Example of base of plan mentioned in chapter 4.3. Example of the reading plan, will be as follows:

- the upper three levels will consist of 2 files (there are 2 objects in level 6) :
 - 1.BPH describing levels 6, 5, 4 of branch 1 (Šumperk)
 - 2.BPH describing levels 6, 5, 4 of branch 2 (Zábřeh na Moravě)
- the lower three levels will consist of 9 files (there are 9 objects in level 3) :
 - 1-1-1.BPL describing levels 3, 2, 1 of branch 1-1-1-1 (Šumperk-Česká čtvrť-Blanická--2787/10)
 - 1-1-1-2.BPL describing levels 3, 2, 1 of branch 1-1-1-2 (Šumperk-Česká čtvrť-Blanická-1804/6)
 - 1-2-1-1.BPL describing levels 3, 2, 1 of branch 1-2-1-1 (Šumperk-Temenice-Sokolská-1451/8)
 - 1-2-1-2.BPL describing levels 2, 1 of branch 1-2-1-2 (Šumperk-Temenice-Sokolská-2110/12)
 - 1-2-2-1.BPL describing levels 3, 2, 1 ofbranch 1-2-2-1 (Šumperk-Temenice-Finská-2715/10)
 - 2-1-1-1.BPL describing levels 3, 2, 1 of branch 2-1-1-1 (Zábřeh na Moravě-not used-Sokolská--1853/10)
 - 2-1-1-2.BPL describing levels 3, 2, 1 of branch 2-1-1-2 (Zábřeh na Moravě-not used-Sokolská--1672/8)
 - 2-1-2-1.BPL describing levels 3, 2, 1 of branch 2-1-2-1 (Zábřeh na Moravě-not used-Jiráskova--2805/14)
 - 2-1-2-2.BPL describing levels 3, 2, 1 of branch 2-1-2-2 (Zábřeh na Moravě-not used-Jiráskova--2248/6)

Part describing the upper three levels (levels 6, 5, 4) of Sumperk city (object number 1) will be as follows:

Šumperk		
Česká čtvrť	Blanická	
Temenice	Sokolská	Finská

The binary file will be named 1.BPH (Šumperk is description of object number 1 on level 6) and following values will be written to it (in hexadecimal):

- 00 00 00 03 4B number of rows,
- 00 00 00 03 4B number of table columns,
- 00 00 00 07 4B number of characters in the description "Šumperk",
- 8A 75 6D 70 65 72 6B character codes Š u m p e r k,
- 00 00 00 00 4B length of an empty description (first row, second table column),
- 00 00 00 00 4B length of an empty description (first row, third table column),
- etc. by each row.

The resulting file 1.BPH will contain (in hexadecimal):

	0001	0203	0405	0607	0809	OAOB	OCOD	OEOF	0123456789ABCDEF
00	0000	0003	0000	0003	0000	0007	81475	6D70	[Šump
10	6572	6B00	0000	0000	0000	0000	0000	OBC8	erkČ
20	6573	6BE1	20E8	7476	729D	0000	0008	426C	eská čtvrťBl
30	616E	6963	6BE1	0000	0000	0000	0008	5465	anickáTe
40	6D65	6E69	6365	0000	0008	536F	6B6F	6C73	meniceSokols
50	6BE1	0000	0006	4669	6E73	6BE1			káFinská

Part describing the lower three levels (levels 3, 2, 1) describing house 1804/6 will be as follows:

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1804/6					
Plašilovi	kitchen	liv. room	bedroom	room 2	
Horváthovi	kitchen	liv. room	bedroom	corridor	room2

The binary file will be named 1-1-2.BPL (1804/6 is description of object number 2 in level 3 belonging to the object number 1 in level 4, belonging to the object number 1 in level 5, belonging to the object number 1 in level 6) and values will be written the same way as to binary file 1.BPH describing the upper three levels.

	0001	0203	0405	0607	0809	OAOB	OCOD	OEOF	0123456789ABCDEF
00	0000	0003	0000	0006	0000	0006	3138	3034	
10	2F36	0000	0000	0000	0000	0000	0000	0000	/6
20	0000	0000	0000	0000	0009	506C	619A	696C	Plašil
30	6F76	6900	0000	066B	7563	6879	F200	0000	ovikuchyň
40	096F	622E	2070	6F6B	6F6A	0000	0007	6C6F	.ob. pokojlo
50	9E6E	6963	6500	0000	0770	6F6B	6F6A	2032	žnicepokoj 2
60	0000	0000	0000	000A	486F	7276	E174	686F	Horvátho
70	7669	0000	0006	6B75	6368	79F2	0000	0009	vikuchyň
80	6F62	2E2O	706F	6B6F	6400	0000	076C	6F9E	ob. pokojlož
90	6E69	6365	0000	0006	6368	6F64	6261	0000	nicechodba
AO	0007	706F	6B6F	6A20	32				pokoj 2

The resulting file 1-1-1-2.BPL will contain (in hexadecimal)::



5. SOLUTION OF MOST COMMON PROBLEMS

PROBLEM DESCRIPTION	Recommended solution
Individual records are not displayed in column (2), (3) or	The error is caused by damaged RFU30.STS file - located where the program is installed, in folder "[installation folder]\RFU30\".
(4) (see Illustration 5: Graphical user interface of RFU PC)	Overwrite RFU30.STS file with original RFU30.STS file. This file can be found on delivered CD or asked from the manufacturer.
Individual records are not displayed in column (3) (see Illustration 5: Graphical user	Controlling software will display read devices (heat cost allocators and radio modules for water meters) from the plan at the moment when data from first planned device are read.
interface of RFU PC)	Check if plan is loaded. If yes, verify if plan match with area, where reading is performed.