

WIRELESS RECEIVER WRMnano

USER MANUAL

Rev. 0.2a

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1. General description

WRMnano is a device, which translates OMS wireless m-bus messages to wired m-bus. It receives wireless m-bus messages and saves them in its internal memory. It can save data for up to 64 wireless devices. Then it can relay data for any saved wireless device upon request with valid wired m-bus telegram (usually REQ_UD2). It is powered entirely by m-bus, thus assisting easy mounting and best possible placement.

If more than 64 wireless m-bus devices must be relayed to wired m-bus, then several WRMnano devices should be employed, all on the same m-bus interface. In this case user should take care to set different Primary addresses both to WRMnano devices and integrated meters, if reading is to be made by Primary addresses.

Each WRMnano has its own Primary address (settable by user) and unique Secondary address - WRMnano serial number. They are used when programming WRMnano such as activating/deleting new meters in its memory, saving AES-128 key for desired meter and so on.

All wireless messages from different meters are saved in WRMnano internal memory, based on their identification number (ID). There are two modes of WRMnano operation:

- automatic mode – in this mode automatic activation is implemented. When WRMnano receives valid wireless m-bus message, it activates the ID of the device, (if not already activated), saves the message in its internal memory, and updates it upon each reception. It is done until the maximum 64 devices are activated. Then only messages are updated upon each new reception. Each new device will have Primary address of 0;
- manual mode – the IDs of the wireless m-bus devices that should be read must be manually activated in the WRMnano memory. This way WRMnano saves only the messages from the already activated devices and ignores all other radio messages. This activation is made through m-bus interface and since its with manufacturer specific telegrams user should use our software for this or implemented commands in his own system. M-bus telegrams are described further in this document.

The saved telegrams from the wireless devices can be accessed via standard readout m-bus command, short telegram (REQ_UD2). Activated radio devices within WRMnano memory act as separate logical wired m-bus devices, each with its own ID and primary address. The ID is the same as the one of the wireless device, and the primary address can be set by (and changed any time) the master. The default value for primary address, as mentioned above, is 0. WRMnano has its own ID and primary address, and all commands to the device (activation/deletion of RF device, work mode selection, setting various options) should be send to this address. By default device is set with Primary address 249.

WRMnano also supports mode 5 AES-128 decryption of the received wireless m-

bus messages, and if decryption is enabled and correct key(s) is/are programmed, it can decrypt wireless m-bus telegrams. The user can set separate key for each activated device and if the data is encrypted, WRMnano would decrypt it. For now there is no possibility to use one key automatically for all devices, but programming same key for all meters with our software is easy to do and does not take much time.

In addition, WRMnano has special filter capabilities, when operates in automatic mode. This means that user can limit automatic activation to meters of interests. This is useful in many cases, because in most of the cases there are meters that do not belong to network of interest, but anyway are read due to interference.

There are three different **FILTER** masks that can be activated:

- filter meters by manufacturer identification - for instance *GIN*
- filter meter by serial number ID, using wildcards in serial number (eg. *1234FFFF*)
- filter meters by medium measured - for instance activated only water and heat meters

Each filter type has up to 8 different values that can be saved and used. This means that if user decides to filter wireless m-bus meters by manufacturer, he can 'tell' WRMnano to activate automatically only "*GIN*", "*SON*" and "*BMT*" meters, for instance. Same applies for medium and serial number mask. In many cases this can save time when setting WRMnano on site.

WRMnano has internal clock, which can be set to real time. It is not energy independent, so if m-bus power supply fails then new setting of RTC should be made. As an option user can set WRMnano to add timestamp to each wireless meter telegram. This timestamp then can be used to know when particular meter has been read for last time. Timestamp is coded as standard m-bus telegram, data type F.

And last, WRMnano can provide RSSI data in manufacturer specific part of each telegram, if programmed to do that.

2. Technical parameters

Parameter	Value
m-bus voltage	24 to 40V
m-bus current draw	Up to 7.5mA (5 std. M-bus loads)
antenna connector	SMA-F
number of meters read	Up to 64
wireless m-bus modes	T and S
AES-128 encryption	Yes, CBC, Mode 5
status info	Multicolor led
dimensions (w/o antenna)	x/x/x mm
IP protection	IP30
working temperature	0 to +40 °C
storing temperature	-10 to +50 °C
own weight	20 g

3. Wired m-bus telegrams and setting the device

All settings of WRMnano (adding or deleting ID, setting filters, saving AES-128 keys) are made via m-bus interface and manufacturer specific. To do that user should have standard transparent m-bus converter, we suggest using MBnano-10 (). WRMnano has its own primary and secondary address that should be used to make settings.

Wireless meters/messages can be read via standard m-bus readout telegrams (SND_UD/RSP_UD). Both primary and secondary addressing is supported. SND_NKE is supported too.

The primary addresses of the logical devices (eg. meters activated) can be set via standard m-bus telegrams. Standard procedure is to select the logical device by its secondary address, then set primary address, then deselect the device. This can be done not only with our software, but with any compliant m-bus software.

If two or more logical devices are set with the same primary address, this would result in collision when trying to read any of them by primary address. Secondary addressing is supported too, so user can read also all devices by secondary address, search by ID mask and so on.

3.1. M-bus telegrams description

3.1.1. Standard readout m-bus telegram for logical device/meter

User can read either via Primary address short telegram:

0x10 0x5B/0x7B A CHK 0x16

or by selecting device via secondary address. Then meter of interest will start to

respond on Primary address 253 (0xFD).

The response from WRMnano of the standard short-frame readout command is something like this:

0x68	L	L	0x68	C	A	CI	DATA	CHK	0x16
------	---	---	------	---	---	----	------	-----	------

where:

0x68 and 0x16 are start/stop bytes

L is length of the telegram according to EN 13757-3

C, A, CI are respectively C-field, primary address and CI-field

CHK is checksum of the telegram, according to EN 13757-3

DATA is user data, including header and the payload

HEADER (12 bytes fixed length)	DATA PAYLOAD
--------------------------------	--------------

Header is 12-byte fixed length, then the data comprises of the wireless message and several option fields, if enabled. These fields may include timestamp of the message and RSSI of this particular message.

Header format is as follows

ID	MFR	Version	Medium	Access No	Status	Signature
4-byte BCD	2 byte	1 byte	1 byte	1 byte	1 byte	2 byte

ID is the 8-digit ID of the wireless m-bus device

MFR is the manufacturer of the device, encoded in 3 letters, copied from Wireless m-bus telegram

Version – this is the firmware revision of the device, copied from Wireless m-bus telegram

Medium – medium of the device, copied from Wireless m-bus telegram

Access No – transmit count of the device, rollover @ 255; copied from Wireless m-bus telegram

Status – Status, copied from Wireless m-bus telegram

Signature – signature, copied from wireless m-bus telegram, with one exception – if decryption is enabled and the message is decrypted, all encryption fields are deleted to notify the master that the message is no longer encrypted.

Data payload is formatted as follows:

Wireless m-bus message	Timestamp (option field)	RSSI (option field)
Variable length	6 bytes	2 bytes

Wireless m-bus message is copied without any changes, as received from the meter. Timestamp is added only if enabled, this is the time & date of the last message reception from the device with this selected ID. The clock of the timestamp is the internal clock of the WRMnano. The timestamp format is as follows:

0x04	0x6D	TIMEPOINT
DIF	VIF	Standard 4-byte time&date m-bus format, data type F

RSSI is added only enabled, it consists of 2 bytes:

0x0F	RSSI
MFR-specific DIF	RSSI in -[dBm]

3.1.2. Changing Primary address of an activated meter in WRMnano

Each device activated in WRMnano - either manually or automatically, in the beginning has Primary address 0. If user plans to read meters from WRMnano memory via Primary address commands, then each logical meter should have unique Primary address to be read from.

This follows strictly EN 13757-3 and m-bus standard, so is out of scope of this document. In general, here are the steps that software should do:

- select meter of interest by Secondary address
- change Primary address of the selected meter
- de-select meter

The above can be accomplished with our free software or any m-bus software that follows the standard.

3.1.3. M-bus setup telegrams for WRMnano

These telegrams must be sent only to the WRMnano's own m-bus address.

Send telegram format (master to slave and slave to master):

0x68	L	L	0x68	C	A	CI	SEND DATA/RECEIVE DATA	CHK	0x16
------	---	---	------	---	---	----	------------------------	-----	------

0x68 and **0x16** are start/stop bytes

L is length of the telegram, according to EN 13757-3

C – C-field (0x53 is C-field in master to slave direction, 0x08 in slave to master direction)

A is destination primary address - i.e. the WRMnano primary address

CI – CI-field (0x51 is CI-field in master to slave direction, 0x72 in slave to master direction)

CHK is checksum of the telegram

WRMnano can respond either with confirmation character (E5), or full readout telegram.

SEND DATA sub-telegrams

Set current time/date

0x04	0x6D	TIMEPOINT
DIF	VIF	Standard 4-byte time&date m-bus format, data type F

Purpose: set internal clock of WRMnano to current datetime

Activate new RF ID

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x01	0x04	ID0	ID1	ID2	ID3

Purpose: Activates in WRMnano memory wireless m-bus device with this ID. ID is coded as in m-bus standard.

Delete activated RF ID

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x81	0x04	ID0	ID1	ID2	ID3

Purpose: Deletes wireless m-bus device with this ID from WRMnano memory. This command also deletes the primary address of this device (sets it to 0), but only if in automatic mode.

Selection of activated RF IDs

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x02	0x04	POS	NO	0	0

Purpose: to read activated devices in WRMnano memory more quickly. Master request readout of activated IDs, starting from position [POS] (1 to 64), and expects to read [NO] Ids (max 24, there is no more space in the telegram). POS does NOT relate to meter's Primary addresses, this is internal organization of activated meters in WRMnano memory.

Delete activated RF IDs by position

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x82	0x04	POS	NO	0	0

Purpose: to delete activated meters i WRMnano wuickly, or to delete all memory with one command instead each meter one by one. Master requests WRMnano to delete [NO] activated RF-devices, starting from position [POS]

[NO] – 1 to 64, **[POS]** – 1 to 64

Again, POS does NOT relate to Primary address of meters, its the internal order of activated meters in WRMnano memory.

Set/Clear WRMnano flag

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x05	0x04	FLAG #	S/NC	0	0

Purpose: to enable/disable various options of WRMnano operation.

Sets (**B1** = 1) or clears (**B1** = 0) selected flag number (**FLAG#**).

List of implemented flags and their function:

Flag #	Flag bitfield	Flag description
--------	---------------	------------------

1	0x0001	Auto mode (auto activates each new received device ID until memory full)
2	0x0002	Return timestamp it the back of the telegram
3	0x0004	Return RSSI at the back of the telegram
4	0x0008	Automatically decrypt telegrams with saved AES-128 key
5	0x0010	Decode Apator telegrams and make them into standard m-bus
6	0x0020	Decode Techem telegrams and make them into standard m-bus
7		Enable filter by Manufacturer
8		Enable Filter by Medium
9		Enable Filter by ID

Set AES key for specific RF ID

1	2	3	4	5	6	7	8	9	10	11	...	24
DIF	VIF	VIFE	-	B0	B1	B2	B3	B4	B5	B6	...	B19
0x0F	0xFF	0x0A	0x14	ID0	ID1	ID2	ID3	AES0	AES1	AES2	...	AESF

Purpose: Sets [AES0-F] - 16 bytes HEX as AES-128 key for decryption of the messages if the device with ID [ID0-3]. ID is coded as in m-bus standard.

Requests to read the AES key for specific ID

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x8A	0x04	ID0	ID1	ID2	ID3

Purpose: to read AES key for logical device with exact ID [ID0-3]. ID is coded as in m-bus standard.

3.1.4. WRMnano respond on commands - RECEIVE DATA sub-telegrams

Each command sent to WRMnano has a response - either telegram with long header or just ACK (0xE5). These telegrams give info on command success/failure and general data for a WRMnano. They are described in details below.

General info for wireless devices – returned at each short telegram readout

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3
0x0F	0xFF	0x06	0x04	DEVN	DEVR	MAXDEV	0

DEVN – currently active wireless devices

DEVR – currently read device number (at least one valid telegram received)

MAXDEV – max. number for activated devices (fixed at 64)

Flag register data – returned at each short telegram readout

1	2	3	4	5	6	7	8
DIF	VIF	VIFE	-	B0	B1	B2	B3

0x0F	0xFF	0x05	0x04	FLAG0	FLAG1	FLAG2	FLAG3
------	------	------	------	-------	-------	-------	-------

Returns flag register as 32-bit value. Flag bits are represented as bitfields (see previous page)

RF device IDs return (RF device index 1 to 31)

1	2	3	4	5	6	7
DIF	DIFE	VIF	B0	B1	B2	B3
b1m001100	b0000ssss	0x79	ID0	ID1	ID2	ID3

These IDs are returned on activated ID readout request

m:s encodes storage number (5 bits – **bssssm**), ssssm – current address index

ID0-3 – ID of the RF logical device

RF device IDs return (RF device index 1 to 31)

1	2	3	4	5	6	7	8
DIF	DIFE1	DIFE2	VIF	B0	B1	B2	B3
b1m001100	b0000ssss	b0000ssss	0x79	ID0	ID1	ID2	ID3

These IDs are returned on activated ID readout request

m:s encodes storage number (9 bits – **bssssssssm**), ssssssssm – current address index

ID0-3 – ID of the RF logical device

Read selected AES key

1	2	3	4	5	6	...	20
DIF	VIF	VIFE	-	B0	B1	...	B15
0x0F	0xFF	0x8A	0x10	AES0	AES1	...	AESF

Returns AES-128 as 16 HEX bytes string.

Examples and further information

If the device with this ID is not yet read over the air, the m-bus telegram is "empty" - there is no manufacturer, no medium, no access counter, and data is empty.

Here is an example of trying to read activated device with ID17063986 and primary address 10, which is not yet read:

68 0F 0F 68 08 0A 72 86 39 06 17 00 00 00 00 00 00 00 60 16

And this is the m-bus telegram for the same device after it is read over the air, with activated both timestamp and RSSI:

68 B8 B8 68 08 0A 72 86 39 06 17 EE 4D 16 08 C4 00 01 00 04 6D 34 0A 9E 2A 03 6E 11 00
00 42 6C E1 F7 43 6E 11 00 00 52 59 9E 0A 82 88 01 6C 61 25 83 88 01 6E 11 00 00 8D 88
01 EE 1E 35 33 FE 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 11 00
00 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 11 00 00 05
FF 2D 00 00 80 3F 85 20 FF 2D 00 00 80 3F 02 59 7A 09 02 65 27 09 12 59 F7 09 83 10 FD
31 00 00 00 82 10 6C 01 01 81 10 FD 61 00 82 20 6C 18 23 0B FD 0F 02 00 01 02 FF 2C 00
00 02 FD 66 A0 08 04 6D 18 01 02 01 0F 50 DC 16

This is control telegram – response to WRMnano's own m-bus address:

68 1F 1F 68 08 0B 72 00 00 00 00 2E 1D 01 0E 01 00 00 00 0F FF 06 04 40 32 40 00 0F FF 05

04 01 00 00 00 C2 16

It can be seen that it has 64 (0x40) activated devices of 64, and 50 of them are read with their valid wireless m-bus telegrams.

4. Using GINEERS software to set WRMnano

To ease WRMnano setup user can use our standard m-bus software. The software follows strictly m-bus standard and can be used for other m-bus related things, but it can also help to use specific commands for WRMnano.

User should use only TAB "M-bus devices", which looks like below:

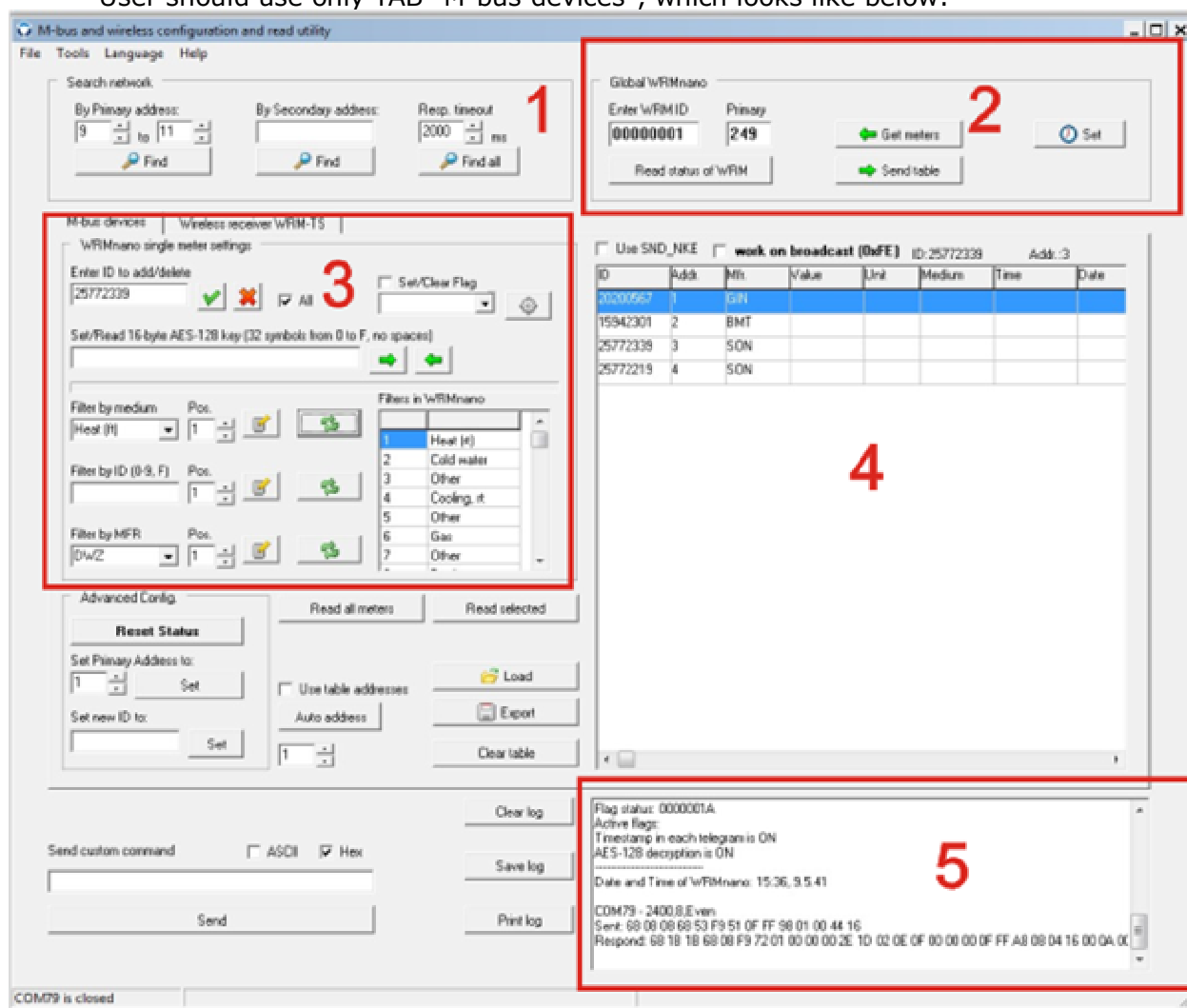


Fig. 1. General view and description

Using our software one can do the following with WRMnano:

- activate or delete exact meter ID in WRMnano meter
- delete all meters from WRMnano memory
- set AES-128 key for each/all activated meter
- turn On or OFF WRMnano flags and corresponding functions
- set up to 8 filters for each FILTER activated
- change Primary address of desired logical meter in WRMnano memory

- change Primary address of WRMnano itself
- search and read meters by Primary or Secondary address

Software has several important sections, shown on the Figure and they have the following functions:

1 - Search m-bus network (WRMnano) by Primary or Secondary address. This is used to read activated meters in WRMnano memory;

2 - Main WRMnano parameters - here user has to set correct Secondary and Primary ID of WRMnano, if he wants to set correctly meters. Also from here user can read full WRMnano memory for meters, see status data and read current clock;

3 - setting/deleting particular wireless meters in WRMnano memory. Also from here different filtering can be set, if needed;

4 - main table, where all read meters via wired m-bus are displayed. User can also manually write in the table (for instance new Primary address or AES-128 key) and can import external CSV file for writing it down in WRMnano

5 - log window, where all status information is displayed

First thing to do when working with WRMnano is to enter CORRECT Id and Primary address of WRMnano itself. This has to be made in the following fields:

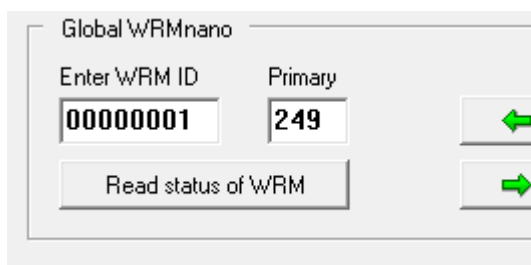


Fig. 2. Entering ID and Primary address of WRMnano

By default each WRMnano comes with Primary address of 249 and secondary address on its sticker and warranty card. If user does not type correct identification then WRMnano will not respond to a command/commands. If one does not know the exact serial number of a particular WRMnano - then a search by Secondary address can be made from the software:

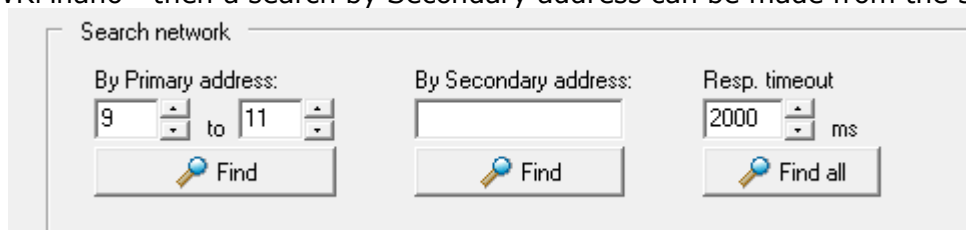


Fig. 3. Searching wireless meter or WRMnano itself by Primary/Secondary address

If WRMnano is not in automatic mode of operation (which is not by default), then user should end up with only one found device and this will be WRMnano. Worth mentioning also that WRMnano medium in its m-bus header is set to "Bus/System", which also can be used for distinguishing meters from WRMnano.

4.1. Activate/Delete exact meter ID in WRMnano

User should type meter ID in the field "Enter ID to add/delete" and press button :

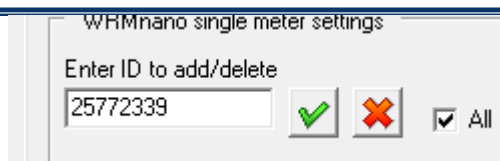


Fig. 4. Setting/deleting meter from WRMnano memory

Same applies for deleting a meter, but user should use button .

If **checkbox "All"** is checked - then user will delete ALL meters in WRMnano memory. This, however, can be used also for activating multiple devices automatically. To do that user should load previously made csv file in the table. If then "All" is selected and user presses

button  - software will try to activate all meter IDs from the table in WRMnano memory. If user has entered Primary m-bus addresses for each meter - then software will also set each meter with corresponding Primary address in the table. This way, with a little preparation and one mouse click user can program all devices of interest in WRMnano.

Software also supports selecting multiple meters from the table and activating only them. Selection is made with left mouse click on each row, holding down Ctrl (Ctrl+left click). Each selected row will be in dark blue color. Then right click opens a context menu from which "Activate selected" should be pressed.

Same applies for deleting devices from WRMnano memory.

4.2. Deleting all devices from WRMnano memory

Two ways to do that:

- 1) Checkbox "All" should be checked, then press button .
- 2) select whole table with left mouse button double click, then from context menu select "Delete selected"

4.3. Set AES-128 key for each activated meter

Select meter from a table - its ID will be filled in ID box. Then type desired AES-128 key in the field for aES-128 key. Keys should be typed in hexadecimal value, symbols 0-F, only uppercase. If key is correct then it should consist of total of 32 symbols (16-byte key). To save this key i WRMnano press button . To read a key for desired meter - use button .

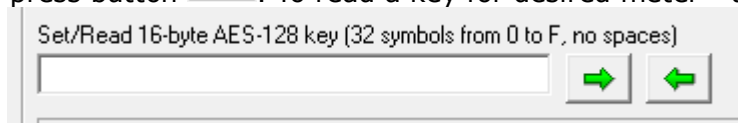


Fig. 5. Entering AES-128 key for a meter

If checkbox "All" is selected and user presses button  then program will save all AES-128 keys from the main table - if they are entered. This usually shall be made in external file and loaded in the program (Load from file) or user can enter manually key for each meter in the table directly. AES-128 key shall be entered in column 12 of the table.

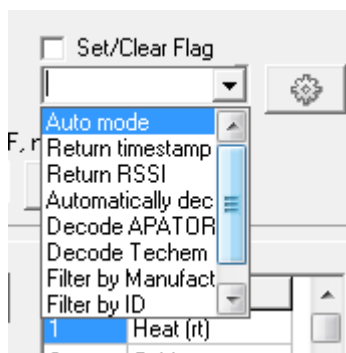
4.4. Turn On or OFF WRMnano flags and corresponding functions

Flags and functions they enable were described in detail in section 3.1.3. Software just makes this process easy as a mouse click. To enable or disable function/flag user should do the following:

- selects should function be ON (**Checkbox "Set/Clear"** is checked) or OFF (Checkbox

"Set/Clear" should be cleared;

- select function of interest from the drop-down menu:



- press button 

If everything is correct (generally WRMnano ID and primary address are typed correct and WRMnano is powered), WRMnano will respond with a telegram, which 'tells' us what is On and what is Off. In our software this is automatically decoded and all functions state can be seen in log window after WRMnano respond as shown below:



Fig. 7. Status flags

Flags, that can be set, are as follows:

- **Auto mode** - if set WRMnano will add automatically meters from the air, until their number reaches 64;
- **Return timestamp** - in each wired m-bus telegram WRMnano will put m-bus timestamp of the last reading. This way user knows when exactly WRMnano has read a device;
- **Return RSSI** - WRMnano in each wired m-bus telegram last read RSSI value for particular meter;
- **Automaticall decrypt AES-128** - turns On or Off AES-128 decryption by WRMnano
- **Decode APATOR** - decodes some APATOR meters, which are not exactly OMS-compatible, to standard m-bus telegram;
- **Decode Techem** - same, decodes Techem telegram, which are manufacturer specific
- **Filter by Manufacturer** - if set, then Filtering by saved manufacturer codes is ON
- **Filter by ID** - if set, then Filtering by saved ID masks codes is ON
- **Filter by Medium** - if set, then Filtering by saved mediums is ON. Allowed are only valid m-bus mediums due to 13757-3.

4.5. Set up to 8 filters for each FILTER activated

As said before, WRMnano gives the user ability to filter meters that will be activated in WRMnano memory. This can be done by three different criteria or their combination:

- by meter manufacturer
- by meter medium
- by meter serial number

For each type of filter up to 8 different values can be saved and they all apply simultaneously. Different filter types also works as a combination of all three types. There is also special value for each filter type that can make WRMnano accept all values as valid ("All" selection of each drop-down menu).

Our software gives the possibility to set each filter type, up to 8 values and to read current WRMnano filters with their internal positions. To set filter value user should do the following:

- select or type filter value - there are some pre-defined values in the drop-down menus, but user can write its own;
- select position in WRMnano memory of this filter value - from 1 to 8
- press button 



Pos.	Filter Value
1	Heat (rt)
2	Cold water
3	Other
4	Cooling, rt
5	Other
6	Gas
7	Other

Fig. 8. Filter positions

For different filters following values are allowed:

- for Manufacturer filter - 3-letter signature of desired M-bus manufacturer
- for Serial number filter - any combination of digits 0-9 and wild card 'F'
- for Medium Filter - any valid Medium, described in m-bus standard. All mediums allowed infact are showed in the drop-down menu

To read positions for certain type of filtering user should use button  near each filter group. Values will be filled in the Filter table as shown above on Fig. 8

Do not forget to ALLOW (i.e. - turning ON desired flag/functions) when you will use filtering. If corresponding flag for desired filter is cleared - then no filter will be applied in WRMnano operation.

4.6. Change Primary address of desired logical meter

If WRMnano works in Automatic mode, then it adds each meter received as ACTIVE one, until number of meters reaches 64. Each new meter is activated with Primary address of 0. So, if the user plans to read meters via primary m-bus address - each meter should have unique address from 1 to 250 (having in mind that WRMnano also has its own Primary address).

This is done as normal in m-bus world:

- select meter of interest from the table
- select desired new Primary address from the left side of the program:

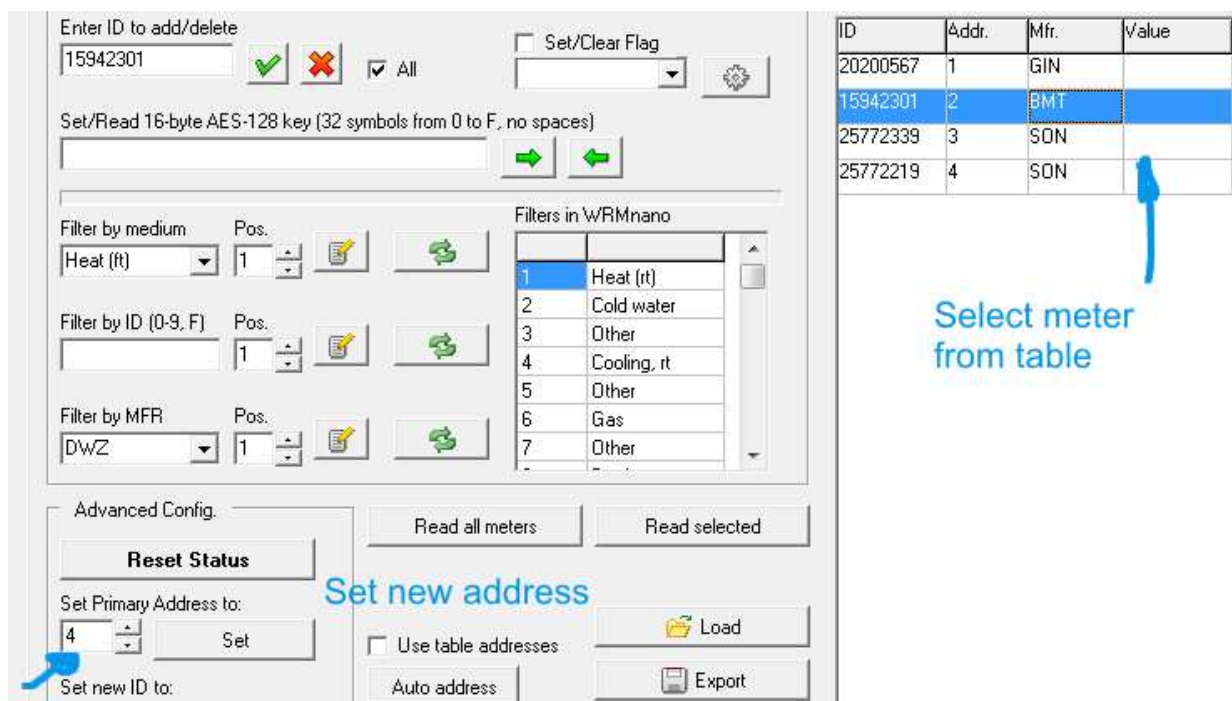


Fig. 9. Set new Primary address of a desired meter in WRMnano memory

- press button **"Set"** next to selected Primary address field.

Then software will select this meter, change its address and then de-select it. This can be seen in log window, but the final result of this will be that meter in the table will have its new Primary address.

There is also an option to address all meters from the table automatically, starting from a specific number or using pre-defined address, written in the table. External CSV file can be imported with pressing button . External file should have columns in the same order as shown in the table. As minimum - it should has Secondary and Primary address. Software is using ';' csv files.

Current table can also be exported in external CSV file, which is compatible with MExcel. This can be made with button .

Hints using program

Pressing right mouse button over the main data table will bring up context menu, which one can use:

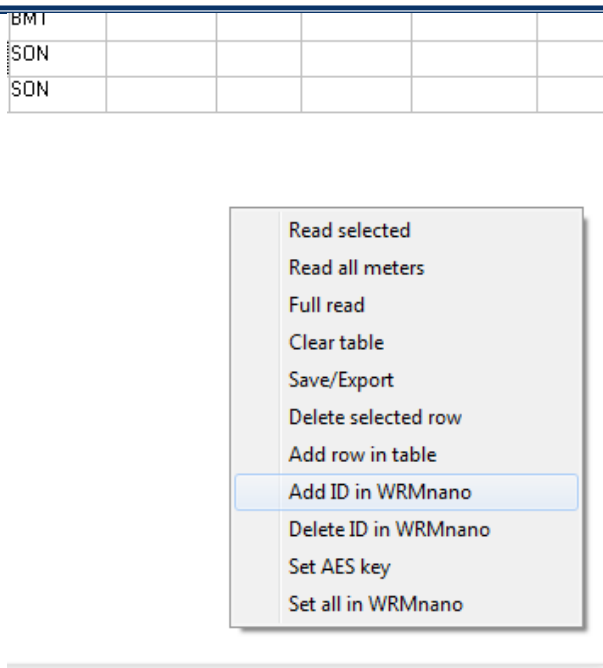


Fig. 10. Context menu

Options in this menu are pretty self-explanatory. Writing down in the table also has some shortcuts:

- **DEL** will delete automatically selected row from table
- **F1** will do a full m-bus read for selected meter in WRMnano memory
- **F2** will send this row ID to WRMnano
- **F3** will delete this row ID from WRMnano
- **Ctrl+A** will send this AES-128 to WRMnano
- **Ctrl+S** will save the table to a CSV file
- **Ctrl+L** will load CSV file in the table, ready for programming
- **Ctrl+F** will save whole table in WRMnano. This means the following:
 - all current meters in WRMnano will be deleted
 - all meters from the table will be activated in WRMnano
 - all valid AES-128 keys will be written in WRMnano
 - all valid Primary address from the table will be set to corresponding meters

For further questions and information, please refer to our official web page:
www.gineers.com

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