

How to monitor M-Bus and wireless M-Bus systems

A complete solution by Carlo Gavazzi

“Not everything that counts can be counted, and not everything that can be counted counts”

Introduction

M-Bus devices are more and more used in monitoring applications.

The M-Bus ("Meter-Bus") is a European standard (EN13757-2, EN13757-3) for remote reading of consumption meters as well as for various sensors and actuators. The wireless M-Bus is specified in EN13757-4.

Differently from other protocols, born to satisfy a wide variety of different needs, the M-Bus protocol has been specifically designed for remote reading and therefore complies almost perfectly with the specific requirements of this application:

- Possibility for network expansion
- Fail-safe characteristics / robustness
- Minimum cost
- Minimum power consumption in the meters
- Acceptable transmission speed

Technically, the main advantages, compared to Modbus RTU, are:

- no connection polarity (error proof connection)
- secondary addressing (unique identifier to avoid manual addressing)
- standard variable identifiers (to avoid manual mapping)

The listed advantages have led to a wide adoption of this solution especially for gas and water reading, environmental sensors (wireless M-Bus) and energy meters.

The solution

The solution offered by Carlo Gavazzi is based on the SIU-MBM-01, SIU-MBM-02 and SIU-MBM-01-160 units. The first module is able to integrate up to 20 wired devices, the second one can integrate up to 20 wired and 32 wireless devices and the last one up to 160 wired devices.

Device	Description
SIU-MBM-01	Wired only. Up to 20 wired M-Bus devices
SIU-MBM-01-160	Wired only. Up to 160 wired M-Bus devices
SIU-MBM-02	Wired + wireless. Up to 20 wired M-Bus devices and 32 wireless M-Bus devices.

Meters and sensors

Compatible M-Bus devices are:

- M-Bus energy meters by Carlo Gavazzi such as EM24 M2 or EM111 M1
- standard M-Bus devices of third-party manufacturers

Compatible wireless M-Bus devices are:

- SIU-MBC (converter from pulse inputs to wireless M-Bus), used to integrate existing meters (e.g. gas or water) when wired connection is not possible due to installation constraints
- standard wireless M-Bus devices of third-party manufacturers

Gateway

The SIU-MBM acts like a gateway, collecting data via M-Bus (cycling reading every 10 s) or wireless M-Bus (868 MHz wireless frames received), converting data according to EN13757 standard, and making them available on a plain Modbus map.

Master

- If the SIU-MBM is used in combination with the VMU-C EM or the UWP 3.0 the export driver function can be used to manual mapping.
- If the SIU-MBM is used with a different Modbus master (e.g. an existing SCADA), the PDF export of the Modbus Map offers, in a clear view, the information required for the commissioning of the system.

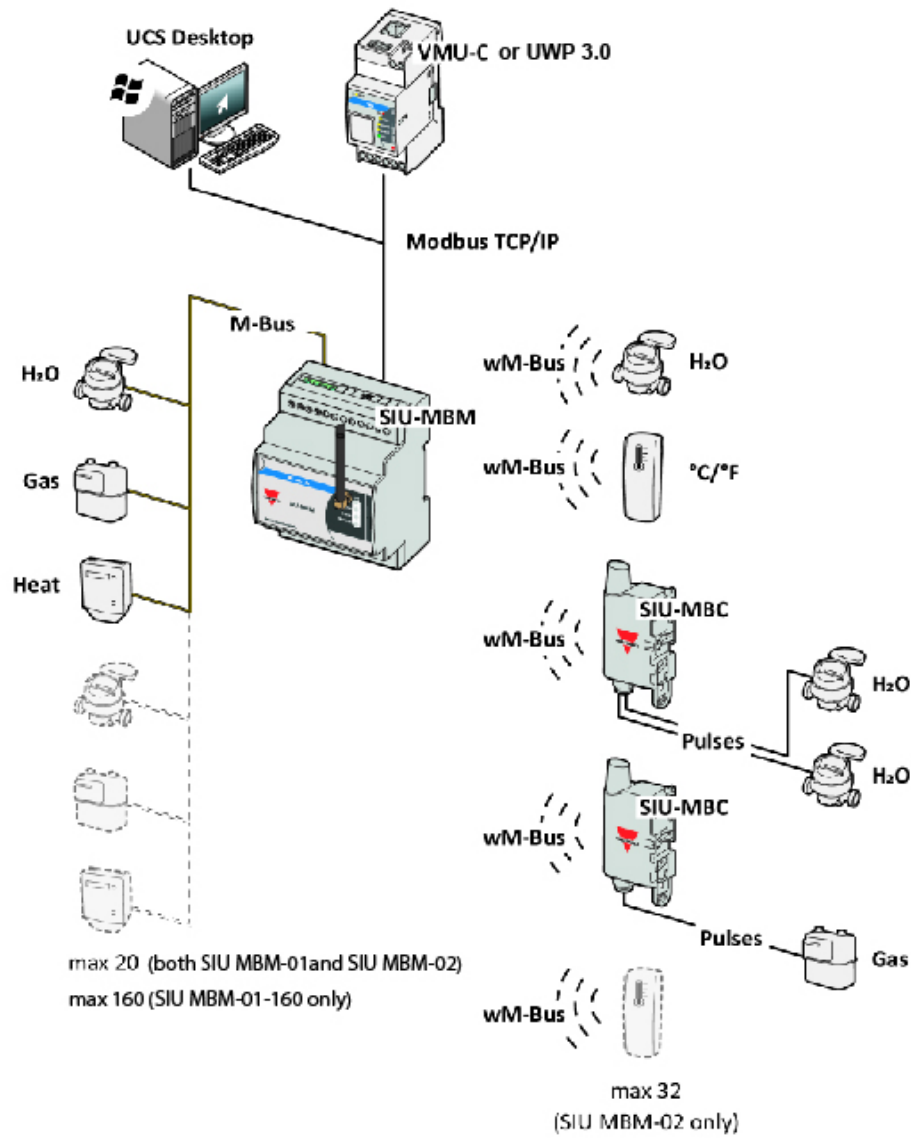


Figure 1: System architecture

Commissioning

The aim of this solution is to offer an easy-to-use tool to integrate a wide variety of different devices into a single platform. For this reason, the configuration wizard (available in the latest update of the UCS software, free to download) is the heart of the solution.

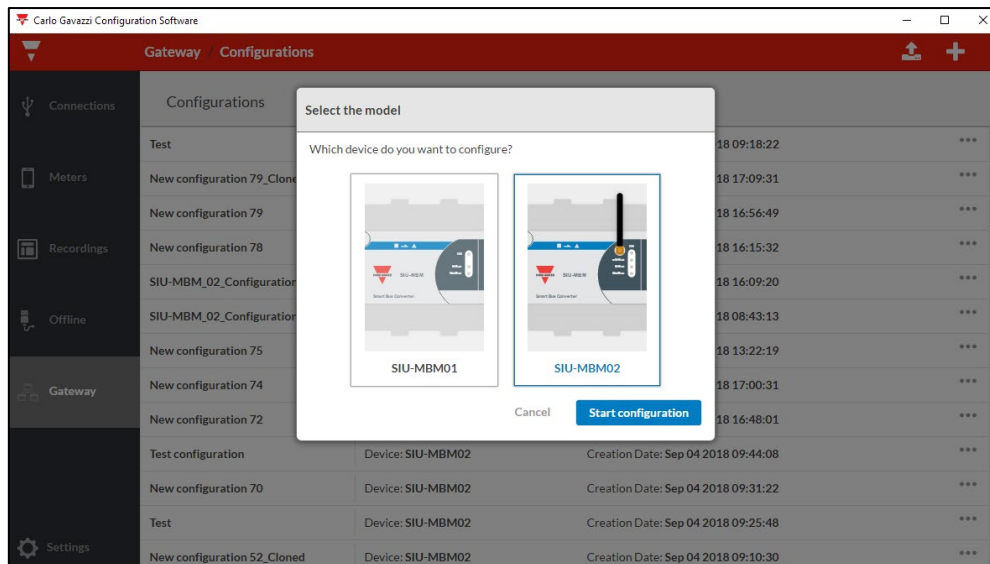


Figure 2: SIU-MBM configuration wizard

1) Communication settings

The first step of the wizard is necessary to adjust the communication to the user needs:

- LAN settings
- M-Bus baud rate, parity and reading interval
- wireless M-Bus mode

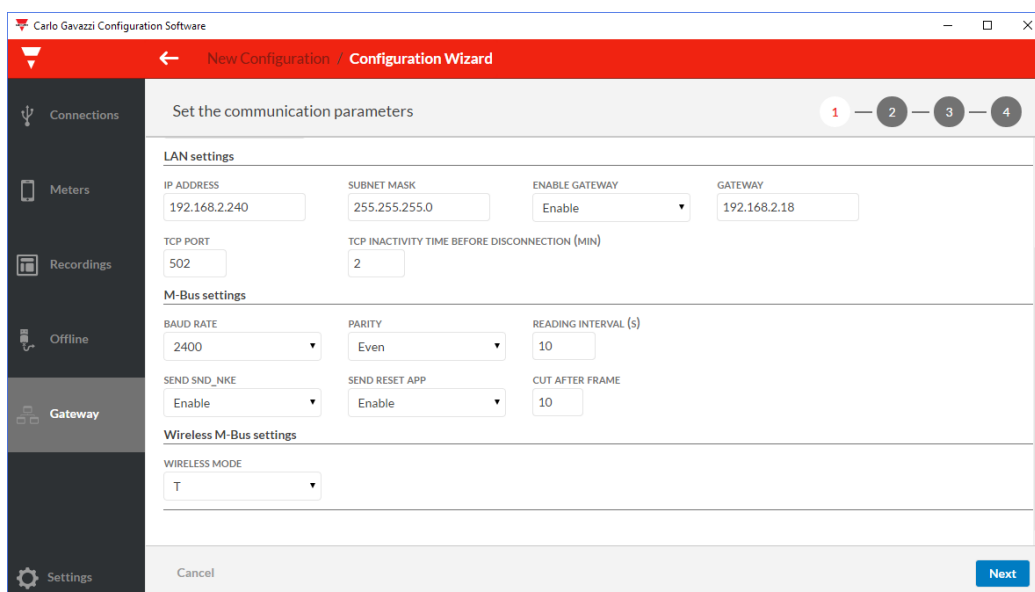


Figure 3: communication settings

2) Autoscan

Differently from other solutions that requires the manual addition of any devices (and the addition of any variable of each device), the SIU-MBM offers an incredibly powerful solution. The automatic network scan, available for both wired and wireless devices is able not only to identify the available devices but also the variables and the relevant scale factors and engineering units for each of them.

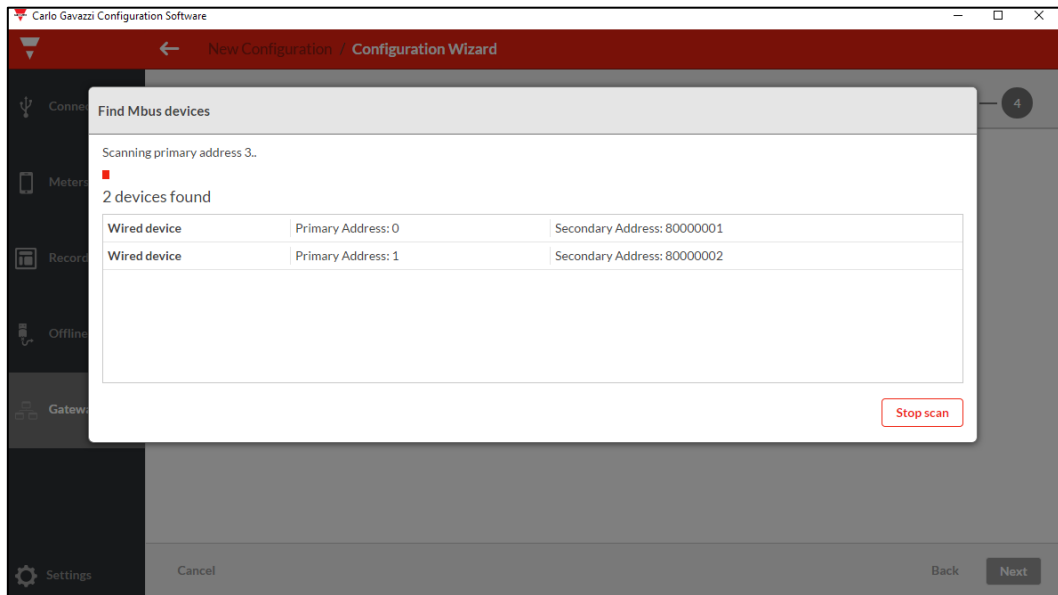


Figure 4: wired network automatic scan

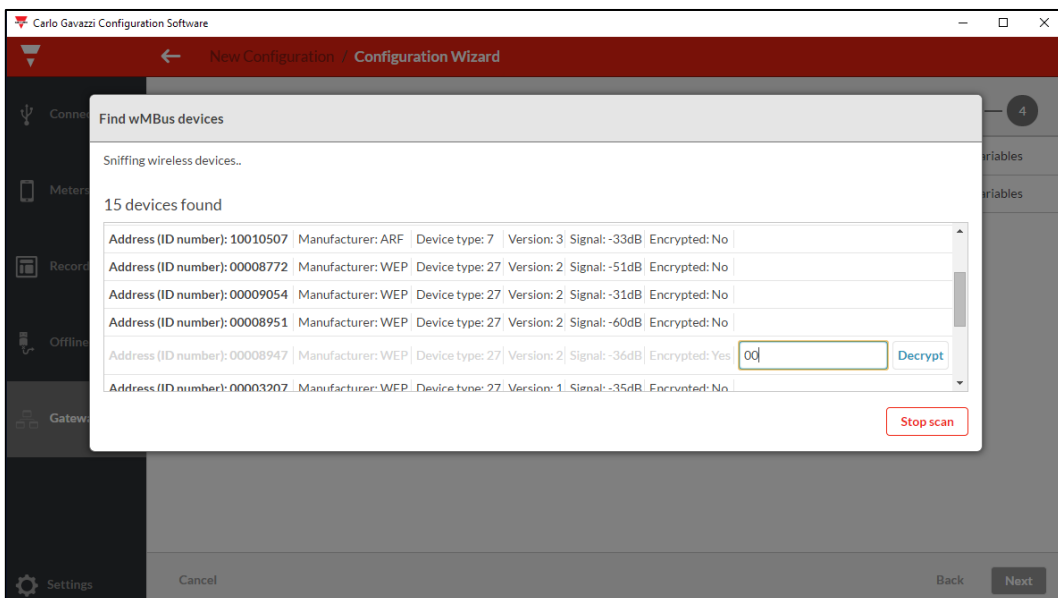


Figure 5: wireless network automatic scan

3) Modbus map

Selecting the desired variables, the Modbus map is automatically prepared.

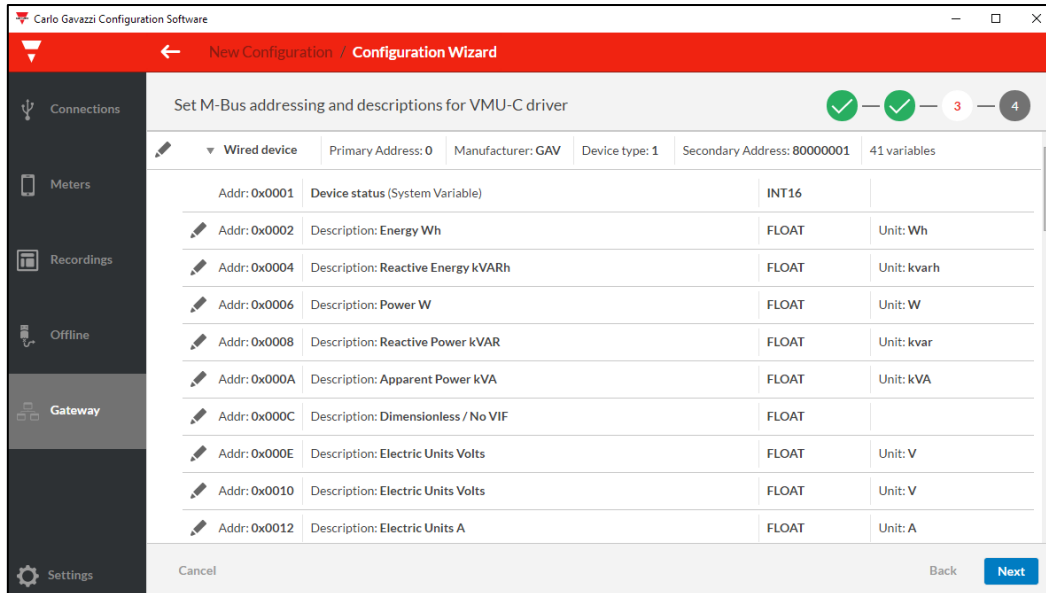


Figure 6: Example of Modbus map

4) Driver configuration

The driver that can be exported is now customized according to specific needs. It's possible to

- assign custom names to devices and variables
- set devices as electric single-phase or three-phase for better integration in VMU-C EM and UWP 3.0

5) Write configuration and export driver

The configuration created is now saved in the SW and can be written to SIU-MBM to start operation while the driver for VMU-C EM or UWP 3.0 can be exported.

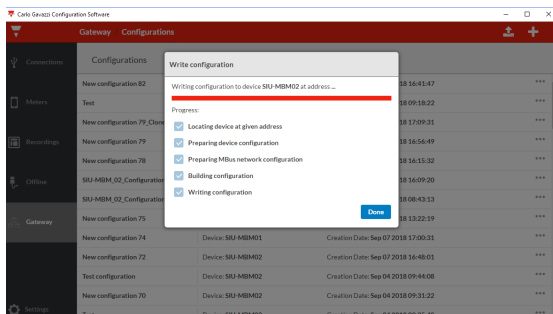


Figure 7: Write configuration

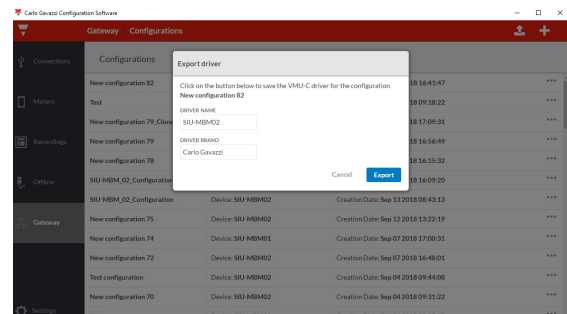
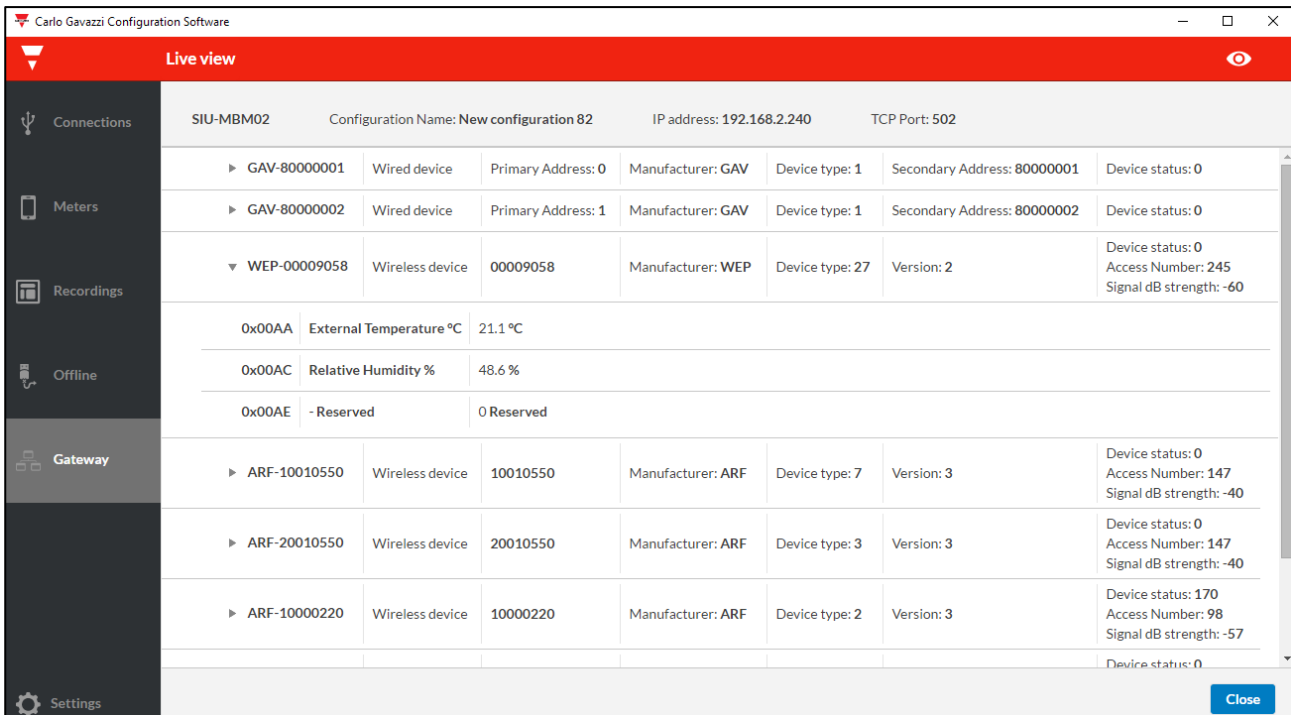


Figure 8: Export driver

Diagnostic tools

Live view

Thanks to the live view it's possible to check in real time the communication between the SIU-MBM and the M-Bus or wireless M-Bus devices.



The screenshot shows the 'Live view' window of the Carlo Gavazzi Configuration Software. The window title is 'Carlo Gavazzi Configuration Software'. The main content area displays a table of device information for configuration 'New configuration 82' at IP address 192.168.2.240 and TCP Port 502. The table lists various devices, including wired and wireless devices, and their communication parameters. A sidebar on the left contains navigation options: Connections, Meters, Recordings, Offline, Gateway, and Settings. A 'Close' button is located in the bottom right corner of the window.

SIU-MBM02 Configuration Name: New configuration 82 IP address: 192.168.2.240 TCP Port: 502							
▶ GAV-8000001	Wired device	Primary Address: 0	Manufacturer: GAV	Device type: 1	Secondary Address: 8000001	Device status: 0	
▶ GAV-8000002	Wired device	Primary Address: 1	Manufacturer: GAV	Device type: 1	Secondary Address: 8000002	Device status: 0	
▼ WEP-00009058	Wireless device	00009058	Manufacturer: WEP	Device type: 27	Version: 2	Device status: 0 Access Number: 245 Signal dB strength: -60	
0x00AA	External Temperature °C	21.1 °C					
0x00AC	Relative Humidity %	48.6 %					
0x00AE	- Reserved	0 Reserved					
▶ ARF-10010550	Wireless device	10010550	Manufacturer: ARF	Device type: 7	Version: 3	Device status: 0 Access Number: 147 Signal dB strength: -40	
▶ ARF-20010550	Wireless device	20010550	Manufacturer: ARF	Device type: 3	Version: 3	Device status: 0 Access Number: 147 Signal dB strength: -40	
▶ ARF-10000220	Wireless device	10000220	Manufacturer: ARF	Device type: 2	Version: 3	Device status: 170 Access Number: 98 Signal dB strength: -57	
						Device status: 0	

Figure 9: Live view

Check the communication (wired devices)

In the case of wired devices, it's enough to check the Device status.

If the device status...	the communication...
is 255	is not working
is not 255	is working properly

Check the communication (wireless devices)

In the case of wireless devices, it's necessary to check also the Access number, that increases at any new frame sent by the wireless M-Bus device.

If the device status...	the communication...						
is 255	is not working						
is not 255	<table border="1"> <thead> <tr> <th>If the access number...</th> <th>the communication...</th> </tr> </thead> <tbody> <tr> <td>increases after the communication interval of the wireless device</td> <td>is working properly</td> </tr> <tr> <td>doesn't increase</td> <td>is not working at the moment, even if at least one frame has been received after power on of the SIU-MBM</td> </tr> </tbody> </table>	If the access number...	the communication...	increases after the communication interval of the wireless device	is working properly	doesn't increase	is not working at the moment, even if at least one frame has been received after power on of the SIU-MBM
	If the access number...	the communication...					
	increases after the communication interval of the wireless device	is working properly					
doesn't increase	is not working at the moment, even if at least one frame has been received after power on of the SIU-MBM						

Furthermore, the signal strength (dB) is available.

Find the best position of the wireless sensors

- Install the SIU-MBM-02 in a proper position
- Power on the wireless sensors and prepare a configuration via UCS, including the wireless sensors
- Write the configuration and go to live view
- Check the signal strength in the possible positions moving the sensor and then waiting for the access number increase to see the new dB value
- -90 dB is the limit for wireless communication with SIU-MBM. When the value is higher than -85 dB the communication is good. If the value is near -90 dB or the access number doesn't increase at all, it's better to find another position or add an M-Bus repeater

Additional tools

Edit configuration

It's extremely frequent that after the first set up it's necessary to update or upgrade the system set-up (i.e. adding new M-Bus or wireless devices). For that reason, any configuration can be edited, allowing

- device and variable name change
- scan again the network to add new models
- change the driver type

Note: if the configuration is locked, the driver maintains the same ID driver and can replace an operating driver into VMU-C EM or UWP 3.0. If it's unlocked, it will be considered as a new driver.

Export configuration to file

Any configuration can be saved to a file in order to:

- be used on a different PC
- be shared with colleagues or other collaborators

Clone configuration

This function can be used to edit a copy of an existing configuration without losing the original one.

Export PDF Modbus map

When the system is used in combination with a generic Modbus Master the driver export functions cannot be used, so it is possible to export the Modbus map as a PDF file to be shared with the system integrator in charge of the Modbus Master or SCADA system.

Modbus Map							
Generated by UCS on: 02/10/2018 - 13:57:00							
Configuration Name				Test			
Device				SIU-MBM02			
IP address				192.168.2.205			
TCP Port				502			
Description				ARF-1000220			
Manufacturer				ARF			
Address				89438000			
IP address				192.168.2.205			
TCP Port				502			
Modicon Address	Physical Address	Length (Words)	Data format	Description	Engine ring Units	Scale	
1	400002	0001h	1	INT16	Device status	-	1.0
2	400003	0002h	1	INT16	Access Number	-	1.0
3	400004	0003h	1	INT16	Signal dB strength	-	1.0
4	400005	0004h	2	IEEE754	Energy Wh	Wh	1.0
Description				ARF-1001067			
Manufacturer				ARF			
Address				88502279			
IP address				192.168.2.205			
TCP Port				502			
Modicon Address	Physical Address	Length (Words)	Data format	Description	Engine ring Units	Scale	
5	400007	0000h	1	INT16	Device status	-	1.0
6	400008	0007h	1	INT16	Access Number	-	1.0
7	400009	0008h	1	INT16	Signal dB strength	-	1.0
8	400010	0009h	2	IEEE754	Volume m3	m3	1.0
Description				ARF-1001060			
Manufacturer				ARF			
Address				88022352			
IP address				192.168.2.205			
TCP Port				502			
Modicon Address	Physical Address	Length (Words)	Data format	Description	Engine ring Units	Scale	
9	400012	0008h	1	INT16	Device status	-	1.0
10	400013	000Ch	1	INT16	Access Number	-	1.0
11	400014	000Dh	1	INT16	Signal dB strength	-	1.0

Figure 10: Example of PDF Modbus map