IntesisBox® Modbus Server

M-Bus meters

User manual

Issue date: 29/11/2013

v10 r16 eng

Intesis Software S.L.
Milà i Fontanals, 1 bis
08700 Igualada
Spain

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

Gateway for the integration of M-BUS devices with Modbus RTU and TCP based control systems.

Three models are available for this gateway, with the following **order codes**:

IBOX-MBS-MBUS-100
Model for the integration of up to 10 M-BUS devices and 100 datapoints in total.

IBOX-MBS-MBUS-A
Model for the integration of up to 60 M-BUS devices and 600 datapoints in total.

IBOX-MBS-MBUS-B
Model for the integration of up to 500 M-BUS devices and 2000 datapoints in total.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

INDEX

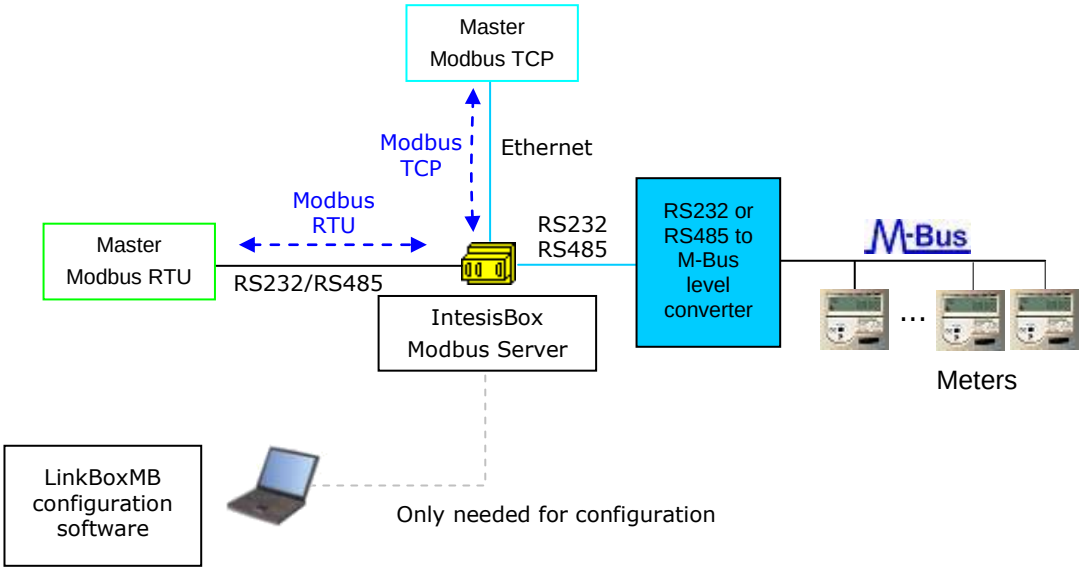
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

1. Description

1.1 Introduction

Integration of data coming from M-Bus meters into a Modbus master device or system, using *IntesisBox Modbus Server - M-Bus* gateway plus an M-Bus to RS232 or RS485 level converter.

The aim of this integration is to make available signals and resources of meters connected to M-Bus, from a Modbus master device or system. For this IntesisBox Modbus Server - M-Bus gateway works, from the Modbus system point of view, acting as a Modbus slave device responding to data polls coming from the Modbus master, and from the M-Bus system point of view acting as an M-Bus master device polling data to the meters, and serving this data to the Modbus side.



Integration of M-Bus meters using IntesisBox Modbus Server

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

1.2 Functionality

The integration operation is as follow:

IntesisBox polls, continuously or only when ordered from Modbus master, the M-Bus devices to obtain the readings for the points configured in it (the signals corresponding to measures and statuses of the meters in the integration signals list explained later in this document). With every read, the new values received are updated in the Intesisbox's memory and become available to be read by the Modbus master device. When a change in any signal configured as output in IntesisBox is detected (this is written from the Modbus master device changing the value of this signal), the corresponding action in the M-Bus will be performed, these actions can be: poll of a concrete M-Bus device associated to the signal (in case is a signal to force the reading of a concrete M-Bus device) or poll of all M-Bus devices (in case is a signal to force a simultaneous reading of all M-Bus devices).

The polling of a concrete M-Bus device, or of all M-Bus devices simultaneously, can be forced in any moment from Modbus side by writing a 1 in the corresponding digital signal specially enabled for this purposes in the IntesisBox.

Also the automatic continuous polling of M-Bus devices can be activated/deactivated writing from Modbus in a specific digital signal of IntesisBox.

Other M-Bus information accessible from the Modbus system using specific signals of the IntesisBox is:

- Bus activity (indicates if meters are actually being polled or if polling is in stand-by).
- M-Bus status of every meter (this M-Bus status is sent by the own meter with every poll).

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

1.3 Capacity of IntesisBox

Element	Max. Tiny version	Max. Basic version	Max. Extended version	Notes
Number of M-Bus devices	10	60	500	Number of M-Bus meters (connected to the bus) that can be read from IntesisBox.
Number of M-Bus signals	100	600	2000	Number of M-Bus signals (readings in the meters) that can be read from IntesisBox.

There are three different versions of *IntesisBox® Modbus Server - M-bus* with different capacity each of them:

- 100 version with capacity of 100 points* and 10 M-Bus meters.
  Ref.: IBOX-MBS-MBUS-100
- A version with capacity of 600 points* and 60 M-Bus meters.
  Ref.: IBOX-MBS-MBUS-A
- B version with capacity of 2000 points* and 500 M-Bus meters.
  Ref.: IBOX-MBS-MBUS-B

* If 32bit Modbus registers are used, the maximum number of readings in the meters allowed by the LinkBoxMB license is reduced by half. In this case, the maximum number is 50, 300, and 1000 readings for the IBOX-MBS-MBUS-100, the IBOX-MBS-MBUS-A and the IBOX-MBS-MBUS-B respectively.

IntesisBox model	Maximum Number of readings in the meters	
	16 bit Modbus registers	32 bit Modbus registers
IBOX-MBS-MBUS-100	100	50
IBOX-MBS-MBUS-A	600	300
IBOX-MBS-MBUS-B	2000	1000

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

2. M-Bus system

In this chapter, a brief description of functionality and features of M-Bus is provided.

2.1 Description

The M-Bus ("Meter-Bus") is an European standard for remote reading of heat meters and it is also usable for all other types of consumption meters as well as for various sensors and actuators.

M-Bus standards are:
- EN 13757-2 (physical and link layer).
- EN 13757-3 (application layer).

Many manufacturers of energy meters, pulse counters, water meters, electricity meters, etc. add to their devices an M-Bus interface, enabling them to be interconnected and remote measured through a 2 wire bus based on the standards of M-Bus. There are many manufacturers of these measurement devices incorporating M-Bus interface and also some other manufacturers of specific communication M-Bus devices like bus repeaters, RS232/RS485 to M-Bus level converters, etc.

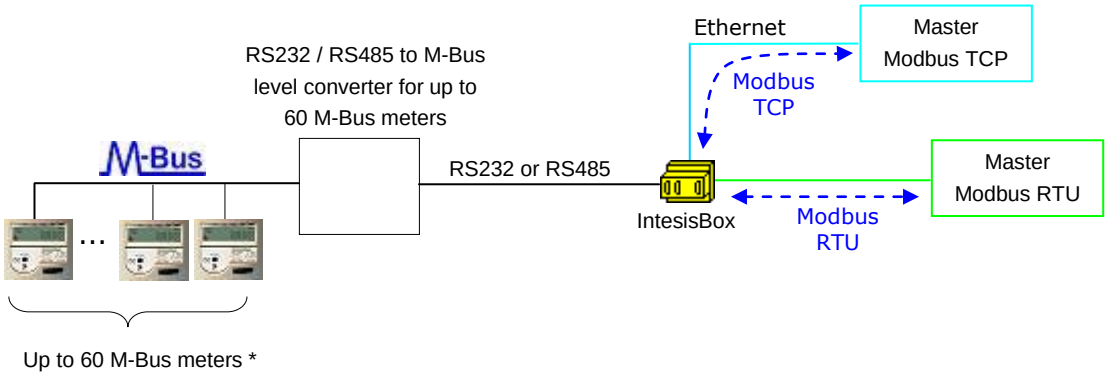
2.2 M-Bus interface

The gateway connects to the M-Bus system through an external RS232 or RS485 to M-Bus level converter, this external level converter is not included in the scope of delivery, and must be ordered separately or purchased directly by the customer. Contact Intesis Software in case you are looking for a supplier for these M-Bus level converters or repeaters for your installation.

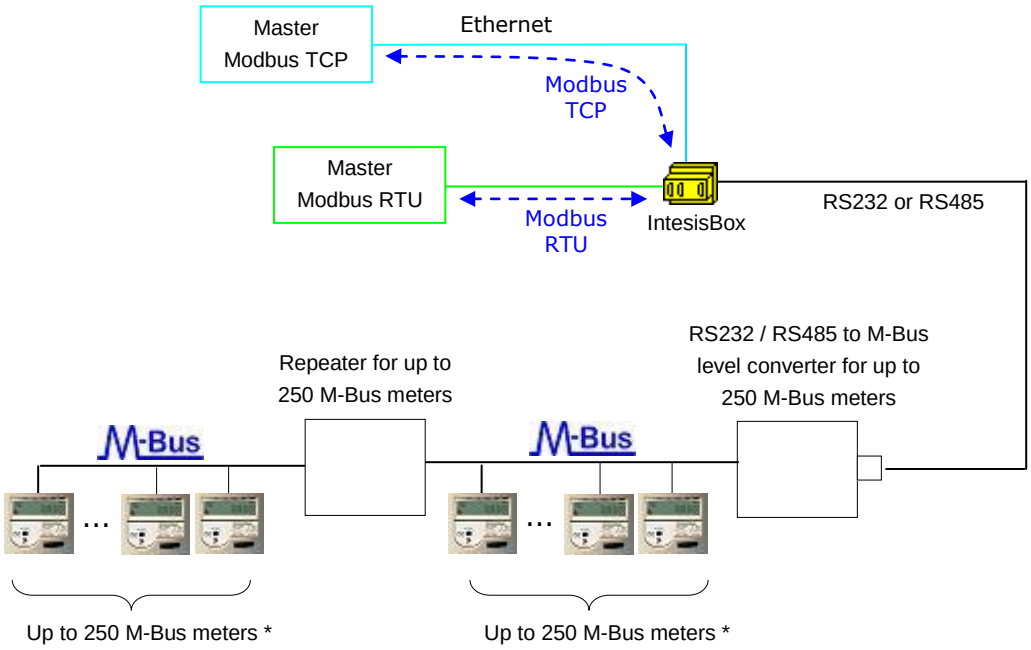
Apart of making the electrical level conversion, the converter must also feed the M-Bus, due to this, there are different models of level converters and repeaters, depending on the maximum number of M-Bus meters that can be connected to them (normally 3, 20, 60, 120 or 250 meters).

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

The following is a diagram of a small/medium size installation (up to 60 meters):



The following is a diagram of a large installation (up to 500 meters):



* The maximum bus distance allowed by the converter or repeater will depend on the baud rate used, the section of the wires used , the number of M-Bus devices connected and the location of the devices inside the bus (all concentrated at the end of the bus, equally distributed along the bus, etc.). See the converter or repeater manual for details in every case.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

These are the main features of the M-Bus interface of IntesisBox:

- RS232 (DB9 male connector, DTE) or RS485 two wires (plug-in terminal bloc with screws), which one to use is configurable.
- Baud rate configurable from 300 to 9600 bps (the allowed baud rates in M-Bus are from 300 to 9600 bps, in general the devices are normally configured at 2400 bps at the factory).
- Primary and secondary addressing allowed.
- Useful timeouts and specific parameters to make the interface widely compatible with many meter's peculiarities found usually between different manufacturers.
- Polling of the meters can be continuously, either configured in the own IntesisBox or you can activate/deactivate continuous polling of the meters from Modbus side using a special datapoint.
- You can force a polling of the meters (refresh of readings) in any moment from Modbus side using special datapoints: one datapoint to force a polling of all the meters, and one specific datapoint per meter to force the polling of the individual meter.
- IntesisBox can also be configured to make a single polling of the meters (refresh of readings) at the start up.
- For each meter, a datapoint is available in Modbus indicating communication error with the meter, also a general communication error datapoint is available (that will be active whenever the communication with one or more meters has failed).
- Fully flexible configuration of the registers to poll in the meter, to adapt to any type of meter.

2.3 Signals

IntesisBox Modbus Server - M-Bus can read the following type of signals offered by M-Bus devices:

- Energy meters:

  - Energy (kWh or J).
  - Volume (m3, feet3, gallon).
  - Mass (kg).
  - Power (kW or J/h).
  - Volume flow (m3/h, m3/min or m3/s, gallon/h, gallon/min, gallon/s).
  - Mass flow (kg/h).
  - Flow Temperature (°C).
  - Return Temperature (°C).
  - Temperature difference (K).
  - External Temperature (°C).
  - Temp. limit (°C).
  - Pressure (Bar).
  - Vols (volts).
  - Amps (amps).
  - H.C.A., without units. (Multipurpose signal used, for example, by some energy meters to offer the readings of auxiliary pulse counter inputs of the device).
  - On Time, normally in hours but depends on the meter.
  - Operating Time, normally in hours but depends on the meter.
  - Averaging Duration, normally in hours but depends on the meter.
  - Actuality Duration, normally in hours but depends on the meter.
  - And others.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

- Electricity meters:

These are the type of signals more frequently offered by M-Bus devices and used by energy meters and electricity meters. The reading of other more specific type of signals also specified in the standard M-Bus, for example date/time, could be also implemented in IntesisBox on demand, contact your nearest distributor for details.

Every meter, depending on manufacturer and model, offers different type of signals from the mentioned before. To know what signals offers the device and of what type, to be able to integrate those wanted, refer to the device technical documentation. Anyway, and to ease and speed up the identification of the signals offered by any device (and of what type), it has been embedded in the firmware of IntesisBox an utility to poll the meter and show details about the signals offered by the device and the corresponding signal code needed in the signals list of IntesisBox for every one of the signals to integrate. This is explained in more detail in Annex I of this document.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

3. Modbus interface of IntesisBox

3.1 Description

IntesisBox acts as a slave device in its Modbus interface, this interface can be the Ethernet port (if using Modbus TCP), or the RS232 port or the RS485 port (if using Modbus RTU). To access the points and resources of the IntesisBox from the Modbus master system, you must specify as the Modbus register addresses, those configured inside IntesisBox corresponding to M-Bus registers and special signals. See details below.

3.2 Functions supported

This part is common for Modbus RTU and TCP.

Modbus functions 03 and 04 (*read holding registers* and *read input registers*) can be used to read Modbus registers corresponding to analog datapoints.

If *poll records* are used to read more than one register, it is necessary that the range of addresses requested contains valid addresses, if not, the corresponding Modbus error code will be returned.

Modbus error codes are fully supported, they will be sent whenever a non valid Modbus action or address is required.

Modbus functions 01 and 02 (*read coils* and *read discrete inputs*) can be used to read Modbus registers corresponding to digital datapoints.

Modbus functions 05 and 15 (*Write Single Coil* and *Write Multiple Coils*) can be used to write Modbus registers corresponding to digital datapoints.

See details of different Modbus register formats per each datapoint type below.

3.3 Modbus RTU

Baud rate can be selected from 1200, 2400, 4800, 9600, 19200, 38400 and 56700. (Data Bits: 8, parity: none, Stop Bits: 1)

Modbus slave number can be configured. Physical connection (RS232 or RS485) can also be selected.

Only the lines RX, TX and GND of the RS232 port are used (TX and RX for RS485).

3.4 Modbus TCP

The TCP port to use can be configured (by default 502 is used).

The IP address, subnet mask and default router address to use by IntesisBox® can be also configured.

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

3.5 Address Map

The address map is fully configurable, see details in section 4.4.

3.6 Definition of datapoints and other functionality

The possible datapoint types are:

Analog Input. Used to hold analog values from the M-Bus system (meters readings), and also a special datapoint per meter indicating the M-Bus status provided by the own meter (see details below in section 4.4 about possible values and their meaning for this datapoint). These datapoints of the IntesisBox will be updated with every poll of the meters.

Digital Input. Used for monitoring the status of the M-Bus system. These are virtual signals defined in IntesisBox to indicate: M-Bus general communication error, and specific communication error with each M-Bus meter defined. Also the actual status of the M-Bus polling process (poll running or in stand-by) is indicated using a signal of this type. These datapoints of the IntesisBox will be updated with every poll of the meters.

Digital Input/Output. Used to write on them from Modbus and perform some actions in the M-Bus system. These are virtual signals defined in IntesisBox to force in any moment the poll of a specific M-Bus meter or the poll of all the meters simultaneously. IntesisBox will initiate the corresponding polling process when this signal is activated from the Modbus system.

Other functionality and datapoints of IntesisBox are:

Continuous polling. Digital output datapoint to indicate to IntesisBox the type of polling of M-Bus meters to perform. 1 indicates continuous polling, 0 indicates non continuous polling.

Bus activity. Digital input datapoint that indicates the actual status of the polling of M-Bus meters. 1 indicates polling actually running, 0 indicates polling actually not running.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

4. LinkBoxMB. Configuration & monitoring tool for IntesisBox Modbus Server series

4.1 Introduction

LinkBoxMB is a Windows 98/NT/2000/XP compatible software developed specifically to monitor and configure IntesisBox Modbus Server series. It is possible to configure all external protocols available for IntesisBox Modbus Server and to maintain different customer's configurations based on a LinkBoxMB project for every different installation. Maintaining always on hard disk a copy of the last configuration files for every external protocol and customer, that is to say for every project.

From LinkBoxMB, as well as configure the integration signals list and connection parameters for every external protocol, it is permitted to select the serial port to use to connect to IntesisBox Modbus Server and the use of some tools for monitoring and debugging de device. Some of these tools will be explained in this document but only some of them, the rest of available debugging tools and commands will not be explained here because they are for exclusive use under the recommendations of Intesis Software technical support.

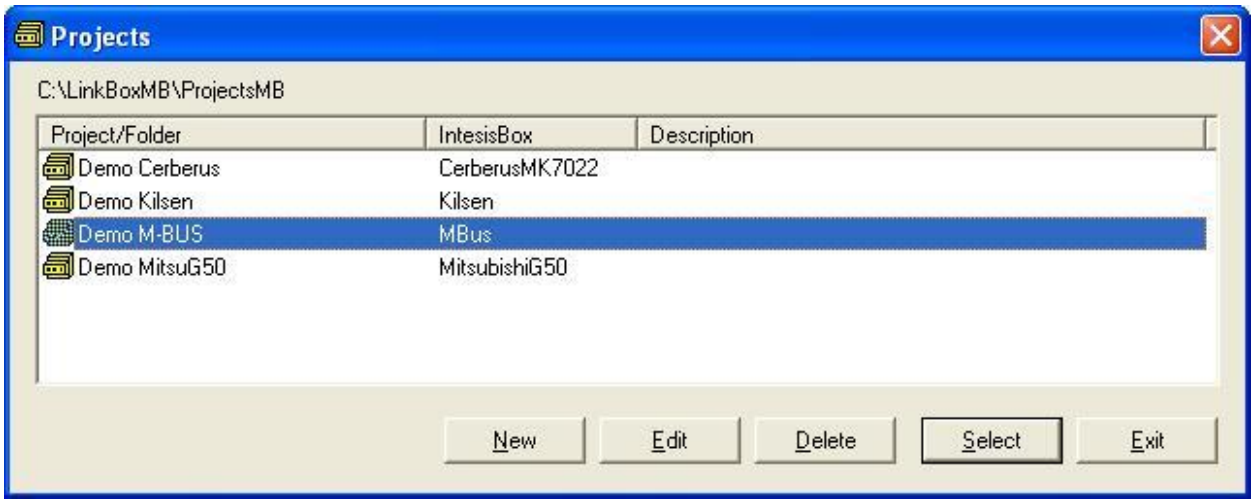
LinkBoxMB allows configuring all IntesisBox Modbus Server series independently of the external system used. For every external system, LinkBoxMB has a specific configuration window. Periodically, new free versions of LinkBoxMB are released incorporating the latest developed integrations for external systems.

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

4.2 Project definition

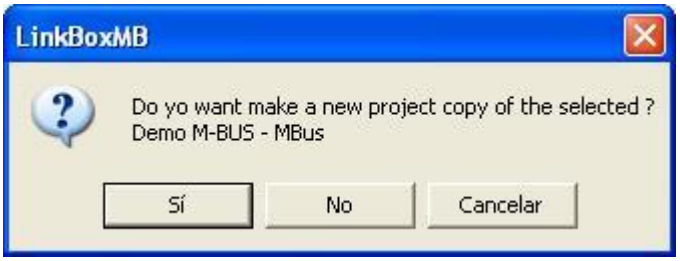
The first step to do in LinkBoxMB for a new installation is to create the installation's project giving a descriptive name to it. When you create a project, a new folder is created with the name of the project containing the configuration files needed depending on the external protocol selected for the project. It is strongly recommended that you create a new project for every installation, if not, overwriting of configuration files of previous installations using the same external protocol may occur, loosing the configuration data for those previous installations. The projects folder is located in AppFolder\ProjectsMB, where AppFolder is the installation folder of LinkBoxMB (by default C:\Program Files\Intesis\LinkBoxMB). Inside the projects folder, a new folder will be created for every project defined in LinkBoxMB with the files needed for the project.

When you open LinkBoxMB, the project selection window will appear inviting you to select a project or create a new one. A demo project for every external protocol supported is provided with the standard installation of LinkBoxMB. You can create a new project or select a demo project based on the external protocol desired, and create a new one from the demo one selected.



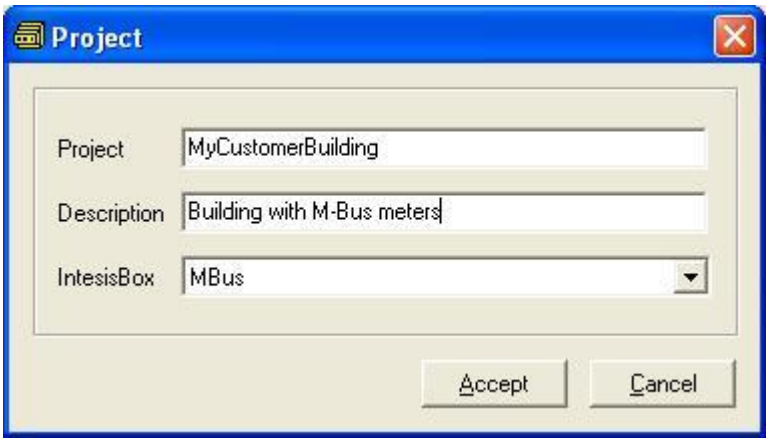
Project selection window

To create a new project, select a project using the same external protocol you want to use in the new project and click on *New* button. You will be prompted to create a copy of the selected project (useful for similar installations) or create a new one.



Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

If you select *Yes* you will be prompted to specify a name and a description for the new project that will be based on the same external protocol than the selected one. If you select *No* you can specify a name, a description and an external protocol to use from the list of available external protocols.



On *Accept*, a new folder will be created inside the projects folder with the name given to the project, this folder will contain the template configuration files if the project is a brand new one, or a copy of the configuration files if it is a copy of a selected one.

A description of the files created for an M-Bus protocol based project can be found in section *Files* in this document.

From all the possibilities of LinkBoxMB, only changes in configuration for the integration and configuration file generation can be performed while disconnected from IntesisBox (working off-line), allowing you to do these tasks in the office more comfortably. Before any monitoring or downloading action to IntesisBox can be performed, the connection between IntesisBox and the PC running LinkBoxMB must be established (working on-line). To do so follow these steps:

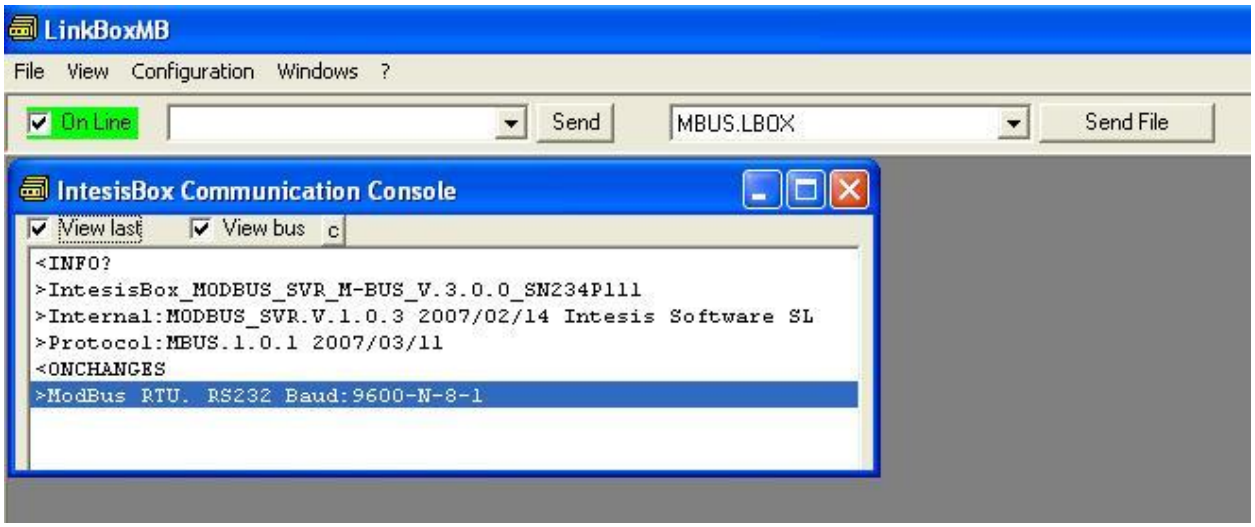
1. Make sure IntesisBox is powered-up a correctly connected to the Modbus system via the Ethernet connection (Modbus TCP) or serial connection (Modbus RTU) and to M-Bus system via the RS232 to M-Bus level converter (consult details for connection and pin assignments in section *Connection*s of this document).

2. Connect a free PC serial port to the IntesisBox serial port marked as *PC Console*. (Use the standard serial cable supplied with the device or a customer's cable following the pin assignments specified in section *Connections* in this document).

3. Select in LinkBoxMB the PC serial port used for the connection to IntesisBox. Use menu Configuration -> Connection.

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

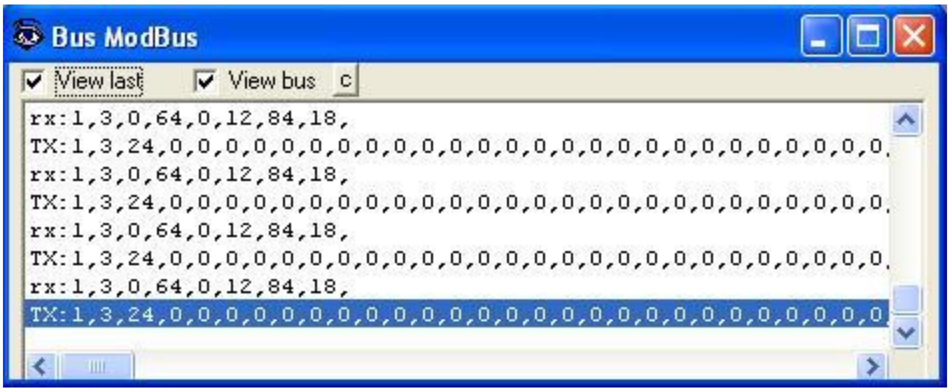
4. Check the checkbox *off-line* under the menu bar (it will change automatically to *on-line*) and LinkBoxMB will ask for INFO about the IntesisBox connected to it via the serial connection, if the connection is ok then IntesisBox will respond with its identification (this can be monitored in the *IntesisBox Communication Console* window, as showed below).



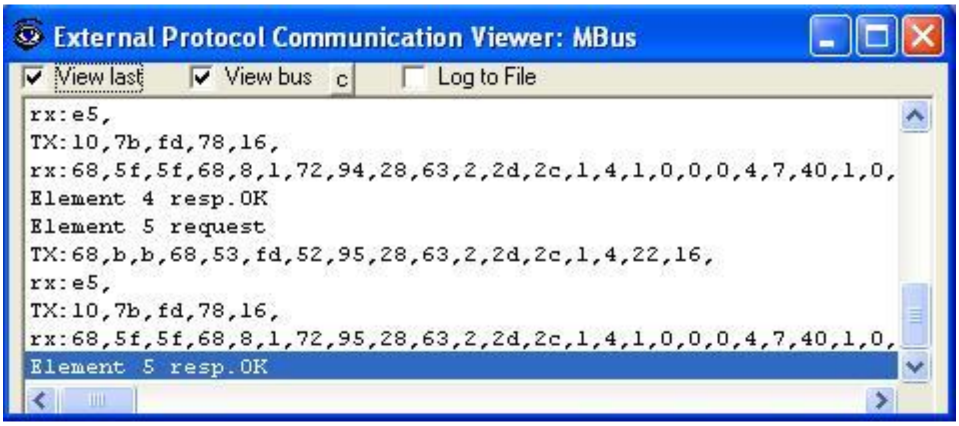
Once connected to IntesisBox, all the options of LinkBoxMB are fully operative.

To monitor the communication between IntesisBox and the Modbus master device, select the menu *View -> Bus -> Modbus*. The *Modbus communication Viewer* window will be opened. This window show in real time all the communication frames between IntesisBox and the Modbus master device as well as debugging messages referent to internal protocol (Modbus) sent by IntesisBox.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134



To monitor the communication between IntesisBox and the external system (M-Bus in this case), select the menu *View -> Bus -> M-Bus*. The *External protocol communication viewer* window will be opened. This window show in real time all the communication frames between IntesisBox and M-Bus devices as well as debugging messages referent to external protocol (M-Bus) sent by IntesisBox.



URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

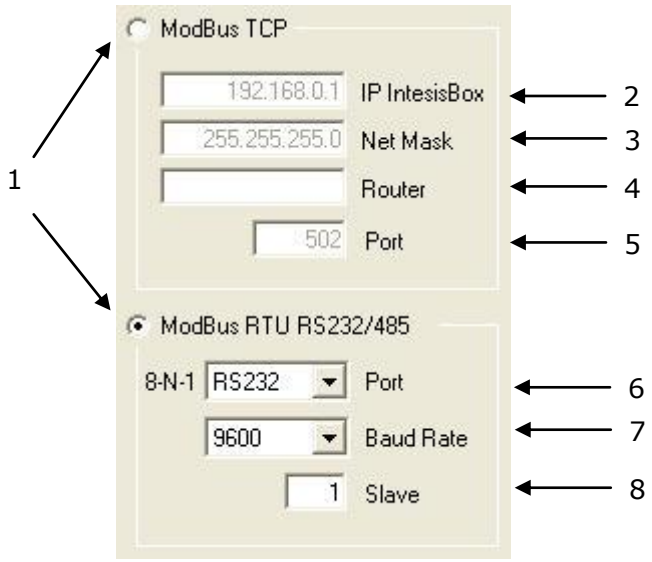
4.3 Connections configuration

To configure the IntesisBox's connection parameters and the signals list, select menu *Configuration -> IntesisBox*. The *M-Bus Configuration* window will be opened.

Select the Connection tab to configure the connection parameters.

Two kinds of information are configured using this window, the referent to the Modbus side and the referent to the M-Bus side.

Modbus side configuration parameters:



Modbus interface configuration

1. Select the type of connection desired (TCP or RTU).

If Modbus TCP is selected, then:

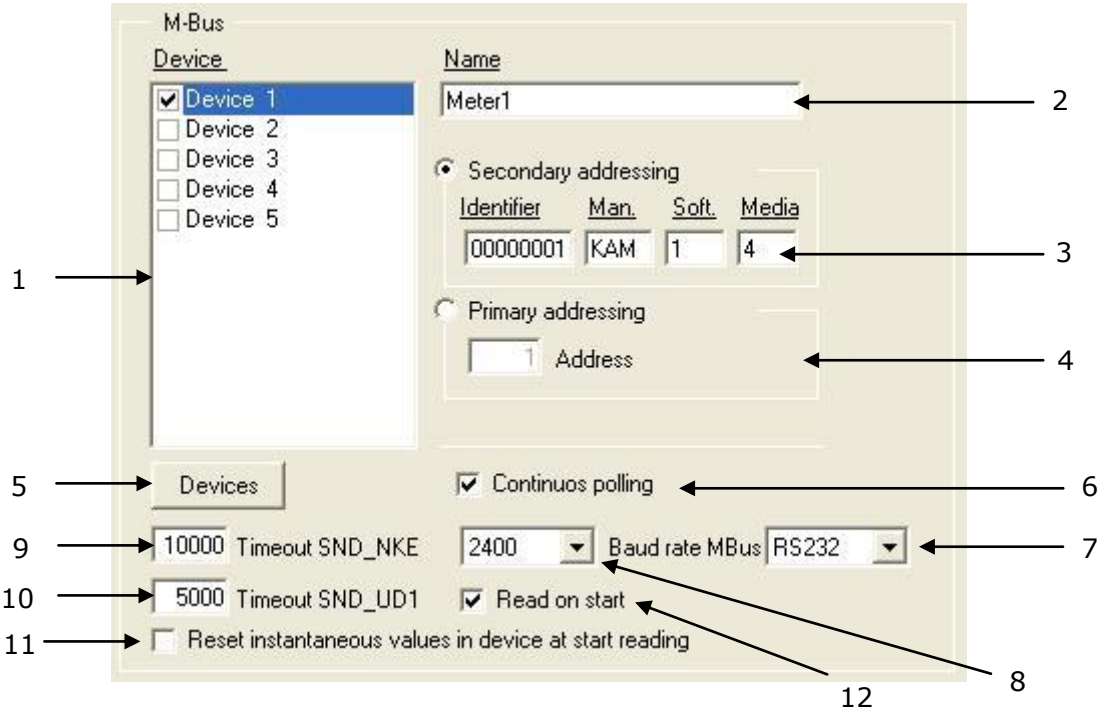
2. Enter the IP address for IntesisBox.
3. Enter the IP netmask for IntesisBox.
4. Enter the default router address to use by IntesisBox, leave blank if there is no need of router address.
5. Enter the TCP port to use, by default 502.

If Modbus RTU is selected, then:

6. Select the type of port to use (RS232 or RS485).
7. Select the baud rate to use.
8. Enter the Modbus slave number for IntesisBox.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

M-Bus side configuration parameters:



M-Bus interface configuration

1. List of configured M-Bus devices, only those checked will be active in the configuration.

Select a device to configure its properties:

2. Device's descriptive name (optional).

3. Device's secondary address. Select this if you want to use the secondary address of the device as the address used by IntesisBox to poll the device. The secondary address of a device is composed of:
   - *Identifier*: It's a number identifying the device, composed of 8 digits, normally is printed in the device's label, as *Id. Number* or similar.
   - *Manufacturer*: Manufacturer IEC code, if unknown enter FFF in this field.
   - *Software*: Software version of the device, if unknown enters FF in this field.
   - *Media*: Code identifying media read, if unknown enters FF in this field.
4. Device's primary address. Select this if you want to use the primary address of the device as the address used by IntesisBox to poll the device.

NOTE: The selection of primary or secondary address affects to all the configured devices. Some models of devices do not support secondary addressing mode (for example the Kamstrup Multical 400), for this kind of devices the primary address must be selected, and in the case of the Kamstrup Multical for example, the primary address entered here must coincide with the last three digits of the serial number of the device. In other devices this primary address is programmed at the factory or can be also programmed later using some software tool supplied by the manufacturer. Refer to the technical documentation of the device in every case to know what types of addressing supports and which is the address number of the device.

5. Click here to specify the number of M-Bus devices you want to use. This automatically will create in the configuration as many devices as specified, adding for every device:

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

communication error signal, *force device reading* signal, and device's *status M-Bus* signal in the signals list.

6. Check this to force a reading of all the meters continuously without any mediation.

7. Select the port used to connect to the external level converter, can be RS232 or RS485, consult *Connections* section for details of pinout for each one of the ports.

8. Baud rate used to communicate with the devices, in general, those devices supporting configuration of baud rate are preconfigured at 2400 bps at the factory. Some device models support autobauding (adjust the baud rate automatically to the baud rate used by M-Bus master polling, refer to the technical documentation of the device to know the baud rates supported in every case). This parameter affects to all the devices.

9. Waiting time (in milliseconds) before sending the SND_NKE frame. Necessary for some models of devices (refer to the technical documentation of the device). This parameter affects to all the devices.

10. Waiting time (in milliseconds) before sending the SND_UD1 frame. Necessary for some models of devices (refer to the technical documentation of the device). This parameter affects to all the devices.

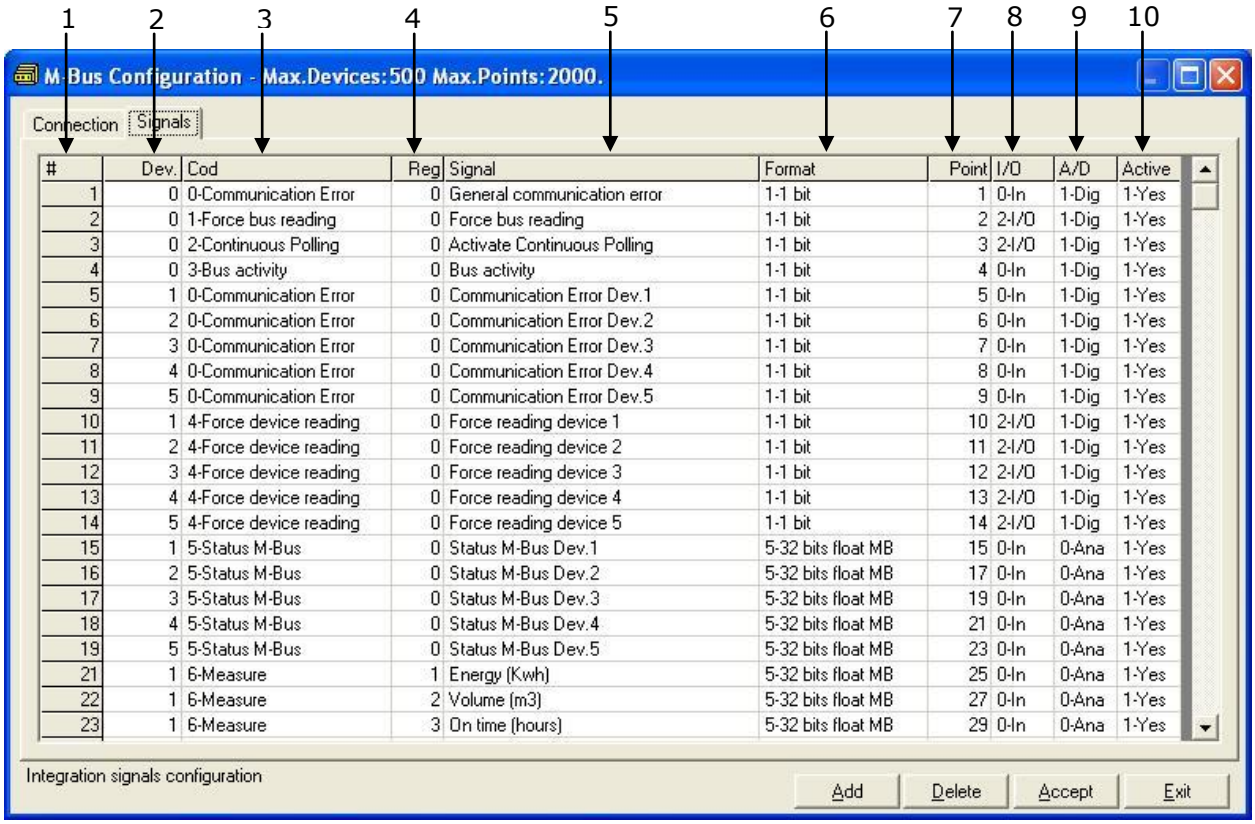
11. Check this to force a reset of instantaneous values in the meter before start reading. This is necessary for some meters, for example SONTEX Supercal 539. Consult the meter technical documentation in every case.

12. Check this to force a reading of all the meters when IntesisBox starts up.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

4.4 Signals configuration

Select the Signals tab to configure the datapoints list.



#	Dev.	Cod	Reg	Signal	Format	Point	I/O	A/D	Active
1	0	0-Communication Error	0	General communication error	1-1 bit	1	0-In	1-Dig	1-Yes
2	0	1-Force bus reading	0	Force bus reading	1-1 bit	2	2-I/O	1-Dig	1-Yes
3	0	2-Continuous Polling	0	Activate Continuous Polling	1-1 bit	3	2-I/O	1-Dig	1-Yes
4	0	3-Bus activity	0	Bus activity	1-1 bit	4	0-In	1-Dig	1-Yes
5	1	0-Communication Error	0	Communication Error Dev.1	1-1 bit	5	0-In	1-Dig	1-Yes
6	2	0-Communication Error	0	Communication Error Dev.2	1-1 bit	6	0-In	1-Dig	1-Yes
7	3	0-Communication Error	0	Communication Error Dev.3	1-1 bit	7	0-In	1-Dig	1-Yes
8	4	0-Communication Error	0	Communication Error Dev.4	1-1 bit	8	0-In	1-Dig	1-Yes
9	5	0-Communication Error	0	Communication Error Dev.5	1-1 bit	9	0-In	1-Dig	1-Yes
10	1	4-Force device reading	0	Force reading device 1	1-1 bit	10	2-I/O	1-Dig	1-Yes
11	2	4-Force device reading	0	Force reading device 2	1-1 bit	11	2-I/O	1-Dig	1-Yes
12	3	4-Force device reading	0	Force reading device 3	1-1 bit	12	2-I/O	1-Dig	1-Yes
13	4	4-Force device reading	0	Force reading device 4	1-1 bit	13	2-I/O	1-Dig	1-Yes
14	5	4-Force device reading	0	Force reading device 5	1-1 bit	14	2-I/O	1-Dig	1-Yes
15	1	5-Status M-Bus	0	Status M-Bus Dev.1	5-32 bits float MB	15	0-In	0-Ana	1-Yes
16	2	5-Status M-Bus	0	Status M-Bus Dev.2	5-32 bits float MB	17	0-In	0-Ana	1-Yes
17	3	5-Status M-Bus	0	Status M-Bus Dev.3	5-32 bits float MB	19	0-In	0-Ana	1-Yes
18	4	5-Status M-Bus	0	Status M-Bus Dev.4	5-32 bits float MB	21	0-In	0-Ana	1-Yes
19	5	5-Status M-Bus	0	Status M-Bus Dev.5	5-32 bits float MB	23	0-In	0-Ana	1-Yes
21	1	6-Measure	1	Energy (Kwh)	5-32 bits float MB	25	0-In	0-Ana	1-Yes
22	1	6-Measure	2	Volume (m3)	5-32 bits float MB	27	0-In	0-Ana	1-Yes
23	1	6-Measure	3	On time (hours)	5-32 bits float MB	29	0-In	0-Ana	1-Yes

Signals list

1. *#.* Signal's number (edit not permitted). Every row in the grid corresponds to a signal. Signals (rows in the grid) can be added or deleted selecting the desired row and clicking *Add* or *Delete* buttons. The special signals (see below) cannot be deleted. This column is used only to enumerate the rows in the grid (signals).
2. *Device.* Device number to which belongs the signal, referenced to the list of devices in the *Connection* tab.
3. *Cod*. Signal code: *6-Measure* indicates normal signal to integrate corresponding to an M-Bus device's reading, this type of signals (readings of meters) are all analog input signals. Any other code is reserved for special signals, being the possible special signals the following:

   0-Communication error, virtual signal indicating the status of the communication with the M-Bus device, this signal will be activated when there is a problem communicating with the device. It's a read only digital input signal. It is also available a general communication error signal associated to the device 0 (non existent device) that will be activated in case of activation of any of the individual communication error signals for the devices. 1 indicates communication error, 0 indicates no error.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

1-Force bus reading, virtual signal used to send an order to IntesisBox to initiate the polling of all the M-Bus devices in any moment. It's an output digital signal. Writing a 1 in this signal will activate a bus reading (a polling of all M-Bus meters).

2-Continuous polling, virtual signal used to activate in IntesisBox a continuous polling of all M-Bus meters. It's an output digital signal. Be careful activating this option because depending on the type of meter, the internal battery of the meter is decreased with every read, so for this kind of meters activating this option will lead to exhausting the meter's internal battery in short time. Writing a 1 in this signal will activate continuous polling.

3-Bus activity, virtual signal used to indicate to the Modbus side if there is a polling running on M-Bus (1) or if the M-Bus is in stand-by (0). It's an input digital signal.

4-Force device reading, virtual signal used to send an order to IntesisBox to initiate the polling of a specific M-Bus device in any moment. It's an output digital signal. Writing a 1 in this signal will activate the polling of the M-Bus meter related.

5-Status M-Bus, virtual signal that indicates the status of the device (status referent to M-Bus indicated by the own device in every poll of the device). It's a read only analog input signal. Codification for this status field is established by the own M-Bus standard as showed in the table below. Consult meter documentation for details about the possible values *Specific to manufacturer,* if there are in the meter used.

Bit	Meaning with Bit set	Significance with Bit not set
2	Power low	Not power low
3	Permanent error	No permanent error
4	Temporary error	No temporary error
5	Specific to manufacturer	Specific to manufacturer
6	Specific to manufacturer	Specific to manufacturer
7	Specific to manufacturer	Specific to manufacturer

Coding of the Status Field

4. *Reg*. Internal register number for the signal into the M-Bus meter (this number identifies this specific signal between all the possible signals offered by the M-Bus meter). For details on how to obtain the list of signals offered by an M-Bus meter and how to identify the register number to enter in this column, see Annex I of this document.
5. *Signal*. Descriptive name for the signal (optional). Useful to describe the physical magnitude read by this signal and/or its location inside the installation (for example: *Energy (kW) – Building 1 - Floor 2 - Door 23*).
6. *Format*. Modbus data coding format for the datapoint. For digital datapoints data coding format is 1 bit. For analog datapoints (M-Bus readings), data coding format can be 32 bit float (MB), or 32 bit float (LSB..MSB).
7. *Point*. Modbus register address desired for the signal. Possible values: from 1 to 10000.
8. *I/O*. Signal's direction, always considered from the Modbus system point of view. Possible values: 0-Input, 2-Input/Output. Edit not permitted, for this integration all the signals corresponding to M-Bus readings will be inputs, and the special signals will be inputs or input/outputs depending on every signal.

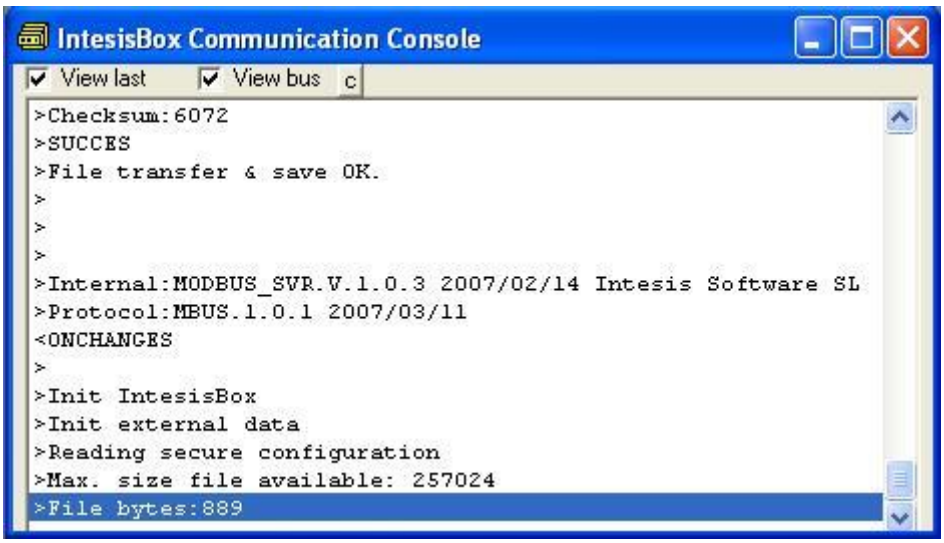
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

9. *A/D*. Signal type. Possible values: 0-Analog, 1-Digital. Edit not permitted, for this integration all the signals corresponding to M-Bus readings will be analog, and the special signals will be analog or digital depending on every signal.
10. *Active*. Indicates if the signal is active or not for the integration. Possible values: 0-No, 1-Yes. Edit using the mouse right-button-click menu available on the column.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

4.5 Sending the configuration to IntesisBox

When the configuration has been saved (button *Accept*) and the IntesisBox configuration binary file has been generated (remember to select yes when asked if you want to generate the IntesisBox file), to send the configuration file to IntesisBox click on the button ***Send File***. The process of file transmission can be monitored in the *IntesisBox Communication Console* window. If the file transmission is ok, IntesisBox will reboot automatically with the new configuration loaded.

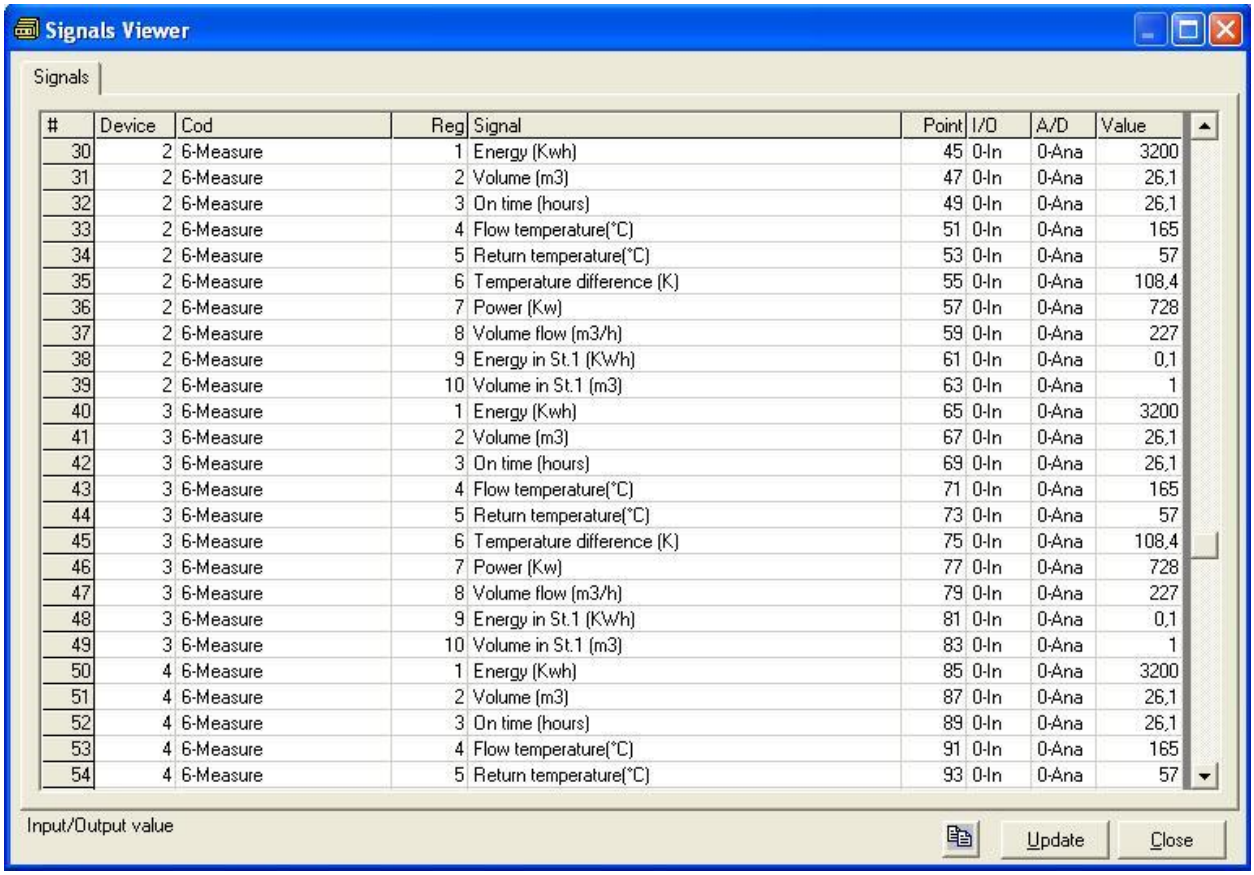


Remember that saving the configuration and generating the IntesisBox file only saves to the hard disk on the PC the configuration files. **Do not forget to send the configuration file to the IntesisBox using button *Send File*.**

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

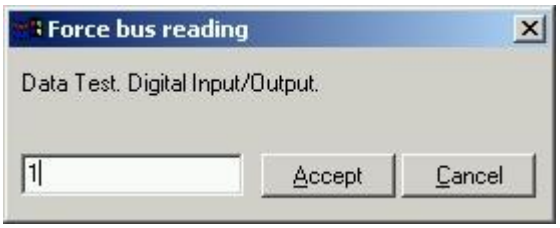
4.6 Signals viewer

Once IntesisBox is running with the correct configuration and communicating with Modbus and M-Bus systems, it is possible to view the readings of the integration signals and even force a change in any signal value from LinkBoxMB. To do so, select menu View -> Signals. The Signals Viewer window will be opened. This window shows all the active integration signals with its main configuration parameters and its real time value in the column *Value*.



#	Device	Cod	Reg	Signal	Point	I/O	A/D	Value
30	2	6-Measure	1	Energy (Kwh)	45	0-In	0-Ana	3200
31	2	6-Measure	2	Volume (m3)	47	0-In	0-Ana	26,1
32	2	6-Measure	3	On time (hours)	49	0-In	0-Ana	26,1
33	2	6-Measure	4	Flow temperature(°C)	51	0-In	0-Ana	165
34	2	6-Measure	5	Return temperature(°C)	53	0-In	0-Ana	57
35	2	6-Measure	6	Temperature difference (K)	55	0-In	0-Ana	108,4
36	2	6-Measure	7	Power (Kw)	57	0-In	0-Ana	728
37	2	6-Measure	8	Volume flow (m3/h)	59	0-In	0-Ana	227
38	2	6-Measure	9	Energy in St.1 (KWh)	61	0-In	0-Ana	0,1
39	2	6-Measure	10	Volume in St.1 (m3)	63	0-In	0-Ana	1
40	3	6-Measure	1	Energy (Kwh)	65	0-In	0-Ana	3200
41	3	6-Measure	2	Volume (m3)	67	0-In	0-Ana	26,1
42	3	6-Measure	3	On time (hours)	69	0-In	0-Ana	26,1
43	3	6-Measure	4	Flow temperature(°C)	71	0-In	0-Ana	165
44	3	6-Measure	5	Return temperature(°C)	73	0-In	0-Ana	57
45	3	6-Measure	6	Temperature difference (K)	75	0-In	0-Ana	108,4
46	3	6-Measure	7	Power (Kw)	77	0-In	0-Ana	728
47	3	6-Measure	8	Volume flow (m3/h)	79	0-In	0-Ana	227
48	3	6-Measure	9	Energy in St.1 (KWh)	81	0-In	0-Ana	0,1
49	3	6-Measure	10	Volume in St.1 (m3)	83	0-In	0-Ana	1
50	4	6-Measure	1	Energy (Kwh)	85	0-In	0-Ana	3200
51	4	6-Measure	2	Volume (m3)	87	0-In	0-Ana	26,1
52	4	6-Measure	3	On time (hours)	89	0-In	0-Ana	26,1
53	4	6-Measure	4	Flow temperature(°C)	91	0-In	0-Ana	165
54	4	6-Measure	5	Return temperature(°C)	93	0-In	0-Ana	57

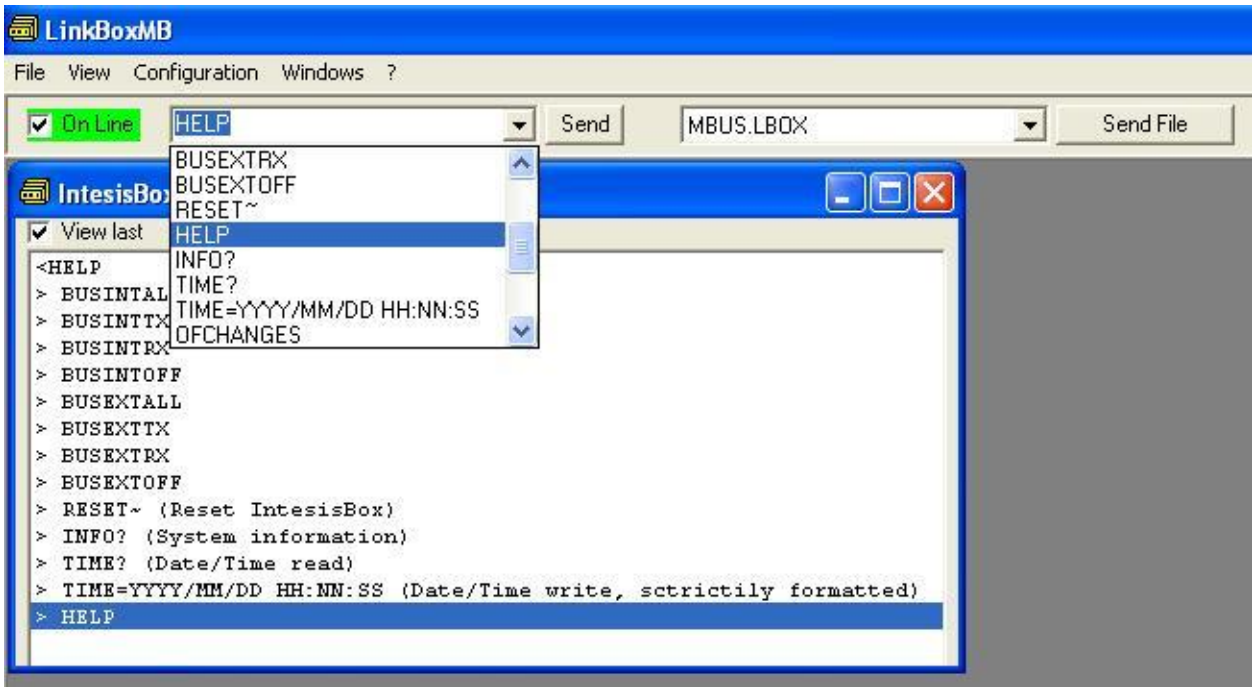
It is possible to force a specific value to any signal for test purposes, to do so just double click on the row and select the desired value and Accept in the Data Test window.



URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

4.7 System commands

LinkBoxMB includes an option to send to IntesisBox a set of system commands for debugging and control purposes; this list is available in the commands list as shown in the figure below. To send a command to IntesisBox just select it from the list, or type it with the correct format, and press *Enter* or click on button *Send*. IntesisBox will act accordingly with the command received; the process can be monitored in the IntesisBox Communication Console window. The use of some of these commands can be critical for IntesisBox normal functioning, having this in mind use only these commands following the recommendations of Intesis Software technical support. A list of the more commonly used commands and the way to use them will be returned by IntesisBox after sending the HELP command.



URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

4.8 Files

LinkBoxMB saves the integration configuration in the following files inside the project folder:

PROJECT.INI	Ini file containing general information referent to the project
MBUS.INI	Ini file containing the information referent to the connection window and other special adjustments
MBUS.DAT	Text file (tab separated values) with the signals information (signals list). This file can be edited (with Excel for example) to change the configuration quicker and easier. Later on, when selecting *Configuration -> IntesisBox* in LinkBoxMB, if the changes have been made respecting the correct format, all the changes in the configuration done from Excel will be reflected in the signals list.
MBUS.LBOX	Binary file created from the information in the two files described above. This is the file downloaded to the IntesisBox.

It is strongly recommended to back up the project folder containing these files in external media, once the installation process is finished. This way you will be able to do future configuration changes in case of reinstallation of LinkBoxMB due, for example, to a failure of the hard disk in the PC where LinkBoxMB was installed.

The configuration cannot be uploaded from IntesisBox to LinkBoxMB, only can be downloaded; the download file MBUS.LBOX does not contain all the integration information, as for example the signals description.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

5. Setup process and troubleshooting

5.1 Pre-requisites

It is necessary to have the Modbus master device operative and well connected to the Modbus port of IntesisBox, remember to respect the maximum of 15 meters cable distance if using RS232 communication.

It is necessary to have the level converter M-Bus to RS232 or RS485 operative and well connected to the M-Bus system and at a distance of IntesisBox installation site of 15 meters maximum if using RS232 communication.

Connectors, connection cables, PC for LinkBoxMB, and other auxiliary material, if needed, are not supplied by Intesis Software for this standard integration. The items supplied by Intesis Software for this integration are:

- IntesisBox Modbus Server device with M-Bus external protocol firmware loaded.
- LinkBoxMB software to configure IntesisBox.
- Console cable needed to download the configuration to IntesisBox.
- Product documentation.

If requested, Intesis Software also can supply:

- Standard plug-in powers supply 220Vac 50Hz to power IntesisBox.
- M-Bus to RS232 or RS485 level converter.

5.2 Setup procedure

1. Install LinkBoxMB on your laptop, use the setup program supplied for this and follow the instructions given by the Installation wizard.

2. Install IntesisBox in the desired installation site. The mounting can be on DIN rail or on a stable not vibrating surface (DIN rail mounted inside a metallic industrial cabinet connected to ground beside the M-Bus/RS232 level converter is recommended).

3. Connect the communication cable coming from the Modbus master device to the port marked as **Modbus** of IntesisBox (used either RS232, RS485 or Ethernet port depending on the type of Modbus communication to use). (See details for this communication cable in section *Connections* of this document).

4. Connect the communication cable coming from the RS232 or RS485 port of the level converter to the corresponding port marked as **M-Bus** of IntesisBox. (See details for this communication cable in section *Connections* of this document).

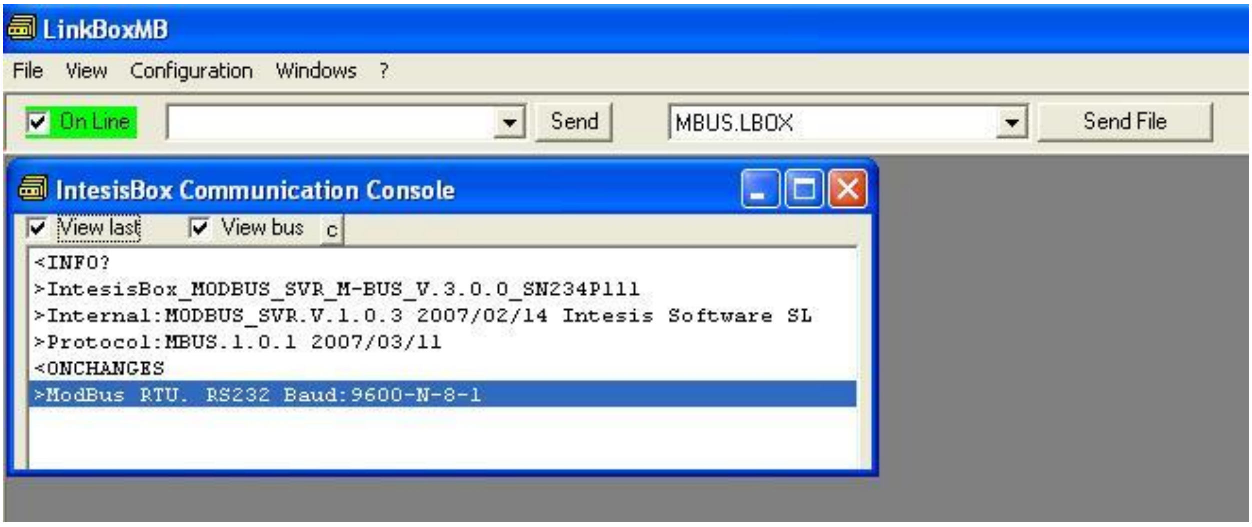
5. Power up IntesisBox. The supply voltage can be 9 to 30 Vdc or just 24 Vac. Take care of the polarity of the supply voltage applied.

6. Connect the communication cable coming from the serial port of your laptop PC to the port marked as **PC Console** of IntesisBox. (See details for this communication cable in section *Connections* of this document).

7. Open LinkBoxMB, create a new project selecting a copy of the one named **DEMO M-Bus** and give it the name desired, select the serial port used to connect to IntesisBox (menu Configuration -> Connection) and switch working mode to *on-line* (checkbox *off-line/on-*

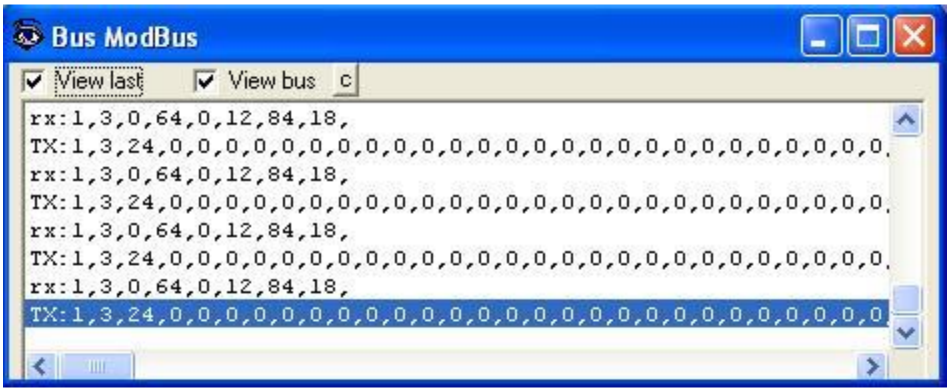
Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

line). The IntesisBox identification must appear in the *IntesisBox communication console* window as showed below.



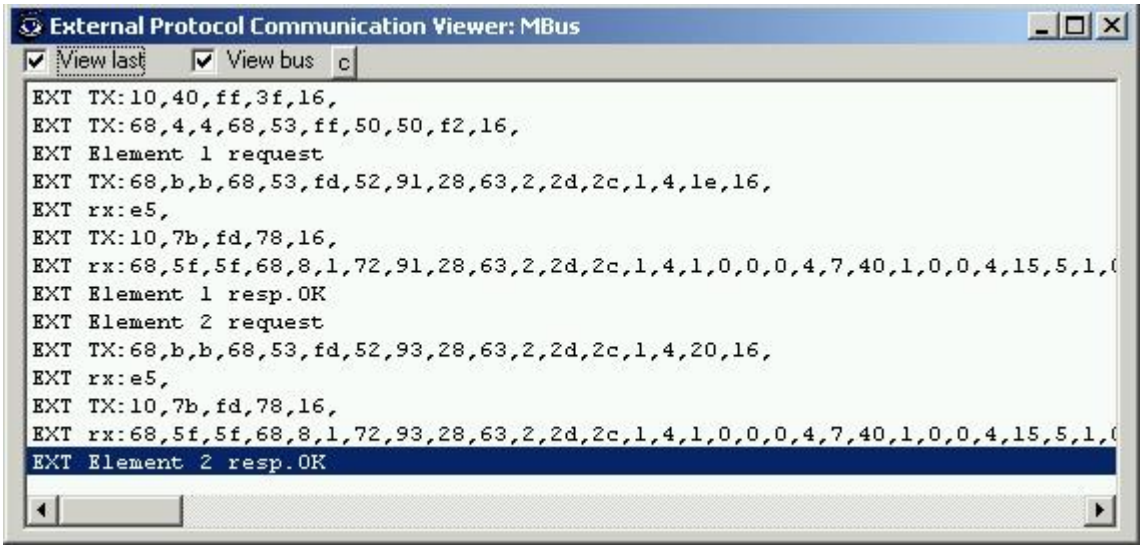
8. Modify the configuration as desired, save it and download the configuration file to IntesisBox as explained before.

9. Open the *Modbus Communication Viewer* window (menu View -> Bus -> Modbus) and check that there is communication activity, some TX frames and some other rx frames. This means that the communication with the Modbus master device is ok. In case there is no communication activity between IntesisBox and the Modbus master device check that it is operative, check the baud rate, and check also the communication cable used to connect both devices. (See details for this communication cable in section *Connections* of this document).



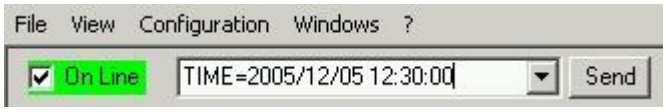
10. Open the *External Protocol Communication Viewer* window (menu View -> Bus -> M-Bus) and check that there is communication activity, some TX frames and some other rx frames as showed in the figure below. This means that the communication with the M-Bus system is ok. In case of no communication activity between IntesisBox and M-Bus check that the level converter is operative and connected (to the M-Bus system and to RS232 or RS485), and check also the communication cable used to connect both devices. (See details for this communication cable in section *Connections* of this document).

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134



11. If you want to adjust date & time of IntesisBox proceed as follow:

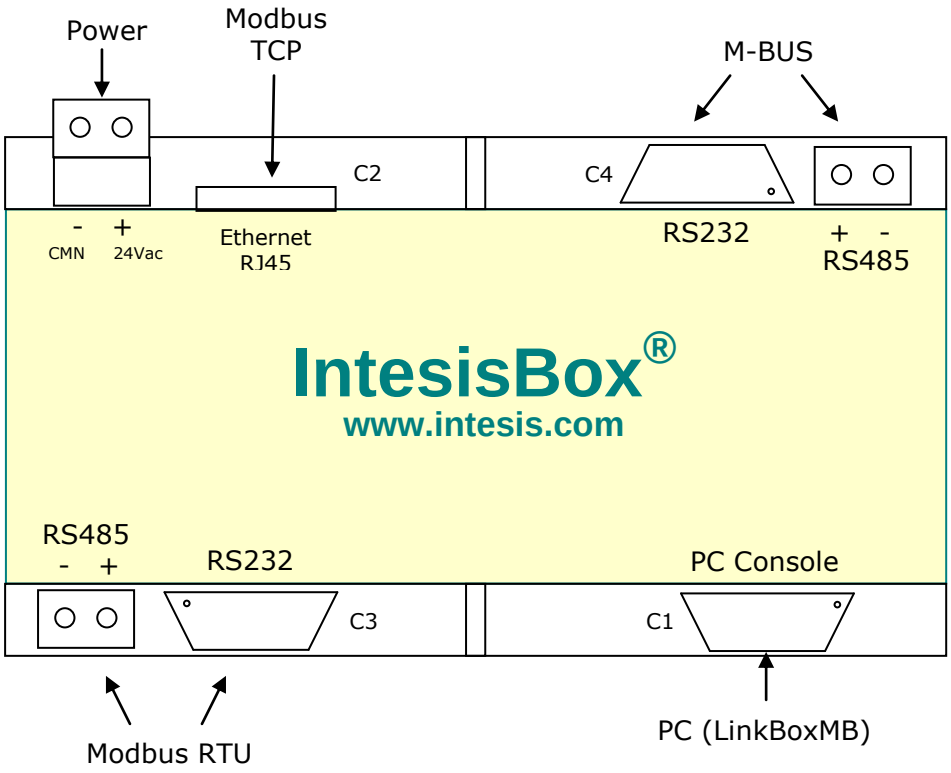
Type **TIME=YYYY/MM/DD HH:NN:SS** in the commands field as showed in the figure below and click on button *Send*. (YYYY = year, MM = month, DD = day, HH = hour, NN = minutes, SS = seconds). Correct settings are acknowledged with OK by IntesisBox.



To check date & time of IntesisBox in any moment type **TIME?** in the commands field as showed in the figure below and click on button *Send*.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

6. Connections



IntesisBox (DB9 F)	C1	PC (LinkBoxMB) Connection		PC (DB9 M)
Cable (DB9 M)		RS-232 (Straight)		Cable (DB9 F)
TX	2	→	2	RX
RX	3	←	3	TX
GND	5	↔	5	GND

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

IntesisBox (RJ45 H)	C2	Modbus TCP Connection (using Ethernet)		Master TCP (RJ45 H)
Cable (RJ45 M)				Cable (RJ45 M)
		Cable UTP/FTP Cat5 Crossed		Direct to device
		Cable UTP/FTP Cat5 Straight	Hub	Through hub or switch

IntesisBox (DB9 M)	C3	Modbus RTU Connection (RS232 using DB9 connector)		Modbus master RS232
Cable (DB9 F)				Cable
RX	2	←		TX
TX	3	→		RX
GND	5	↔		GND

IntesisBox (Terminal block 2p)	C3	Modbus RTU Connection (RS485 using terminal block)		Modbus master RS485
Cable				Cable
TX/RX +	+	↔		TX/RX +
TX/RX -	-	↔		TX/RX -

IntesisBox (DB9 M)	C4	M-Bus connection (RS232 using DB9 connector)		M-Bus to RS232 level converter
Cable (DB9 F)				Cable
RX	2	←		TX
TX	3	→		RX
GND	5	↔		GND

IntesisBox (Terminal block 2p)	C4	M-Bus connection (RS485 using terminal block)		M-Bus to RS485 level converter
Cable				Cable
TX/RX +	+	↔		TX/RX +
TX/RX -	-	↔		TX/RX -

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

7. Mechanical & electrical characteristics

Enclosure	Plastic, type PC (UL 94 V-0). Dimensions: 107mm x 105mm x 58mm.
Colour	Light Grey. RAL 7035.
Power	9 to 30Vdc +/-10% 2.4W. 24Vac +/-10% 2.4VA. Power connector is a 2 poles plug-in terminal block.
Mounting options	Desktop Wall DIN rail EN60715 TH35
Modbus TCP port	1 x Ethernet 10BT (RJ45).
Modbus RTU ports	1 x Serial RS232 (DB9 male DTE). 1 x Serial RS485 (Plug-in screw terminal block 2 poles).
M-Bus ports	1 x Serial RS232 (DB9 male DTE). 1 x Serial RS485 (Plug-in screw terminal block 2 poles).
LED indicators	1 x power. 2 x serial port Modbus activity (Tx, Rx). 2 x serial port M-Bus activity (Tx, Rx). 2 x Ethernet port (LNK, ACT).
Console port	RS232. (DB9 female DCE).
Configuration	Via console port.[1]
Firmware	Allows upgrades via console port.
Operational temperature range	-40°C to +70°C
Operational humidity range	5% to 95%, non condensing
Protection	IP20 (IEC60529).
RoHS conformity	Compliant with RoHS directive (2002/95/CE).
Certifications	CE

[1] Along with the device it is also supplied a standard DB9 male - DB9 female 1.8 m. cable for configuring and monitoring the device using a PC via serial COM port. The configuration software LinkBoxMB (free of charge), compatible with MS Windows® operating systems, is also supplied with the device.

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

8. Functional characteristics

General	
Max. points	2000 (up to 600 for the basic version)
Max. M-Bus devices	500 (up to 60 for the basic version)
Virtual signals	General virtual signals: • Communication error with M-Bus system. • Force bus reading (used to force a reading of all M-Bus devices). • Continuous polling (used to force a continuous polling of all M-Bus devices). • M-Bus activity. (Indicating: reading in progress or bus in stand-by). Virtual signals per M-Bus device defined: • Communication error with the M-Bus device. • Force device reading. • Status M-Bus (this status signal is updated, read from the device, with every reading). All these virtual signals can be read and/or written from Modbus.
M-Bus interface	
Type	RS232 (DTE) or RS485 (plug-in screws terminal block). Requires external RS232/RS485 to M-Bus level converter for connection to the M-Bus meters.

Configuration parameters	Up to 500 devices can be defined. Automatic creation of devices and their associated virtual signals by just entering the number of devices desired.
	
	Configuration per each device:
	• Secondary address.
	  • Device identifier. *Compulsory, normally printed in the device's label.*
	  • Manufacturer. *Optional.*
	  • Software version. *Optional.*
	  • Media. *Optional.*
	• Or Primary address (1..250). *Compulsory, the device must be also programmed with this primary address.*
	The addressing mode can be selected: primary or secondary, this selection applies for all devices defined.
	Primary addressing allows to poll up to 250 devices, every device must be previously programmed with a unique primary address (1..250).
	Secondary addressing has no limitations in terms of number of devices that can be poll, but all devices must have a unique combination of Identifier-Manufacturer-SoftVersion-Media, this combination is factory programmed in every device.

Interactivity with M-Bus system	In order to give the interface the maximum flexibility in front of the wide range of different M-Bus devices (meters) existing in the market, the following general parameters can be configured: • Baud rate selection (300bps…9600bps), the devices comes normally configured at 2400bps from factory. • Timeout to wait after sending SND-NKE message. • Timeout to wait after sending SND-UD1 message (waiting for response timeout).

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

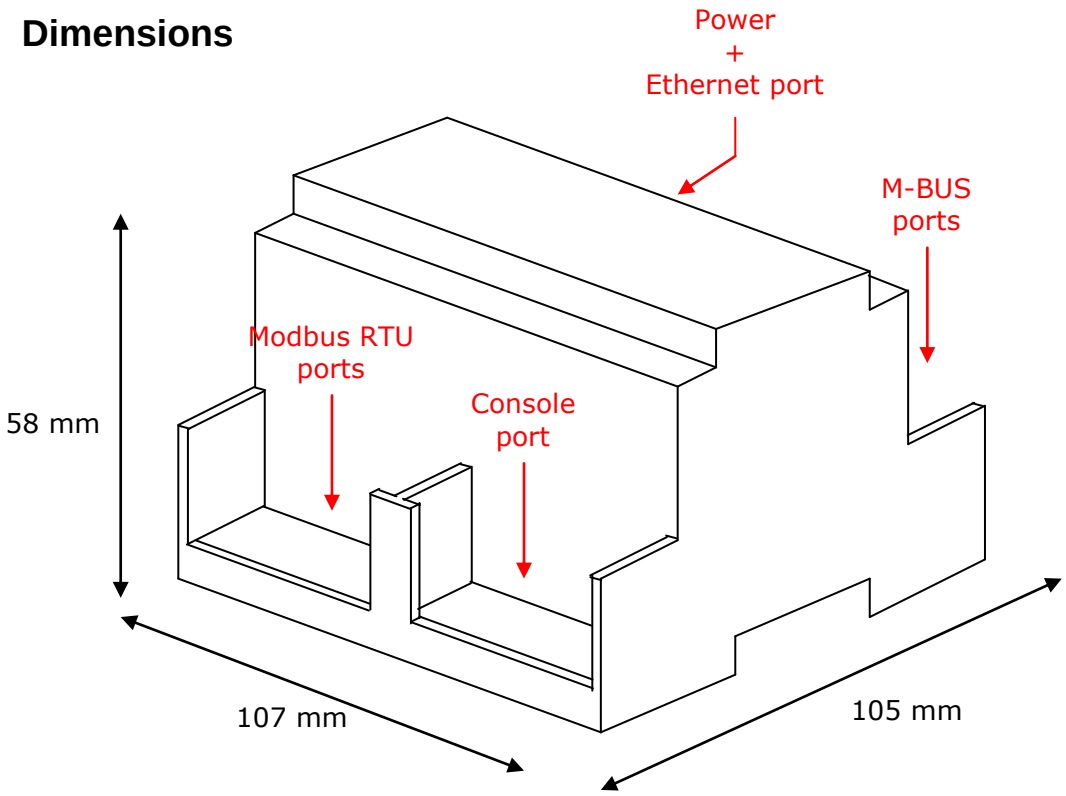
	• Perform a reading after start up (Yes/No). • Reset instantaneous values in the device at start reading (Yes/No). • Any register type* offered by an M-Bus device can be programmed to be read by the gateway, simply specifying the register number wanted to be read. **Only instantaneous values, normally in the first page of the device, can be read by the gateway. Historical data in the device can not be read. Only those signal types supported by the gateway can be read. See M-Bus signal types supported below.* Refer to the M-Bus device technical documentation in order to identify the signals offered by the meter to be used and the register number for every signal. In order to speed up the identification of the registers offered by a meter, an embedded tool into the gateway allows to request all the registers available in any device connected to the bus and identifies the register number to be programmed in the gateway for reading any desired signal offered by the device.
Modbus interface	
Device type	Slave.
Modbus modes supported	TCP, RTU RS232 or RS485.
Modbus TCP configuration parameters	• IP address. • Subnet mask. • Default gateway. • TCP port.
Modbus RTU configuration parameters	• RS232/RS485. • Baud rate. • Slave number.
Points	
Configuration parameters per point	Generic fields. • Point description. Useful to identify the signal type into the meter and point's location into the building. • Active (Yes/No). Useful to deactivate points maintaining the configuration for later use. M-Bus related fields. • Device number (from the previously defined list of devices). • Register number (identifying the signal wanted to be read into the device). This info, along with the meters physical location, must be obtained from the engineer in charge of setting up and installing on site the M-Bus meters, and also from the meter's technical documentation. Modbus related fields. • Register address (1…10000). • Data coding format. This info, along with the point's description, must be supplied to the engineer in charge of setting up the integration into the Modbus system.

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

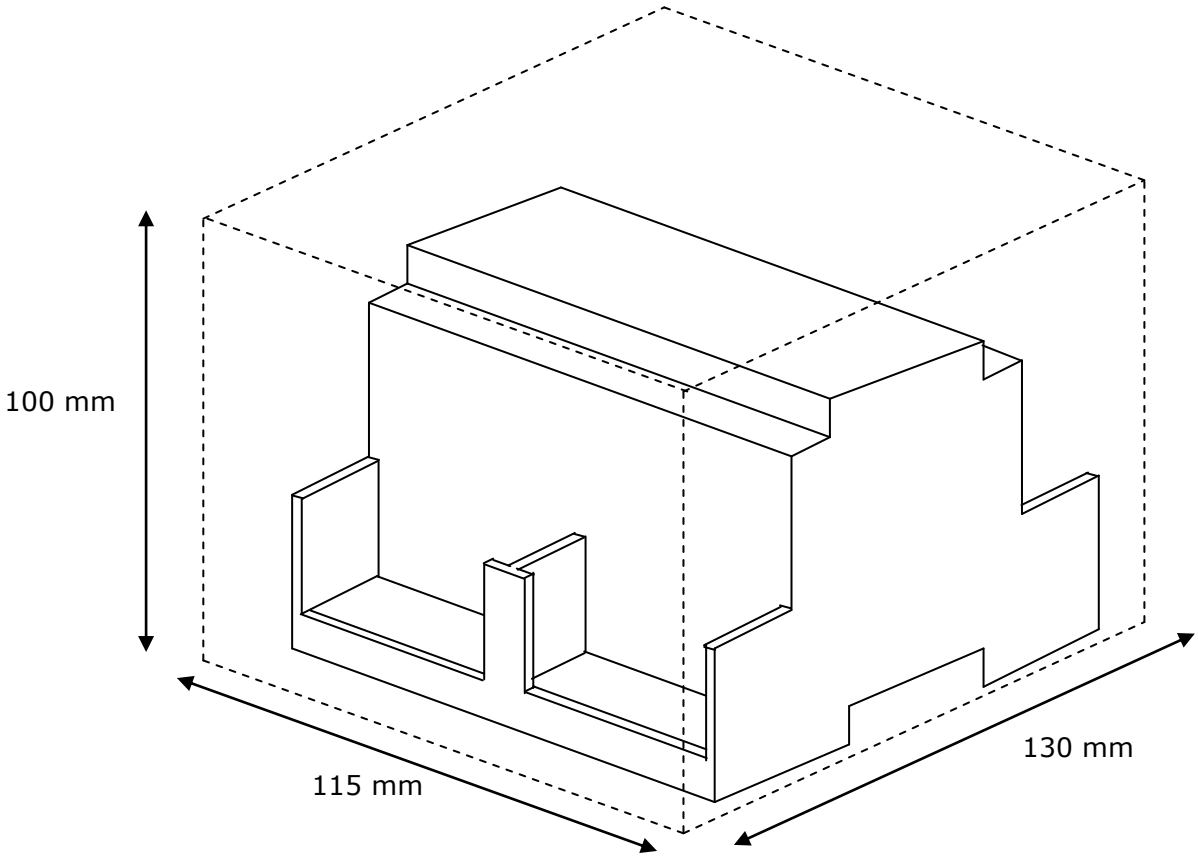
Modbus data coding formats supported	For virtual signals, Data coding format by default is*:* • 1 bit. Data coding format can be selected, for any point in the gateway, to be: • 32 bit float (MB). • 32 bit float (LSB..MSB).
M-Bus signal types supported	The gateway can read the following type of signals offered by M-Bus devices: • Energy (kWh or J). • Volume (m3). • Mass (kg). • Power (kW or J/h). • Volume flow (m3/h, m3/min or m3/s). • Mass flow (kg/h). • Flow Temperature (°C). • Return Temperature (°C). • Temperature difference (K). • External Temperature (°C). • Pressure (Bar). • H.C.A., without units. (Multipurpose signal used, for example, by some energy meters to offer the readings of auxiliary pulse counter inputs of the device). • On Time, normally in hours but depends on the meter. • Operating Time, normally in hours but depends on the meter. • Averaging Duration, normally in hours but depends on the meter. • Actuality Duration, normally in hours but depends on the meter. These are the type of signals more frequently offered by M-Bus devices and used by energy meters. *The reading of other more specific type of signals also included in the M-Bus specification, for example voltage or current, are not supported by the standard version of the gateway. Although they can be also implemented in the gateway on demand. Contact your nearest distributor for more details.* Refer to the M-Bus device technical documentation in order to identify the signals offered by the meter in every case.

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

9. Dimensions



Recommended available space for its installation into a cabinet (wall or DIN rail mounting), with space enough for external connections



URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

10. ANNEX I. Identification of the registers available in a meter and its configuration into LinkBoxMB

In the configuration of the signals to integrate, in the column *Reg* of the signals list, it must be entered the M-Bus register number corresponding to the signal wanted to integrate (from all the signals offered by the M-Bus meter). In case that the signals offered by a given meter is unknown, it can be obtained a list of all the signals offered by the device along with the correct register number value for every one of them to put in the column *Reg* in the signals list. To do so follow these steps:

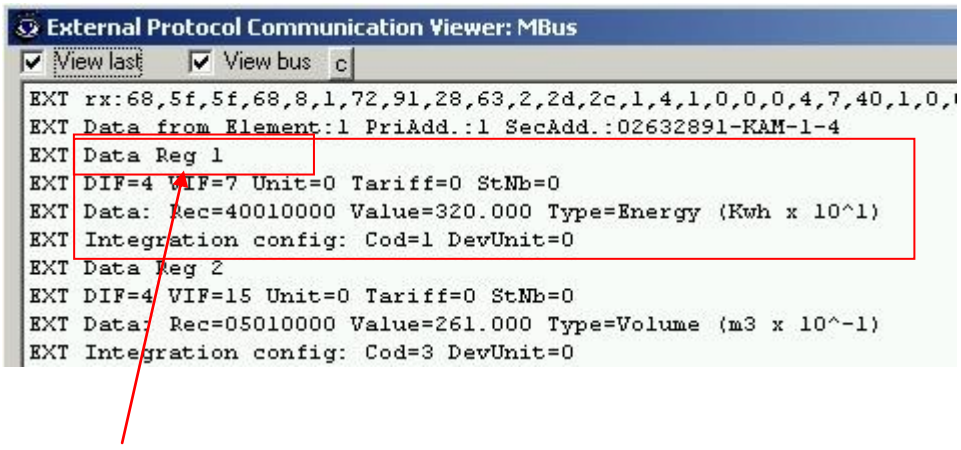
1- Select *View->Bus->M-Bus* (the *external protocol communication viewer* window will be opened).

2- From the list of system commands to send to IntesisBox, select DEBUG=3* and click on button *Send*.

3- Force the reading of the desired device using the special signal for this purpose in the configuration. Double click on the signal *force device reading* for the desired device in the signals viewer window (*View->Signals)* and enter 1 for this signal in the Data Test window. This will force a polling of the device and a list of all the signals offered by the device will be showed in the external protocol communication viewer window (see the figure below).

4- Once identified the signals to integrate, deactivate the debug option of IntesisBox, for this, from the list of system commands to send to IntesisBox, select DEBUG=0 and click on button *Send*.

Example of a device response with DEBUG=3 activated:



In case you want to integrate this meter's signal, enter this value (**1** in this case) in the column *Reg* for this signal in the signals list.

NOTE: If in the type variable you get the message "VIFE not recognized", please visit the M-BUS device manual to check the expected units for that signal. This is usually associated to proprietary data types that need to be specified by the manufacturer itself, therefore more information must be found in the M-BUS device or meter.

* **IMPORTANT:** Debug=3 applies for firmware versions V.42.0.14 and above. For previous versions, please use DEBUG=1.

Intesis software
URL http://www.intesis.com
email info@intesis.com
tel +34 938047134

URL http://www.intesis.com
email info@intesis.com
tel +34 938047134