ME50/70-169 Demo Case User Guide

1vv0301029 Rev.1 – 2014-04-22

Making machines talk.

APPLICABILITY TABLE

PRODUCT
ME50-169
ME70-169

SW Version
GI.U03.01.0X GL.U03.01.0X

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1. Introduction

1.1. Scope

The aim of this document is to describe the Democase dedicated to Wireless M-Bus 169MHz demonstration, based on ME50-169 and ME70-169 modules, embedding Telit in house Wireless M-Bus stack.

After a short description of the Democase and its installation principles, its functioning will be detailed in more advanced operation modes.

1.2. Audience

This document is intended for customers who are about to test or learn how Wireless M-bus works.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-SRD@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters (sample):

"Chapter 1: Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

"Chapter 2: General Description" gives an overview of the features of the product.

"Chapter 3: Detailed equipment description" describes in details the characteristics of the provided hardware.

"Chapter 4: Installation of ME50-169" describes how to use the DemoCase with ME50-169

"Chapter 5: Installation of ME70-169" describes how to use the DemoCase with ME70-169

"Chapter 6: SR Manager Tool Installation" describes how to use the SR Manager Tool

"Chapter 7: Wireless M-Bus 2013 Part4: Tutorial" contains a tutorial on how to set up communication between modules with Wireless M-Bus 2013 Part4 embedded SW.

"Chapter 8: Glossary" provides a complete list of acronyms and abbreviations used in this document.

"Chapter 9: Document History" provides a complete revision list.

1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents

- [1] ME50-169 RF Module User Guide, 1vv0300981
- [2] ME70-169 RF Module User Guide, 1vv0301021
- [3] SR Manager Tool User Guide, 1vv0300899
- [4] Wireless M-Bus User Guide Part4+Part5 Mode R2, 1vv0300828
- [5] Wireless M-Bus Part5_Mode Q User Guide, 1vv0300935
- [6] Wireless M-Bus 2013 Part4 User Guide, 1vv0300953

2. General Description

2.1. DemoCase philosophy

The goal of the DemoCase is to show to customers the possibilities offered by Telit Wireless M-Bus solutions into the 169MHz metering dedicated band.

It allows customers test the Wireless M-Bus functionalities and modules performances. All the devices proposed into the DemoCase are based on ME50-169 and ME70-169 radio modules.

2.2. Hardware Considerations

The DemoCase contains devices based on ME50-169 and ME70-169 radio modules:

- ME50-169: it is a 35mW radio module, allowing range up to 5 km.
- ME70-169: it is a 1W radio module, allowing range up to 25 km.

For more HW information on ME50-169 and ME70-169, please refer to the dedicated documentation [1] and [2] available on the Telit web site.

2.3. Wireless M-bus Considerations

Into the DemoCase, radio modules are configured with “Wireless M-Bus 2013 Part4” Telit embedded SW. Please refer to the dedicated documentation [6] available on the Telit web site.

2.4. SR Manager Tool Considerations

SRManagerTool is the PC software to configure and monitor a Wireless M-Bus Network.

For installation and detailed use, refer to the dedicated documentation [3] available on the Telit web site.

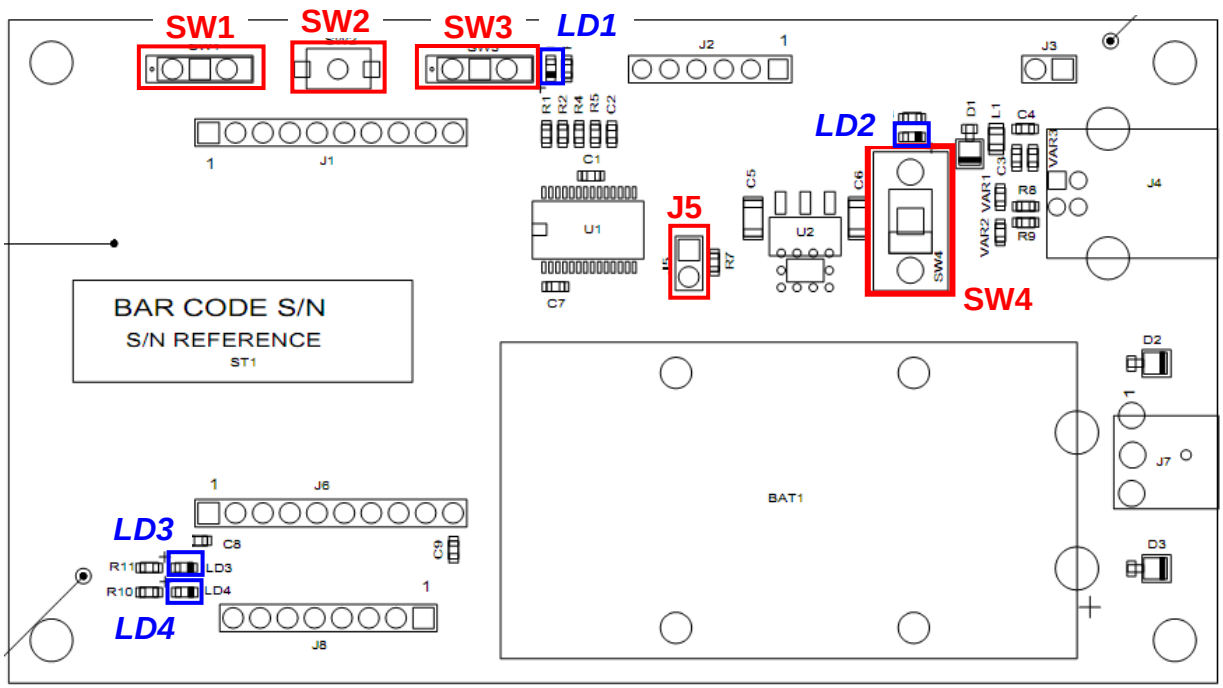
2.5. List of equipment

The ME50/70-169 Democase supplies the following items:

- 2 USB EVKs
- 2 ME50-169 modules mounted on their DIP support
- 2 ME70-169 modules mounted on their DIP support
- 2 Antennas (SMA)
- 2 USB cables
- 2 Power supply DC blocks (+6V)
- 2 Primary batteries (+9V)
- 4 Snap ferrites

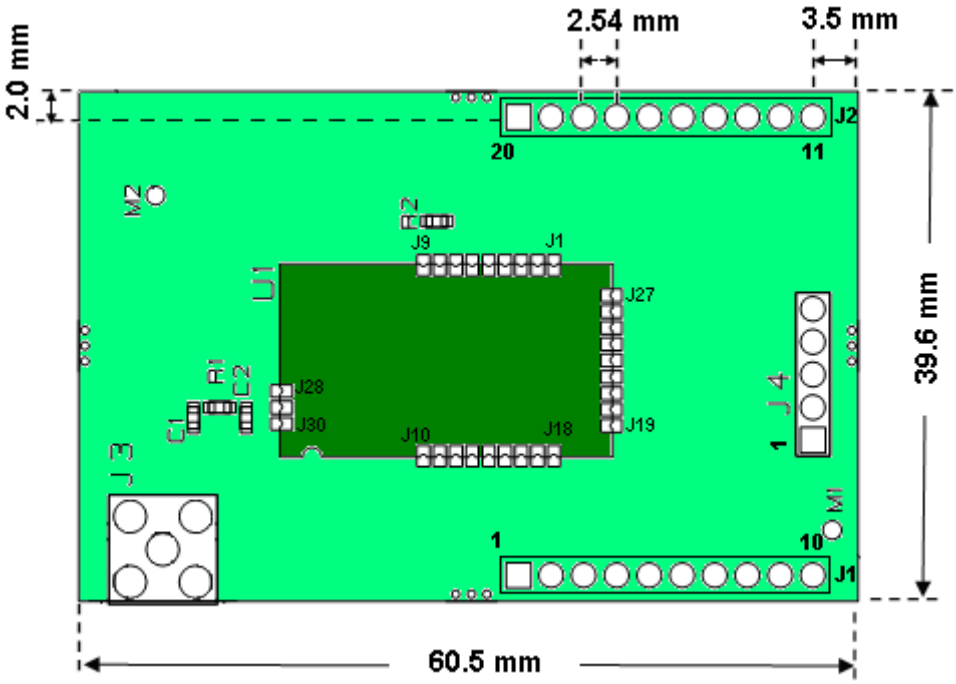
3. Detailed equipment description

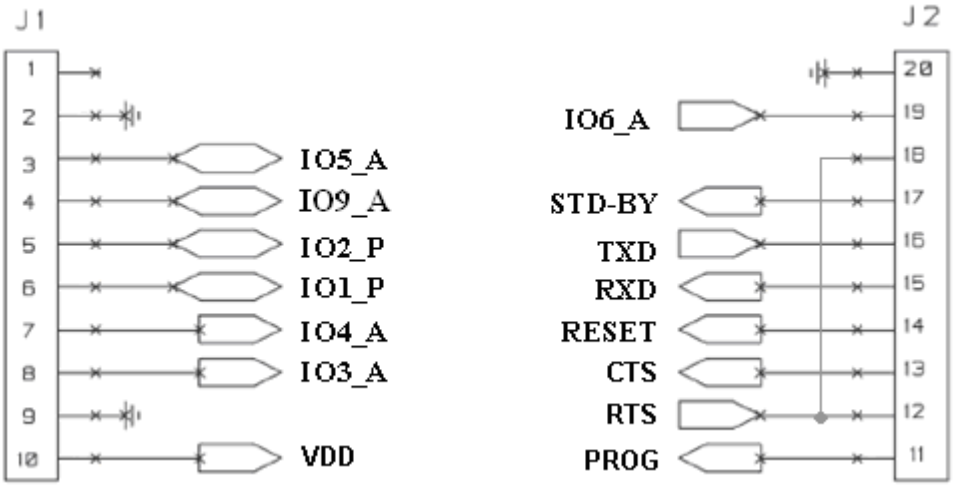
3.1. EVK Description



Designation	Feature
SW1	Stand-by switch
SW3	Programming switch
SW2	Reset push button
SW4	ON/OFF switch
LD1	PROG Yellow LED
LD2	ON/OFF Yellow LED
LD3	Red LED
LD4	Green LED

3.2. ME50/70-169 DIP Pin Out



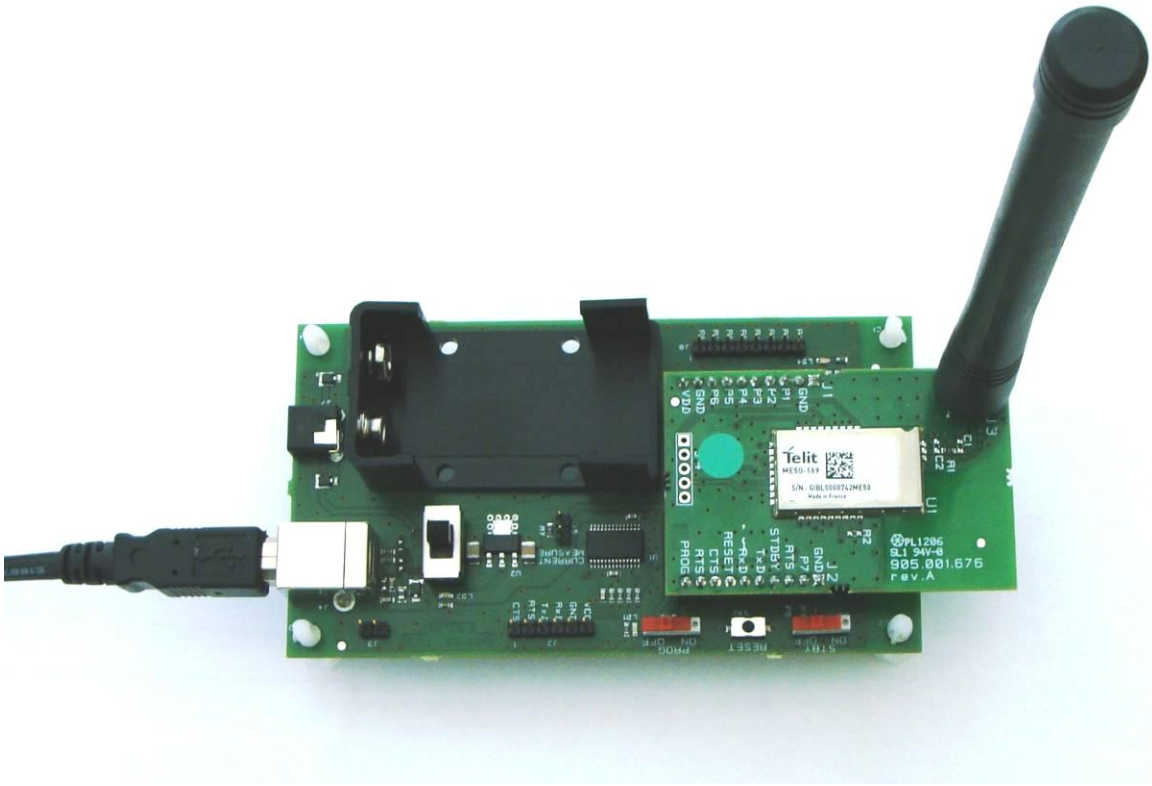


4. Installation of ME50-169

4.1. Demoboard Construction

In order to build each demoboard :

1. Plug 1 DIP module on 1 EVK board.
2. Screw a SMA antenna on each DIP module.
3. Plug a USB cable to each EVK board.
4. Clip a Snap Ferrite onto the USB cable.



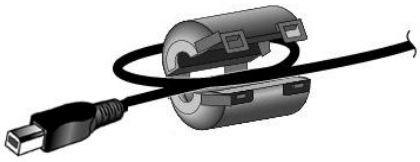
4.2. DemoBoard Connection

In order to connect a demoboard:

1. Connect the USB cable to the PC.

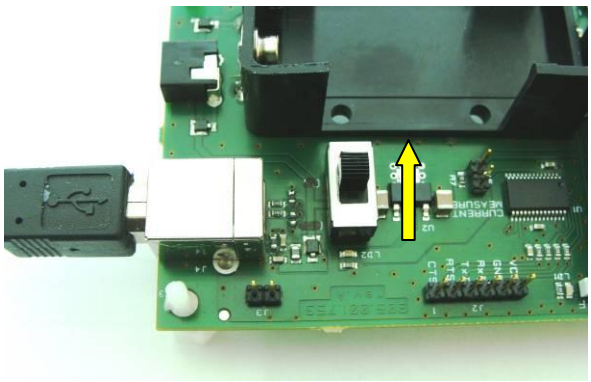
The Demoboard is supplied directly through the USB connection. In case of mobility is needed, a +9V battery can be used. When battery is plugged, it has priority on the USB power supply.

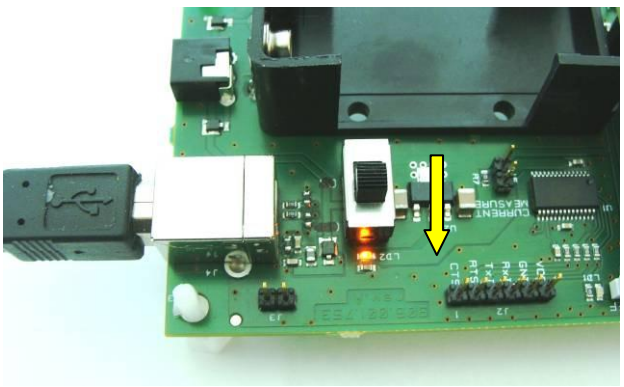
The Snap Ferrites are useful for decoupling the Demoboard from the PC cables. Clip the ferrites close to the EVK in this way:



2. Check that stand-by (STBY, SW1) and programming (PROG, SW3) switches are turned OFF.
3. Switch the DemoBoard ON (SW4). Check that the yellow LED LD2 lights on when power supplying the DemoBoard.

OFF ***ON***





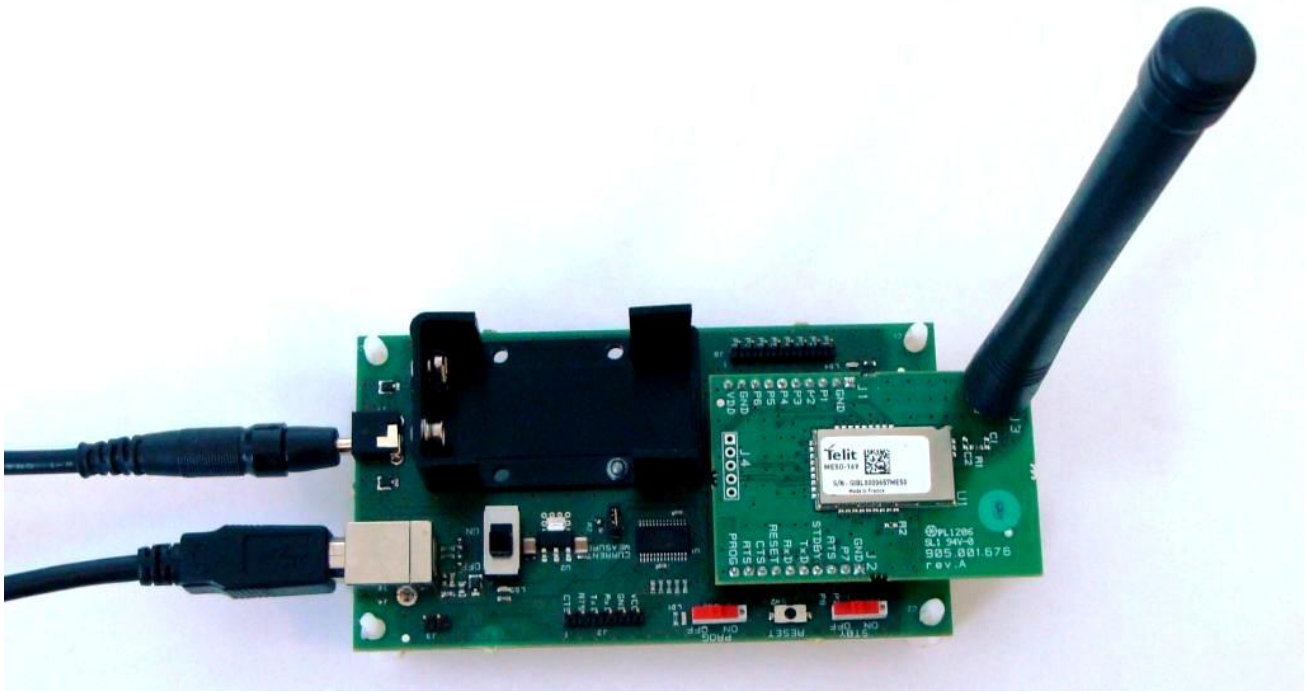
4. Red LED LD3 blinks when the module is transmitting/receiving data frames, corresponds to pin J1.
5. Green LED LD4 lights on when the module is in normal mode (not stand-by mode), corresponds to pin J2.

5. Installation of ME70-169

5.1. Demoboard Construction

In order to build each demoboard:

1. Plug 1 DIP module on 1 EVK board.
2. Screw a SMA antenna on each DIP module.
3. Plug a USB cable to each EVK board.
4. Plug a DC block to each EVK board.
5. Clip a Snap Ferrite onto the USB cable.
6. Clip a Snap Ferrite onto the supply cable.



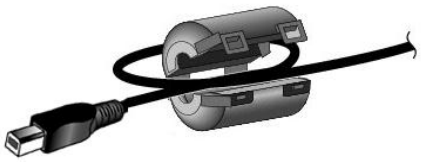
5.2. DemoBoard Connection

In order to connect a demoboard:

1. Connect the USB cable to the PC.
2. Plug the DC block to main power.

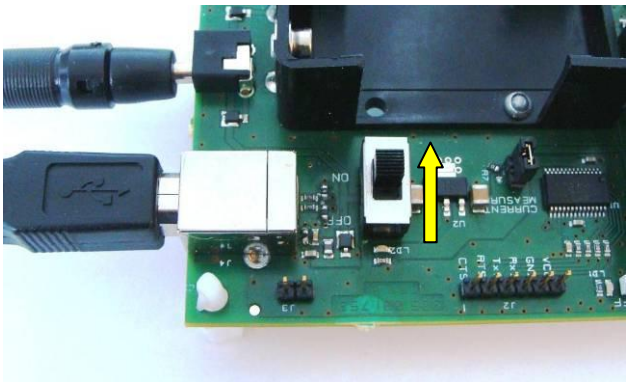
The Demoboard is supplied by the DC block. In case of mobility is needed, a +9V battery can be used.

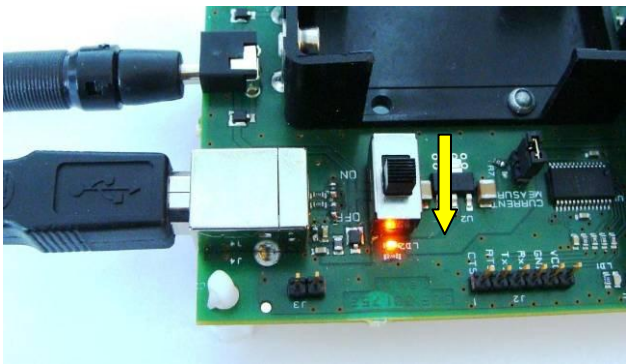
The Snap Ferrites are useful for decoupling the Demoboard from the PC cables. Clip the ferrites close to the EVK in this way:



3. Check that stand-by (STBY, SW1) and programming (PROG, SW3) switches are turned OFF.
4. Switch the DemoBoard ON (SW4). Check that the yellow LED LD2 lights on when power supplying the DemoBoard.

OFF ***ON***





5. Red LED LD3 blinks when the module is transmitting/receiving data frames, corresponds to pin J1.
6. Green LED LD4 lights on when the module is in normal mode (not stand-by mode), corresponds to pin J2.

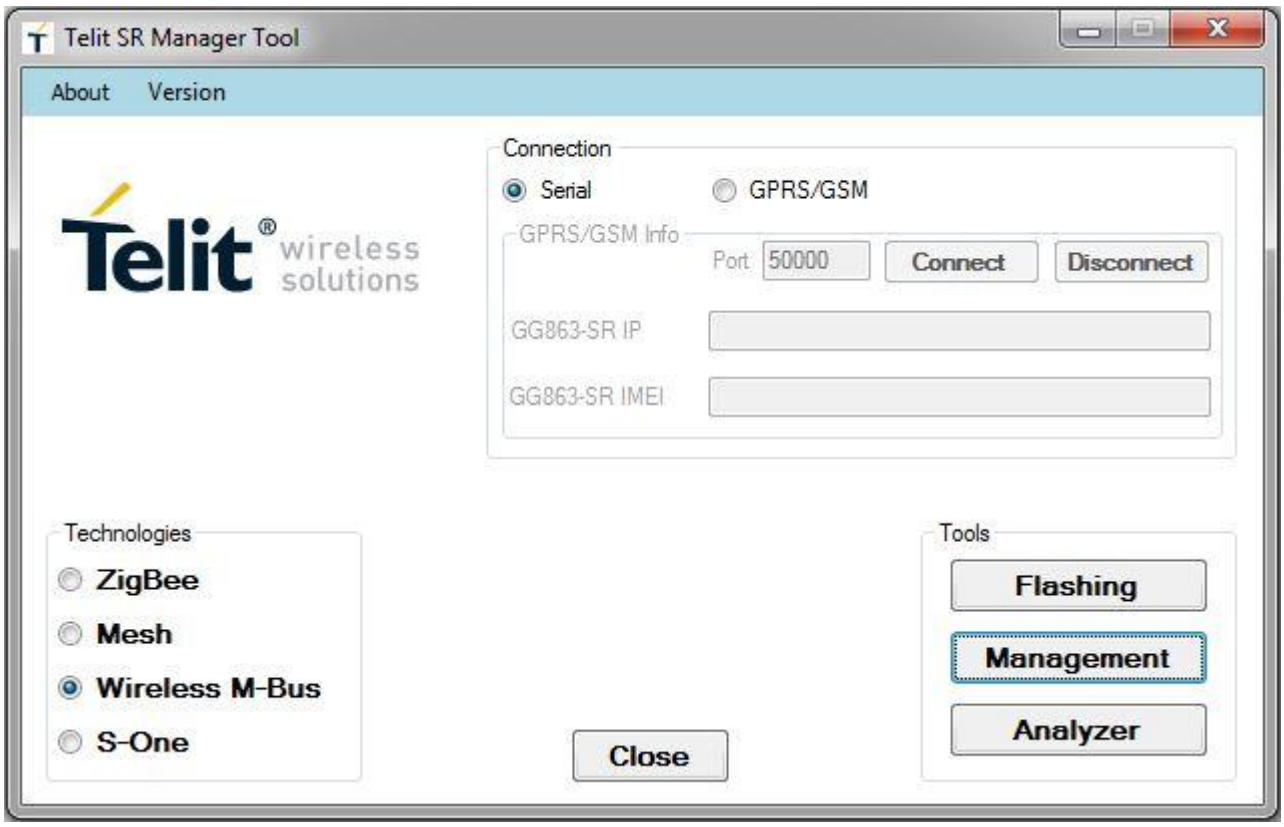
6. SR Manager Tool Installation

Refer to SR Tool user guide [3] for a detail description of SR tool installation

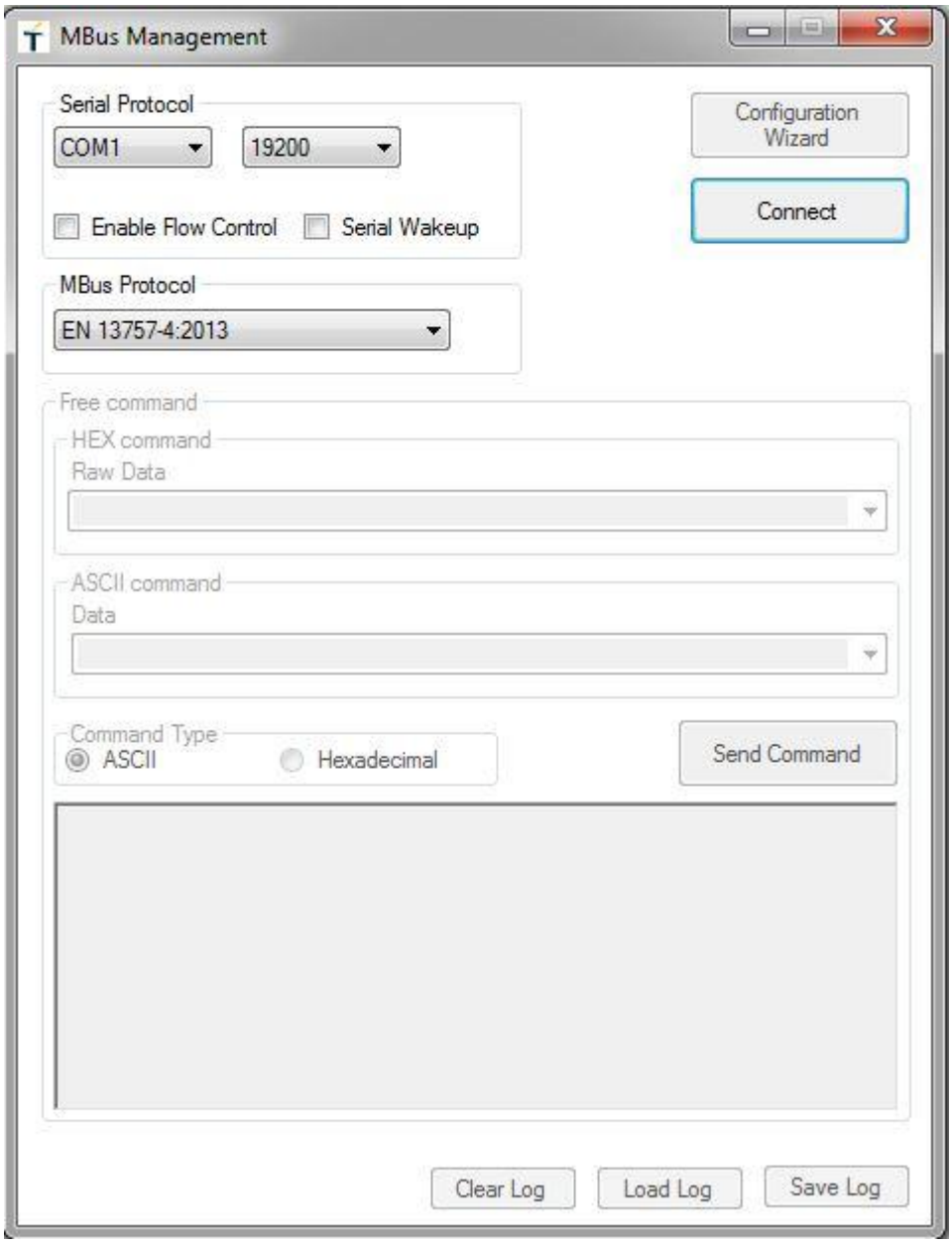
7. Wireless M-Bus 2013 Part4: Tutorial

This chapter contains a step-by-step tutorial on how to set up communication between two ME50/70-169 modules and how to transfer a simple frame from one module to another. One module will be configured as meter and the other module will act as "other" device (data concentrator). Telit SR Manger Tool is used both to configure the modules and to transfer data between them.

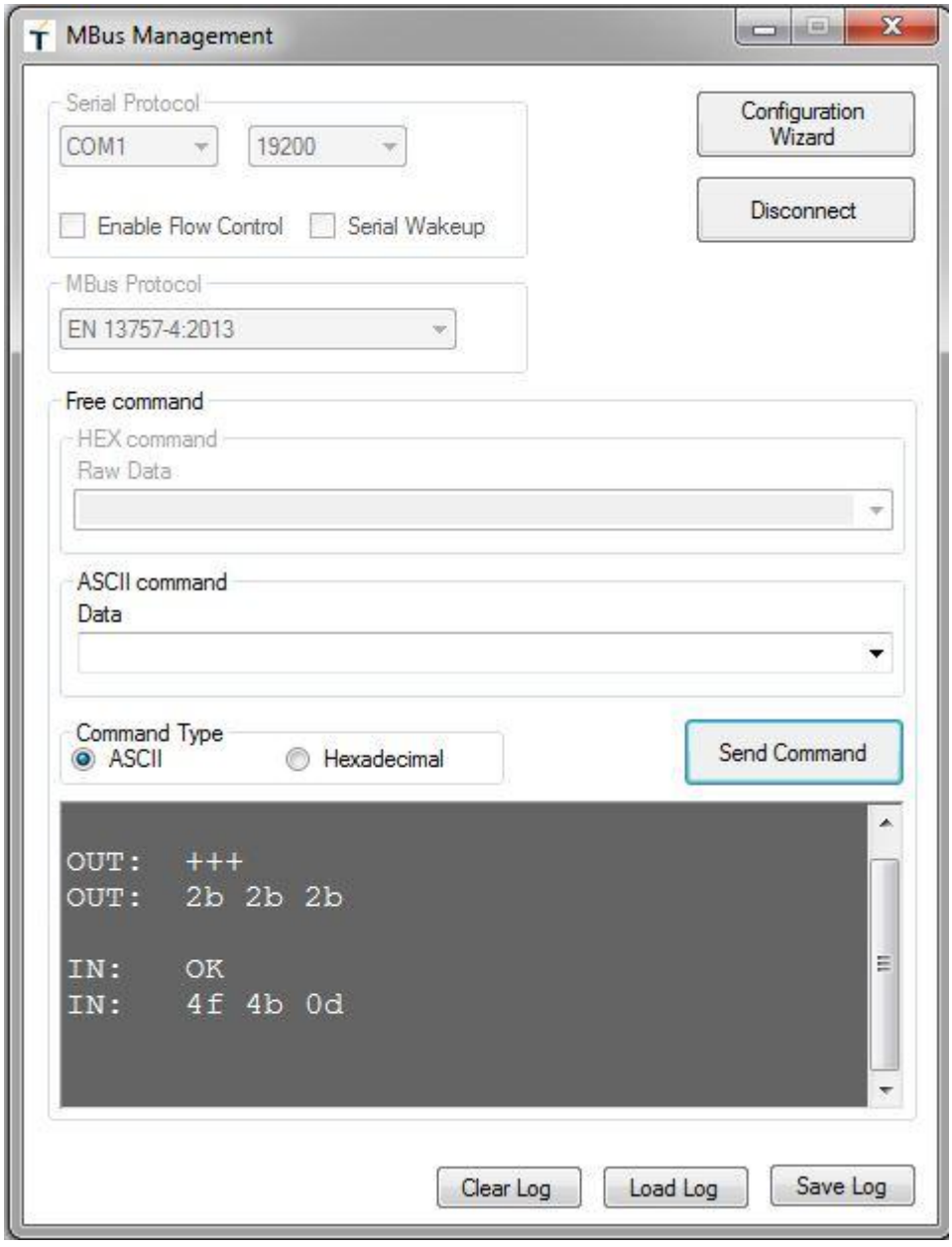
1. Switch on the first DemoBoard and connect it to the PC via the RS-232 serial cable; start SR Manager Tool:



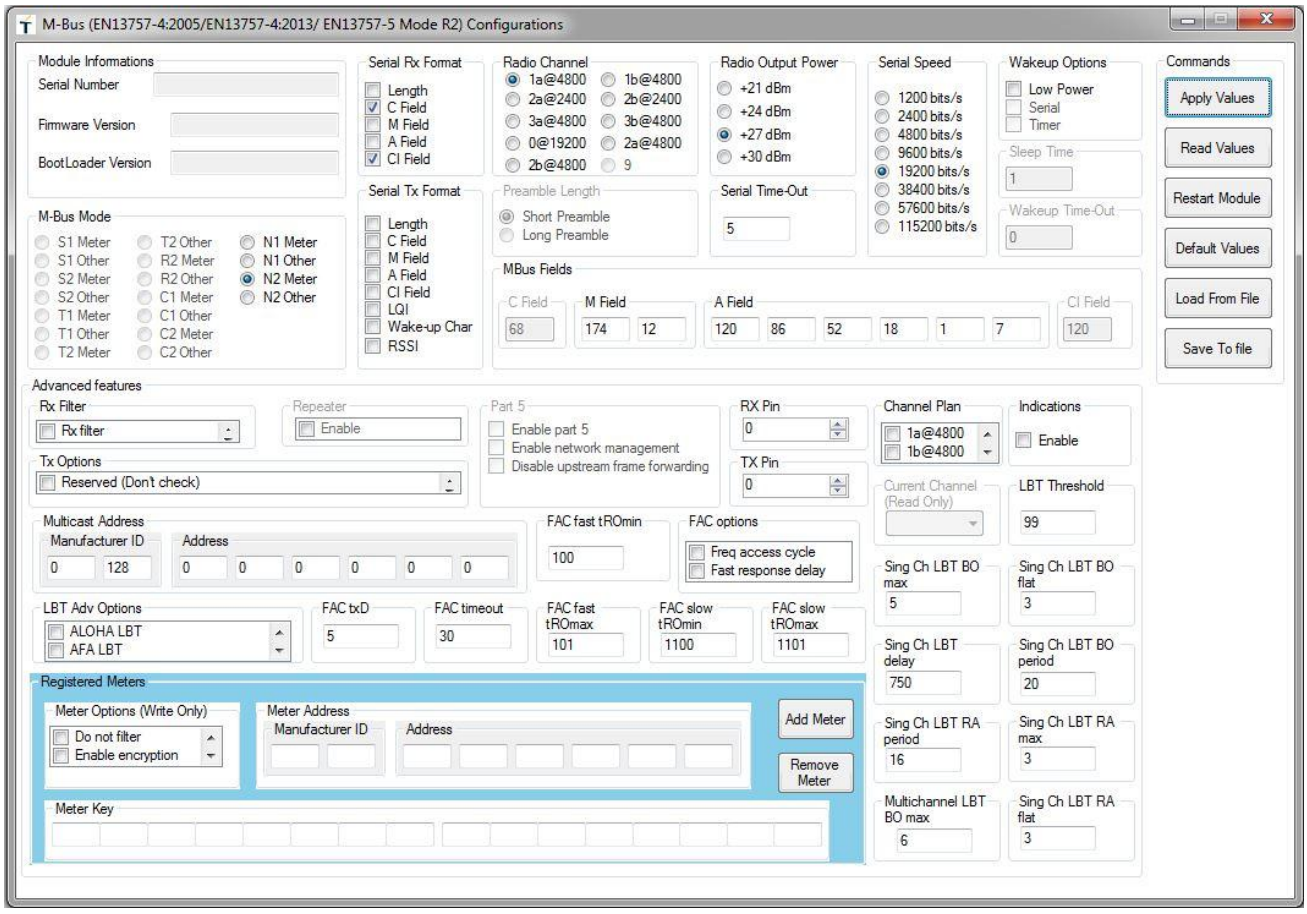
2. Select "Wireless M-Bus" in the "Technologies" panel and click on "Management"; a new window appears:



3. In the “Serial Protocol” panel, select the PC serial port connected to the DemoBoard and select 19200 as baud rate; select “EN 13757-4:2013” in the “MBus Protocol” panel; click on “Connect”:

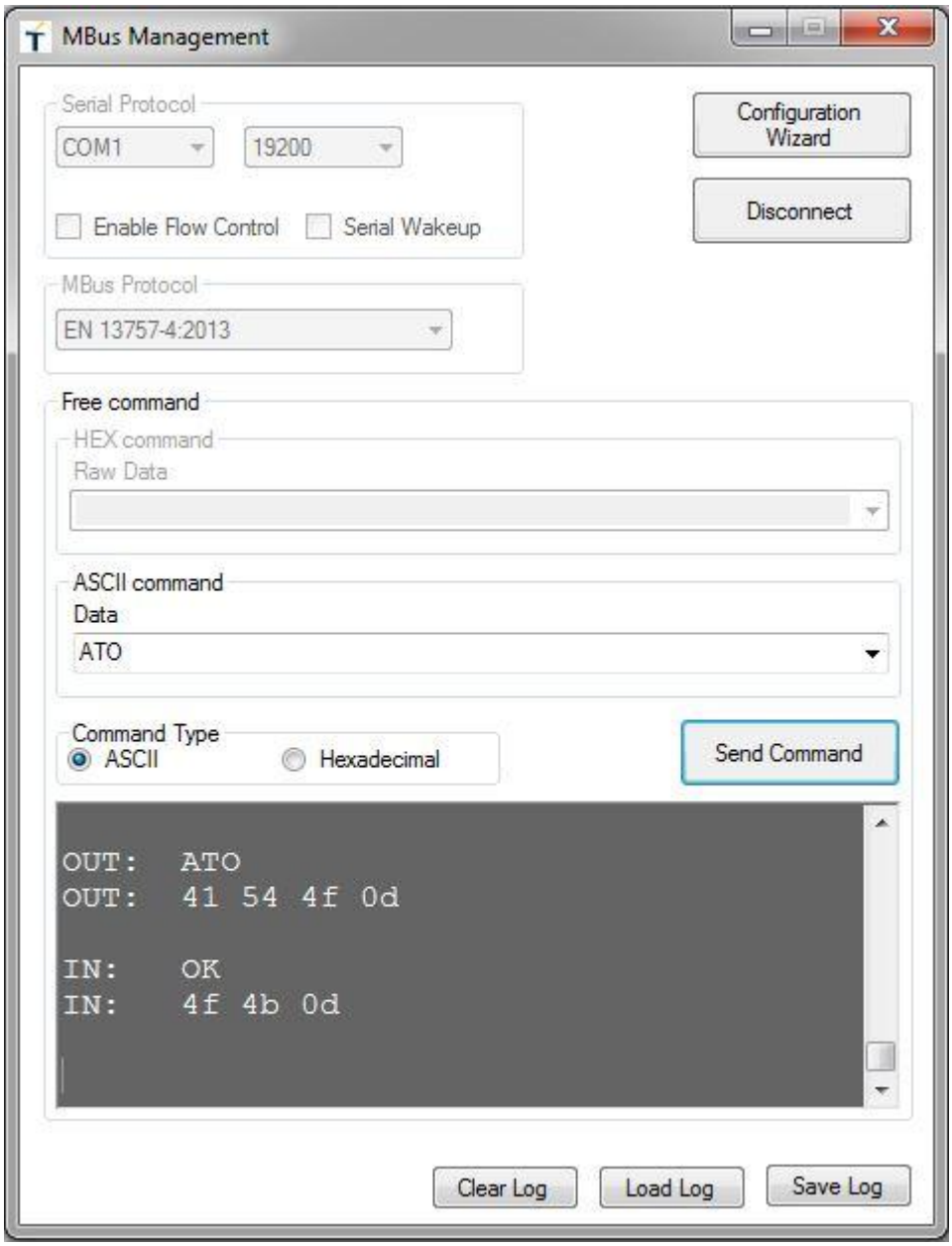


4. Click on “Configuration Wizard”; a new window appears:

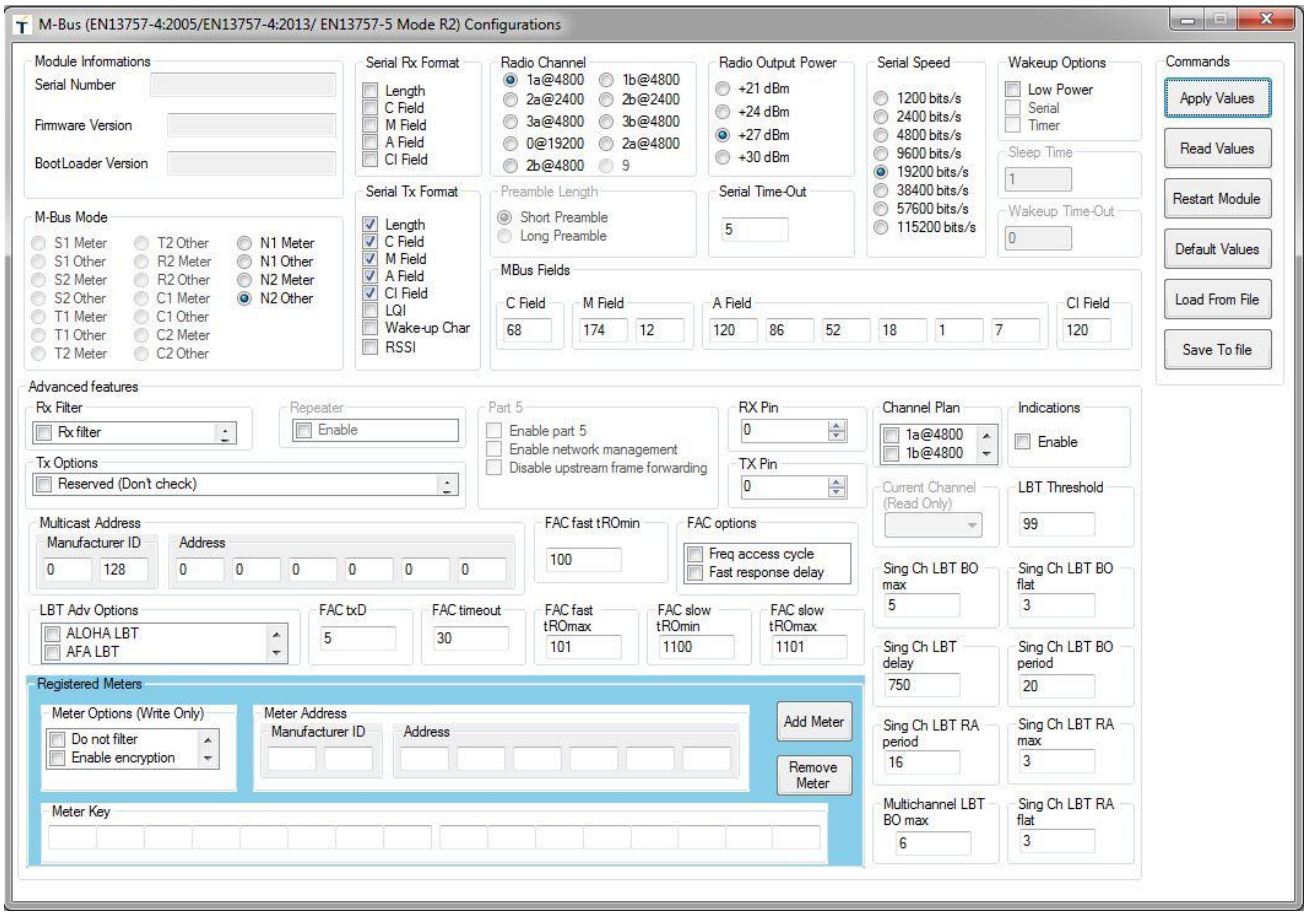


5. Select “N2 Meter” in the “M-Bus Mode” panel, select “C Field” and “CI Field” in the “Serial Rx Format” panel and click on “Apply Values”; wait until a pop-up window appears that confirms the new settings:

6. Click on “OK” in the pop-up window and close the configuration window; in the “MBus Management” window, type the string ”ATO” in the “Data” text box and press Enter:

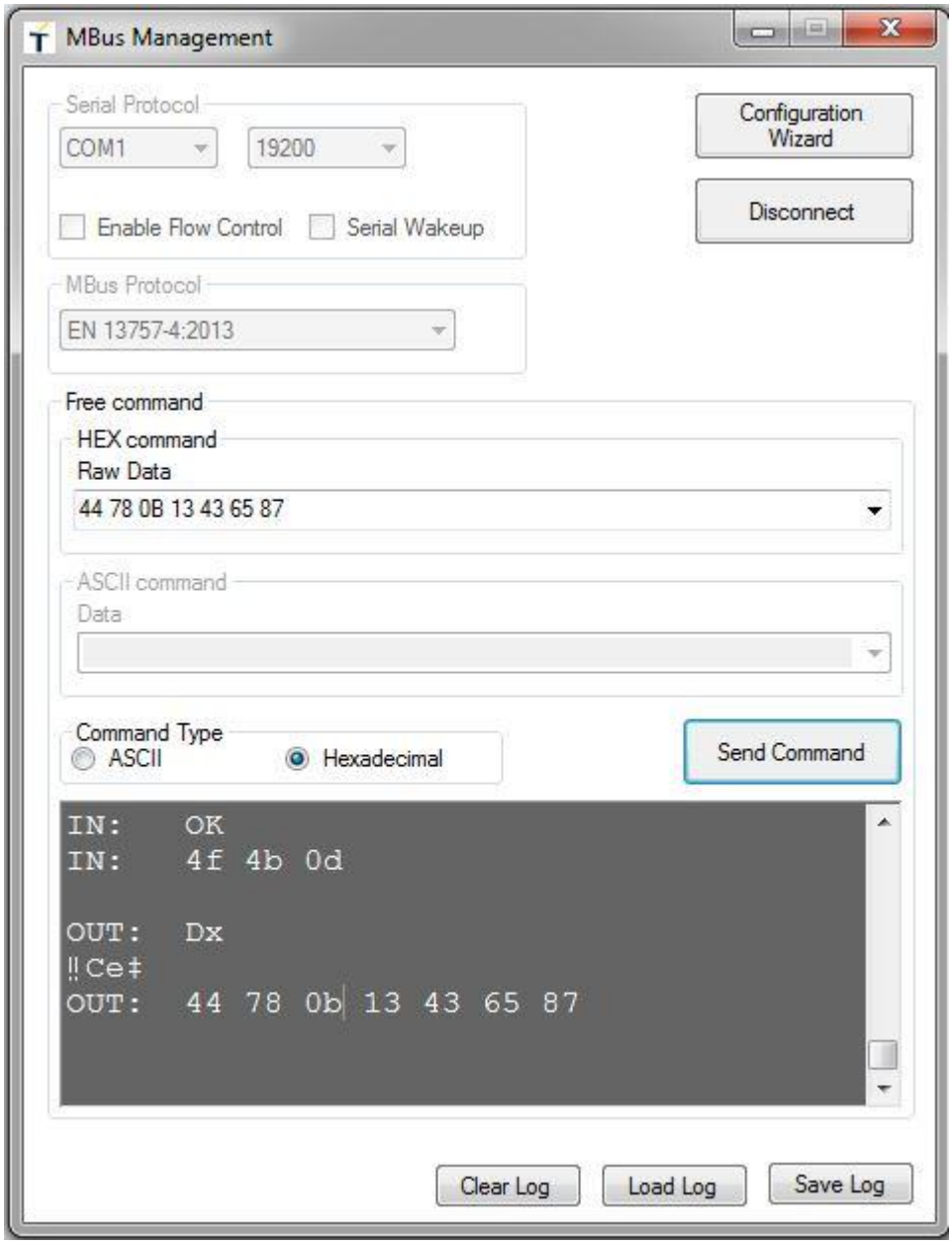


7. In the bottom panel the “OK” response from is shown. Now the module in the first DemoBoard is configured to work as meter in N2 mode and is ready to send or receive data. Keep this window open because it will be used afterwards to send an example frame.
8. To configure the second module as “other” device, open a new instance of SR Manager Tool and follow the same steps shown above to open the configuration window, this time selecting the serial port connected to the second DemoBoard.

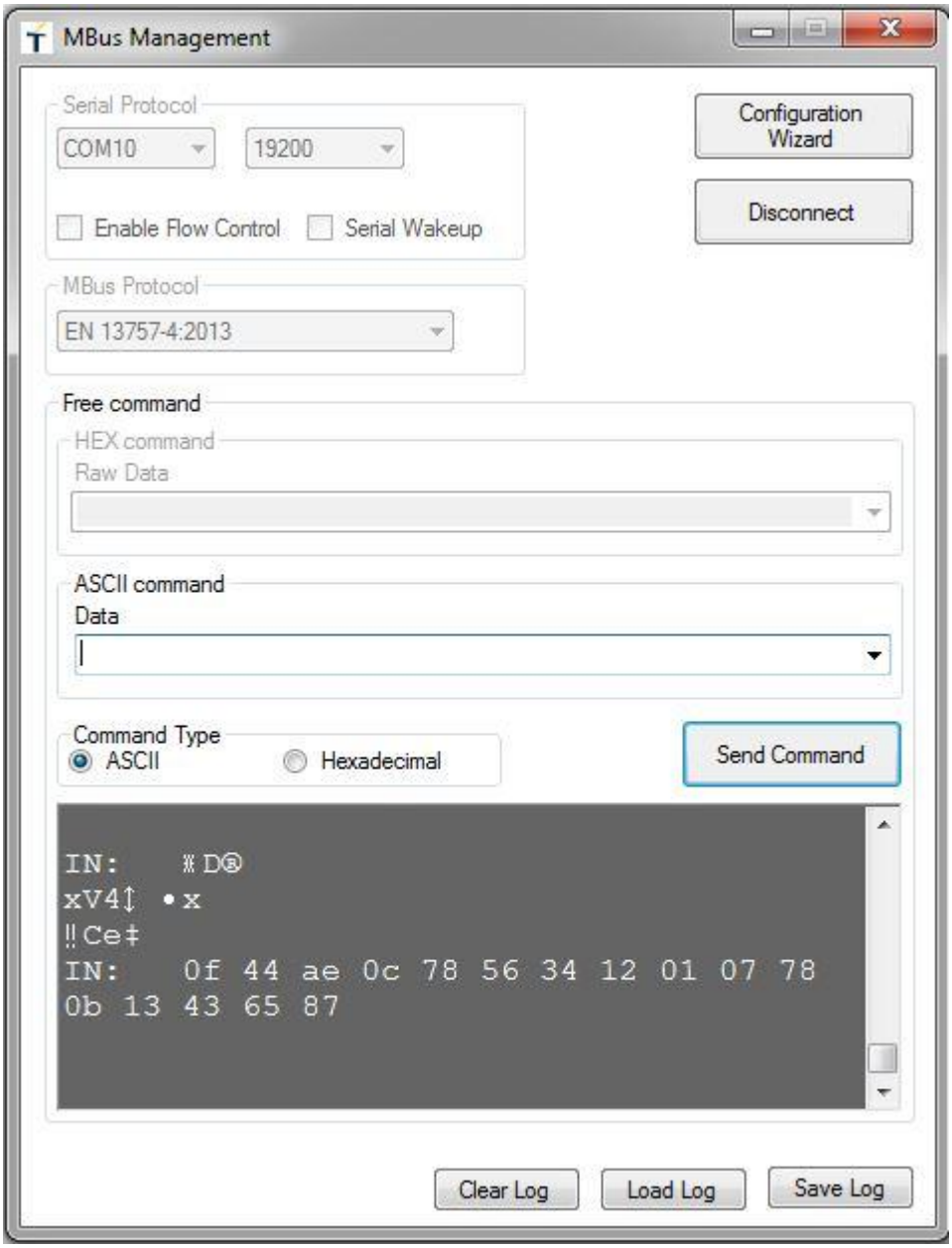


9. Select “N2 Other” in the “M-Bus Mode” panel, select “Length”, “C Field”, “M Field”, “A Field” and “CI Field” in the “Serial Tx Format” panel and click on “Apply Values”; wait for the settings to be applied and close the configuration window. In the “MBus Management” window, send the “ATO” command as done previously with the first DemoBoard. Now both modules are ready to transfer data.

10. To illustrate data communication, an example frame containing a measured volume of 876543 liters will be used. Based on the settings applied to the first module, to send a frame the fields to be sent to the serial port are C-Field and CI-Field, plus an optional Data-Field. In this example, a C-Field value of 0x44 (SEND / NO REPLY) and a CI-Field value of 0x78 (indicating a frame from a meter to a data concentrator, without data header) is chosen; the Data-Field is composed of the byte sequence (in hexadecimal notation) 0B 13 43 65 87, indicating a value of 876543 liters expressed with BCD coding. The total byte sequence to send to the serial port of the first DemoBoard is: 44 78 0B 13 43 65 87. In the “MBus Management” window of the SR Tool instance connected to the first DemoBoard, select “Hexadecimal” in the “Command Type” panel, type the above byte sequence in the “Raw Data” text box and press Enter:



11. The frame is sent by the first module and received by the second module, as shown in the bottom panel of the “MBus Management” widow of the SR Tool instance connected to the second DemoBoard:



12. Specifically, the bottom panel shows the bytes corresponding to the settings previously applied in the “Serial Tx Format” panel of the configuration window: Length (0F), C-Field (44), M-Field (AE 0C, corresponding to the M-Field values contained in the settings of the first module), A-Field (78 56 34 12 01 07, corresponding to the A-Field values contained in the settings of the first module) and CI-Field (78), plus the Data-Field byte sequence (0B 13 43 65 87).

ENCRYPTION EXAMPLE

1. To illustrate encryption, an example frame containing a 13757-3 Application Layer with short Transport Layer will be used (CI-field value is 0x7A).

   In this example, meter address is:

   a. M-Field: AE 0C

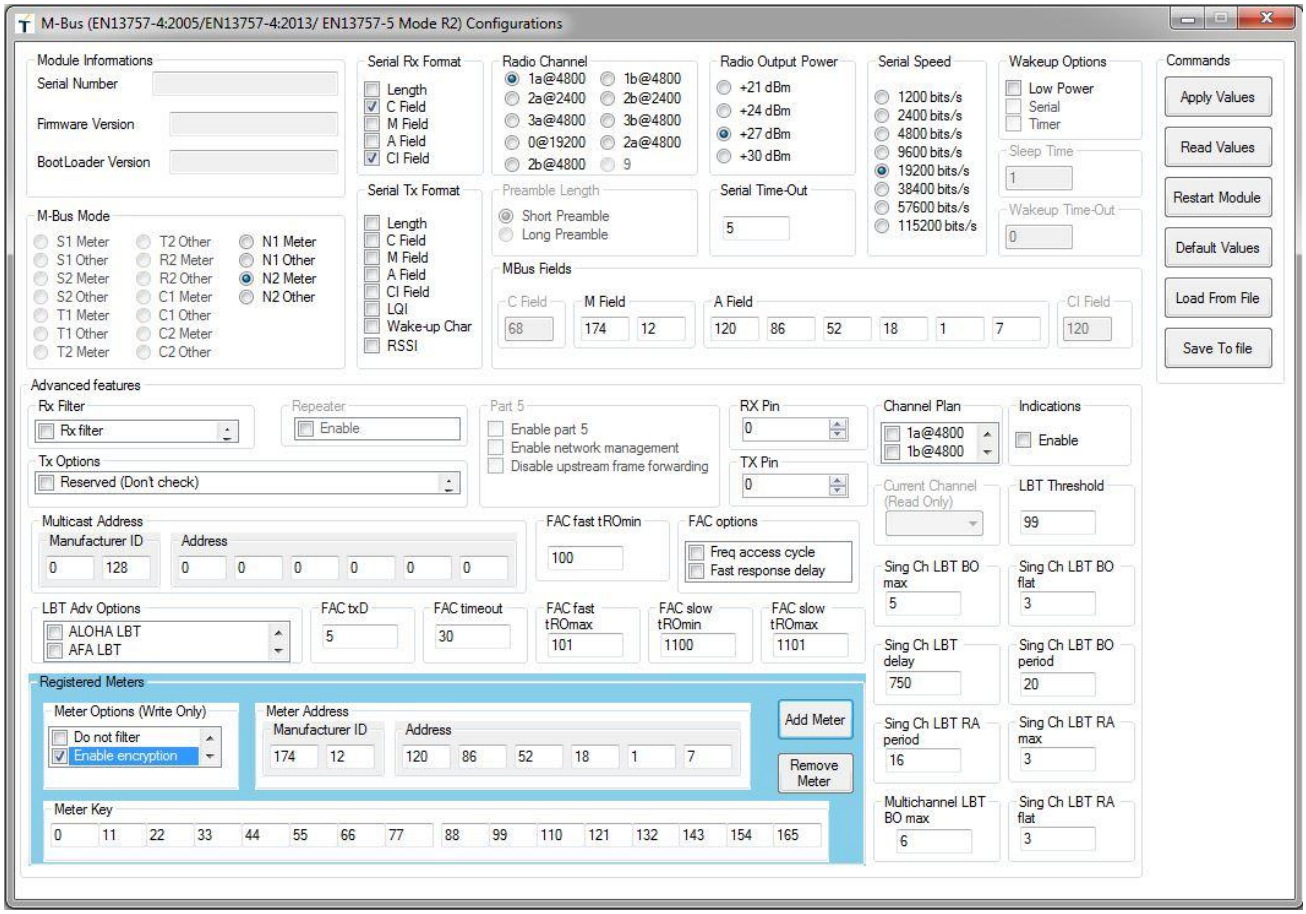
   b. A-Field: 78 56 34 12 01 07

   Its encryption key is:

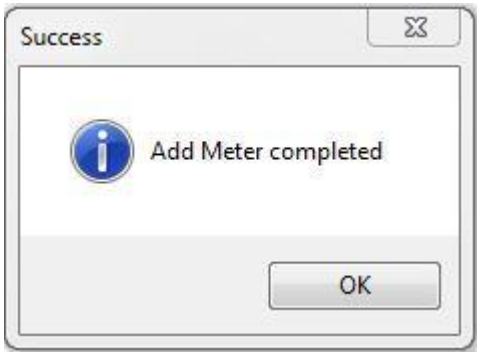
   00 0B 16 21 2C 37 42 4D 58 63 6E 79 84 8F 94 A5

   A meter device must insert its own manufacturer ID, address and key in an entry of the registered meter list and set bit 2 of register 460.

   In the configuration window, insert the meter address and its key in the “Register Meters” panel and select “Enable Encryption”. The meter address in the “Register Meters” panel must be the same of the “MBus Fields” panel.



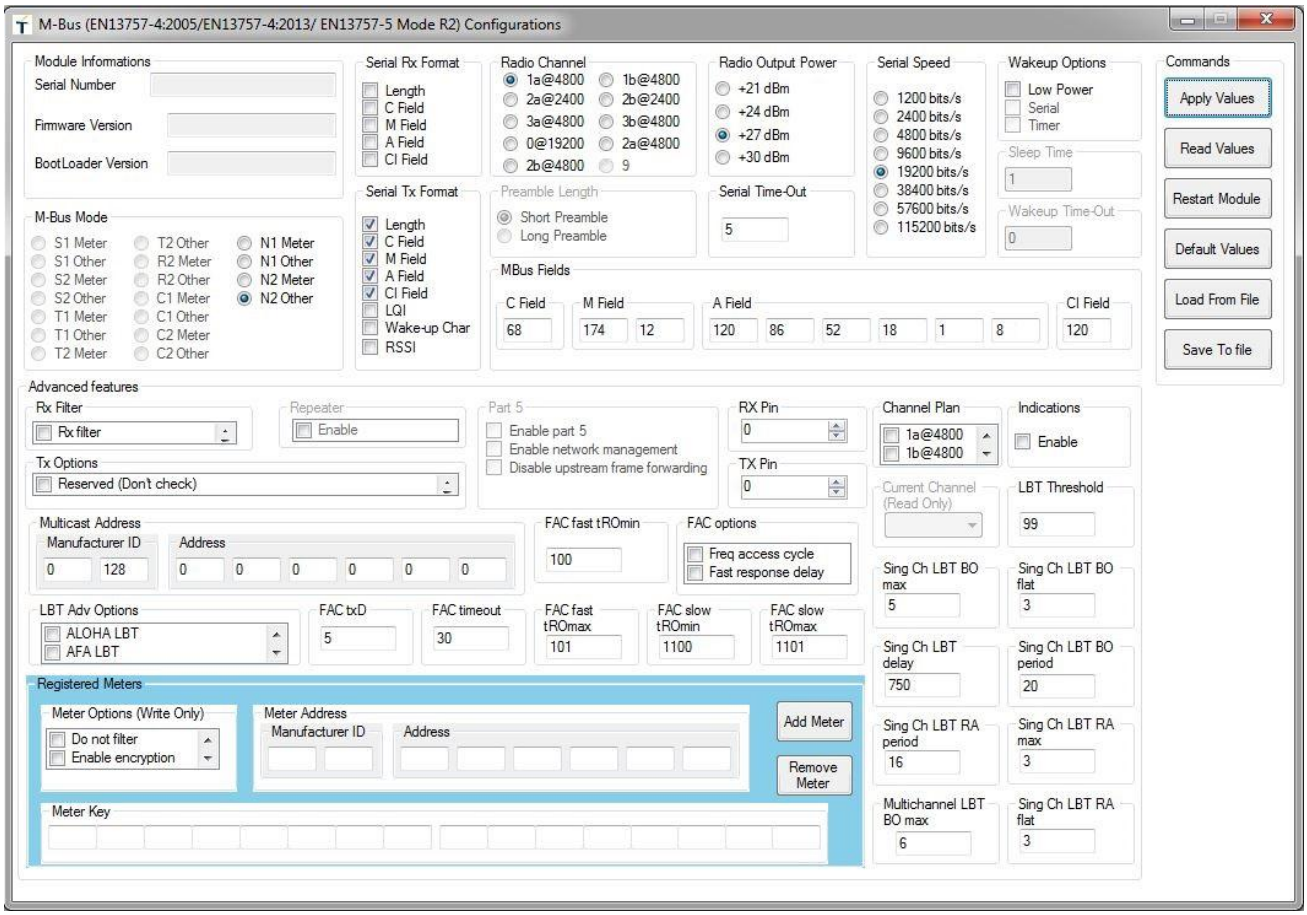
2. Click on “Add Meter”.



Click on “OK” in the pop-up window. Select “N2 Meter” in the “M-Bus Mode” panel, select “C Field” and “CI Field” in the “Serial Rx Format” panel and click on “Apply Values”. Wait for the settings to be applied and close the configuration window. Type the string ”ATO” in the “Data” text box and press Enter. Now meter is ready.

3. The other address is:
    a. M-Field: AE 0C
    b. A-Field: 78 56 34 12 01 08

Insert this address in the “MBus Fields” panel in its configuration window.



4. Select “N2 Other” in the “M-Bus Mode” panel, select “Length”, “C Field”, “M Field”, “A Field” and “CI Field” in the “Serial Tx Format” panel and click on “Apply Values”; wait for the settings to be applied and close the configuration window. In the “MBus Management” window, send the “ATO” command as done previously with the first DemoBoard.
5. When a frame with an extended link layer or a data header specifying one of the supported encryption methods is received from the serial port, the module encrypts the frame using the key corresponding to the meter manufacturer ID and address and the given encryption method. Form the meter side, a frame with 13757-3 Application Layer with short Transport Layer will be sent. The total byte sequence to send to the serial port of the first DemoBoard is:

   46 7A BA 2B 20 25 2F 2F 04 6D 05 33 A9 1C 04 13 01 00 00 00 01 FD 17 08

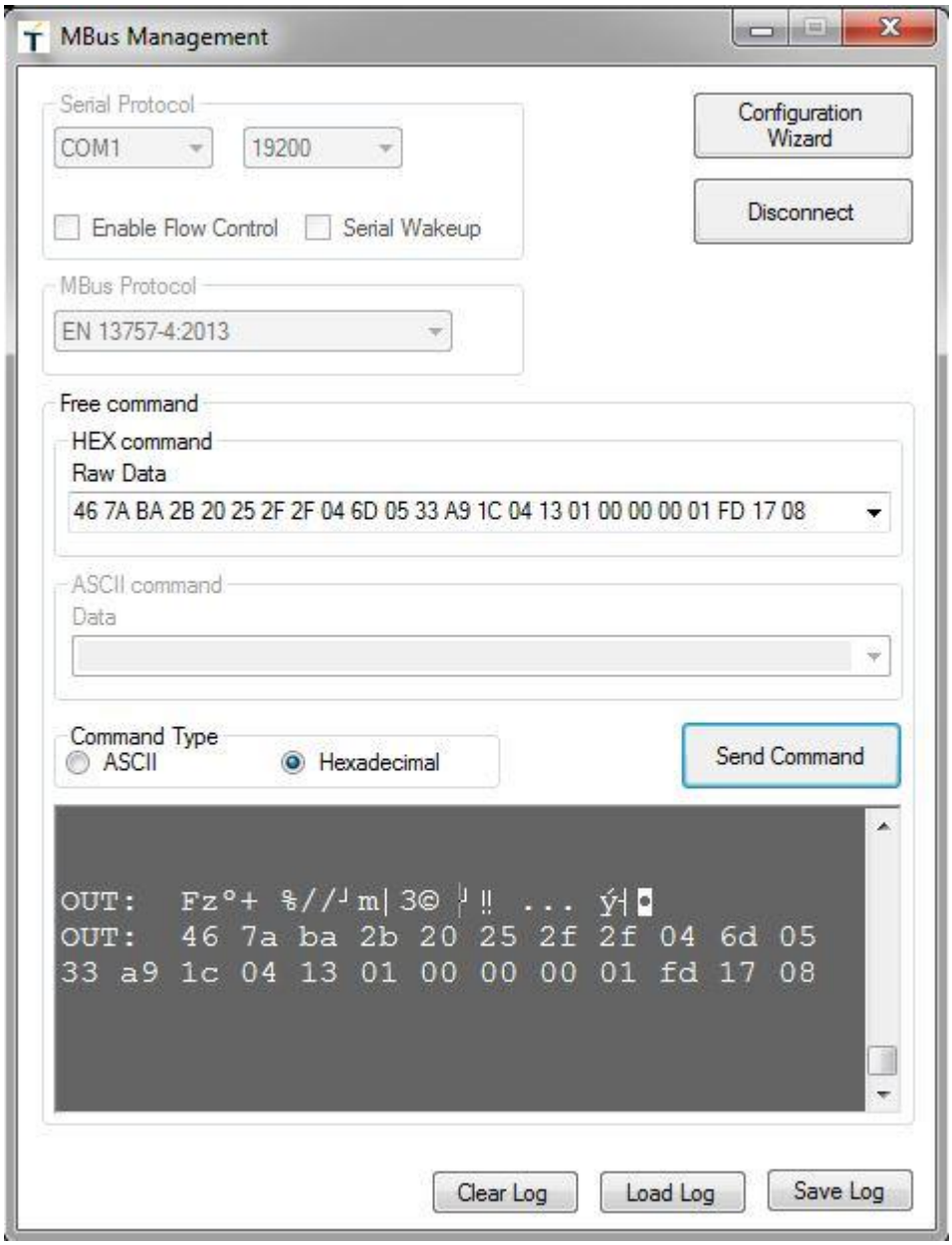
   where:

   a. C-Field: 46
   b. CI-Field: 7A
   c. Access Number: BA
   d. Status Field: 2B

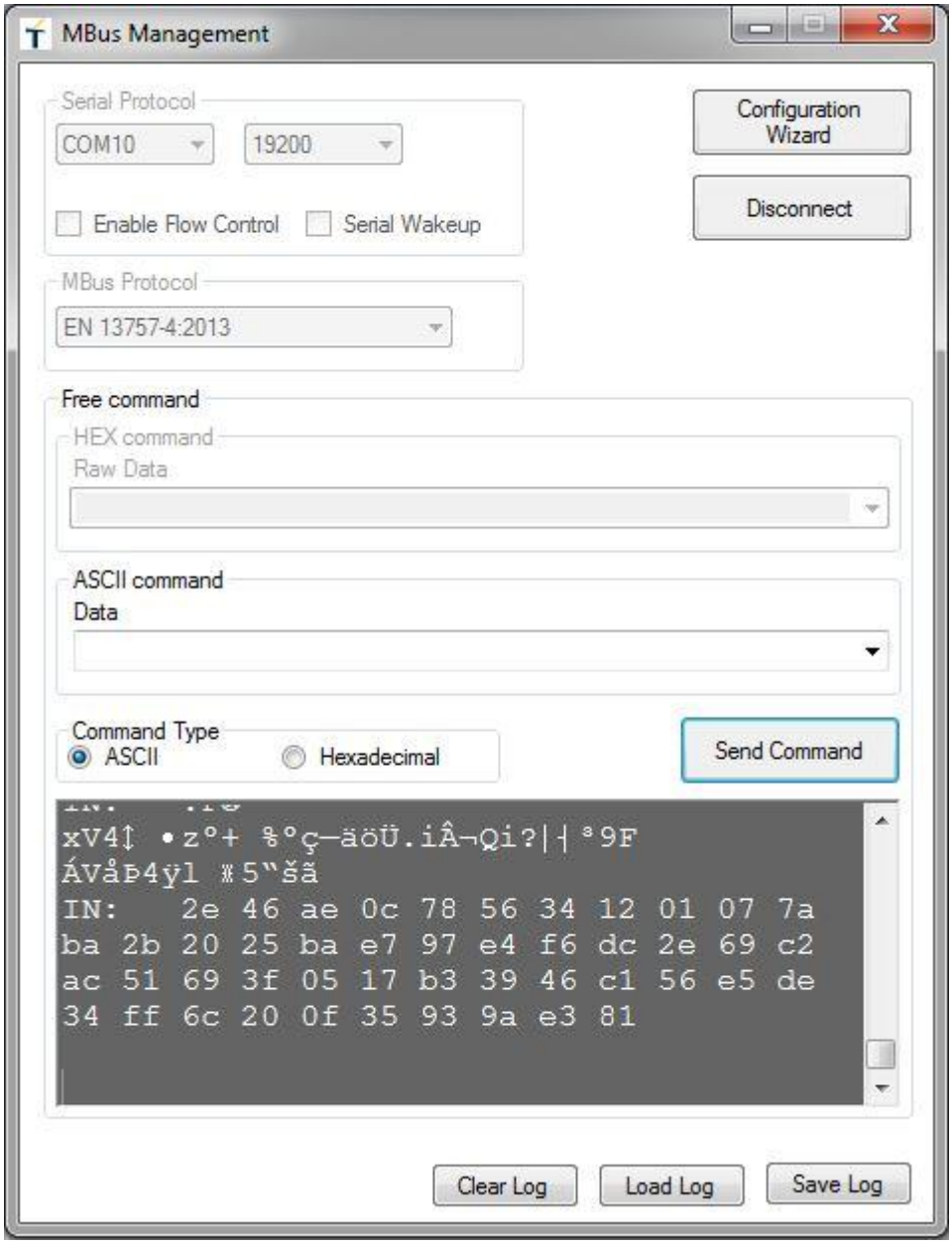
e. Configuratio Word: 20 25 (encryption mode 5, AES 128 CBC, 2 encrypted blocks, synchronized)

f. Encryption verification: 2F 2F

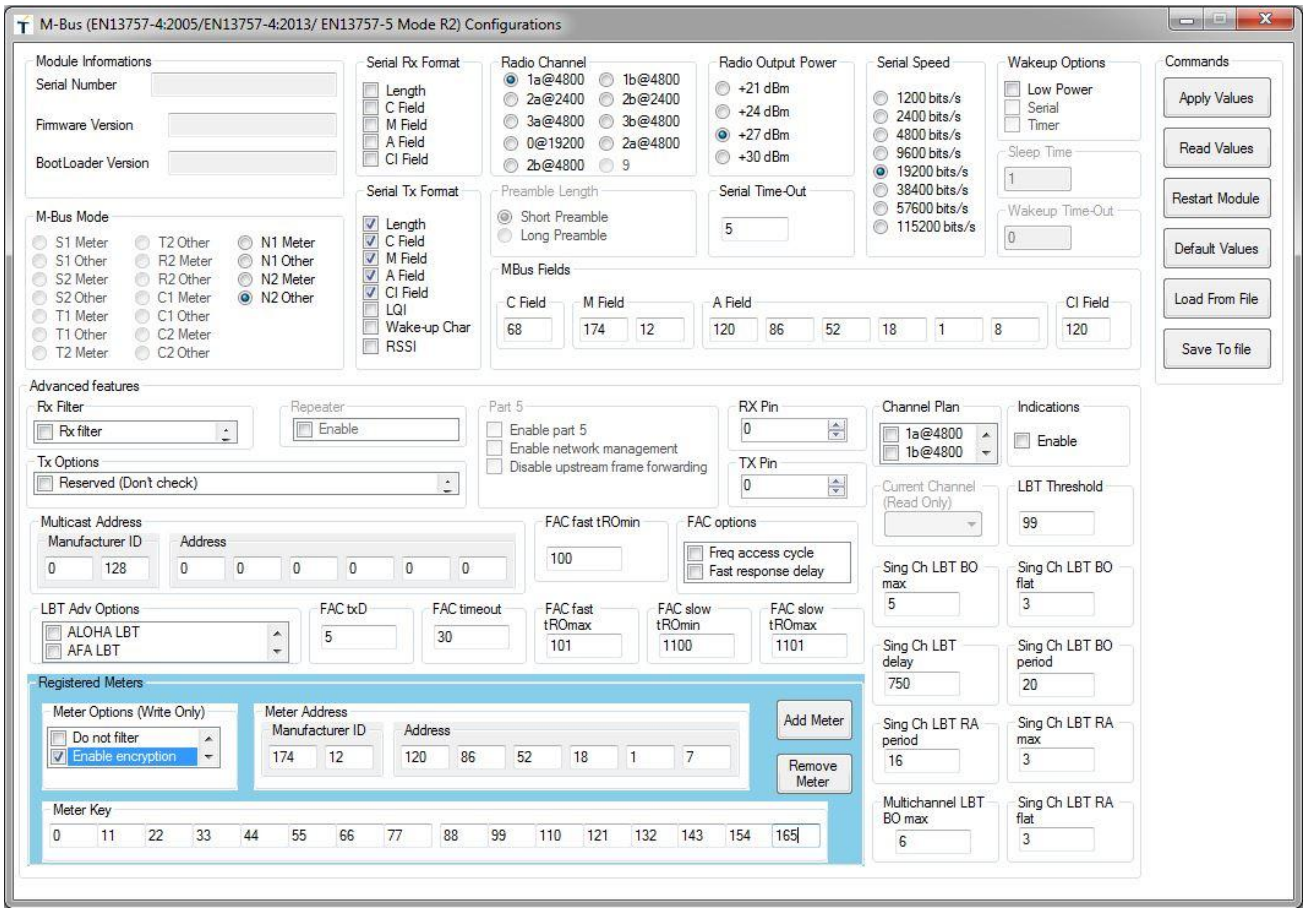
g. Plain data (not coded): 04 6D 05 33 A9 1C 04 13 01 00 00 00 01 FD 17 08



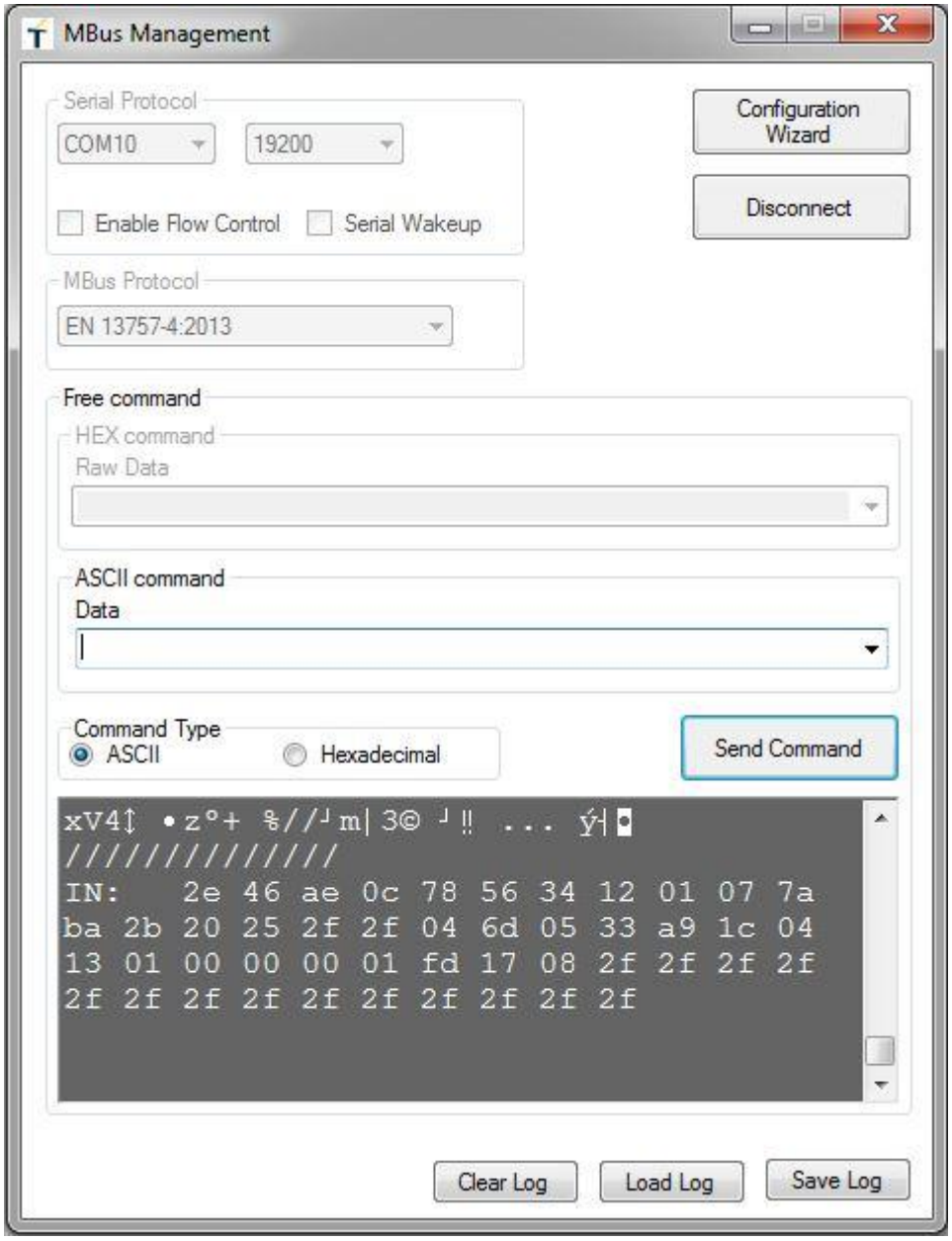
6. This frame is encrypted and sent to the air. Other will be not able to decrypt this, because it does not have the meter key. The bottom panel on the other side will show the coded sequence.



7. Concentrator devices can received encrypted frames to (and send encrypted frames from) any of the registered meters; to enable encryption for communication with a given meter, manufacturer ID, address and key of the meter must be registered in the meter list and bit 2 must be set to 1 in the option register 460.



8. Click on “Add Meter”. Click on “OK” in the pop-up window. Click on “Apply Values” in the configuration window; wait for the settings to be applied and close the configuration window. Type the string “ATO” in the “Data” text box and press Enter.
9. Now if meter re-sends the previous frame, other will be able to decrypt it (2F is the AES CBC padding).



8. Glossary

ACP	Adjacent Channel Power
BER	Bit Error Rate
Bits/s	Bits per second (1000 bits/s = 1Kbps)
CER	Character Error Rate
dBm	Power level in decibel milliwatt (10 log (P/1mW))
EMC	Electro Magnetic Compatibility
EPROM	Electrical Programmable Read Only Memory
ETR	ETSI Technical Report
ETSI	European Telecommunication Standard Institute
FM	Frequency Modulation
FSK	Audio Frequency Shift Keying
GFSK	Gaussian Frequency Shift Keying
GMSK	Gaussian Minimum Shift Keying
IF	Intermediary Frequency
ISM	Industrial, Scientific and Medical
kbps	kilobits/s
LBT	Listen Before Talk
LNA	Low Noise Amplifier
MHz	Mega Hertz (1 MHz = 1000 kHz)
PLL	Phase Lock Loop
PROM	Programmable Read Only Memory
NRZ	Non return to Zero
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Receive Strength Signal Indicator
Rx	Reception
SRD	Short Range Device
Tx	Transmission
SMD	Surface Mounted Device
VCO	Voltage Controlled Oscillator
VCTCXO	Voltage Controlled and Temperature Compensated Crystal Oscillator

9. Document History

Revision	Date	Changes
0	2012-10-01	First Release
1	2014-04-22	• Updated the version of EN 13757-4 (2013) • Added ferrites • Added example of encryption