



IntesisBox[®] Modbus Server

Mitsubishi Heavy Industries Air Conditioning

User's Manual

Issue Date: 14/05/2012
r1.0 eng

Order Code: **MH-AC-MBS-48**
MH-AC-MBS-128

© Intesis Software S.L. 2012 All Rights Reserved.

Information in this document is subject to change without notice. The software described in this document is furnished under a license agreement or nondisclosure agreement. The software may be used only in accordance with the terms of those agreements. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or any means electronic or mechanical, including photocopying and recording for any purpose other than the purchaser's personal use without the written permission of Intesis Software S.L.

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

TRADEMARKS

All trademarks and trade names used in this document are acknowledged to be the copyright of their respective holders.

Gateway for integration of Mitsubishi Heavy Industries air conditioning systems into Modbus (RTU and TCP) systems.

Two models are available for this gateway, with the following **Order Codes**:

MH-AC-MBS-48

Model supporting up to 48 indoor units.

MH-AC-MBS-128

Model supporting up to 128 indoor units.

Index

1.	Description	5
1.1	Introduction.....	5
1.2	Integration signals.....	5
1.3	Functionality	6
1.4	Capacity of IntesisBox®	7
2.	Modbus interface of IntesisBox®	8
2.1	Description	8
2.2	Functions supported.....	8
2.3	Modbus RTU	8
2.4	Modbus TCP.....	8
2.5	Address Map	8
2.5.1	Modbus addresses related to IntesisBox®	9
2.5.2	Modbus addresses related to each Indoor Unit	9
2.5.3	Modbus addresses related to ALL indoor units	10
3.	IntesisBox® Device Connections.....	11
3.1	Connect to Mitsubishi Heavy Industries Interface	12
3.2	Connect to Modbus Interface.....	12
3.2.1	Connect to Modbus RTU.....	12
3.2.2	Connect to Modbus TCP	13
3.2.3	Connect to PC (LinkBoxMB).....	14
3.3	Power Device	14
4.	LinkBoxMB. Configuration & monitoring tool for IntesisBox® Modbus Server series... 15	15
4.1	Introduction.....	15
4.2	Connections configuration.....	15
4.2.1	Configuration tab.....	15
4.2.2	Modbus map tab.....	18
4.3	Sending the configuration to IntesisBox®	18
4.4	Signals viewer.....	19
4.5	Files	20
5.	Setup process and troubleshooting.....	21
5.1	Pre-requisites	21
5.2	Setup procedure.....	21
5.3	Troubleshooting	22
5.3.1	Physical checking.....	22
5.3.2	Software checking	22
6.	Functional characteristics summary.....	23
7.	Mechanical & Electrical characteristics	24
8.	AC Unit Types compatibility.....	25
9.	Error codes.....	26

1. Description

1.1 Introduction

IntesisBox[®] Modbus Server – Mitsubishi Heavy Industries AC is a communication gateway for Mitsubishi Heavy Industries air conditioning (AC) systems to Modbus slave (RTU and TCP).

This gateway allows integrating a Mitsubishi Heavy Industries AC system inside a supervision/control/automation system through PLC, SCADA and, in general, through any device or system with Modbus mastering (TCP or RTU) interface.

The aim of this integration is to make accessible several Mitsubishi Heavy Industries air conditioning indoor units communicating with the Superlink protocol as if they were part of a Modbus system. Therefore, the *IntesisBox[®] Modbus Server* acts as a Modbus slave in the Modbus interface, allowing the Modbus master read and write in the Modbus registers. Moreover, *IntesisBox[®]* includes all hardware required to manage/control Mitsubishi Heavy Industries indoor units without extra components needed.

1.2 Integration signals

Following is the list of parameters that can be monitored/controlled on the indoor units using *IntesisBox[®]*:

- For **each indoor unit** in the system:
 - Communication Status (read-only)
 - On/Off (R/W)
 - Operation Mode (R/W)
 - SetPoint Temperature (R/W)
 - Fan Speed (R/W)
 - Remote Controller Lock/Unlock (R/W)
 - Louver Control (R/W)
 - Room Temperature (read-only)
 - Filter Sign Status (read-only)
 - Error Code (read-only)
 - Compressor Status (read-only)
 - Filter Sign Reset (write-only)
 - Remote Controller Error Reset (write-only)
 - Thermo On/Off Status (read-only)

Apart from these, the *IntesisBox[®]* also implements some extra signals (functions):

- For **all indoor units¹** in the system:
 - HW Communication Status (read-only)
 - On/Off (write-only)
 - Operation Mode (write-only)
 - SetPoint Temperature (write-only)
 - Fan Speed (write-only)
 - Remote Controller Lock/Unlock (write-only)

¹ These signals work as master signals controlling all connected units at the same time

1.3 Functionality

Each of the mentioned signals in section 1.2 is associated to a predefined and fixed Modbus address. Therefore, all the system is seen as a single Modbus slave unit with a fixed Modbus address map from the Modbus system point of view.

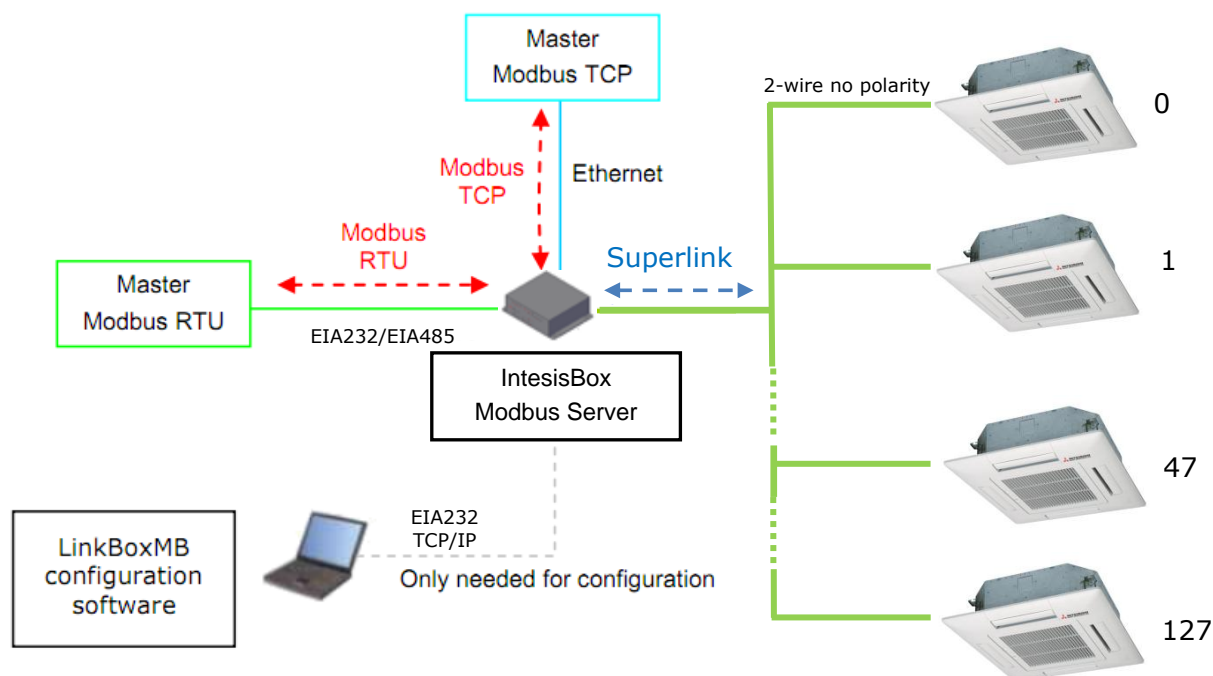


Figure 1.1 Integration of Mitsubishi Heavy Industries AC into Modbus system using IntesisBox®

Two Modbus mode connection types can be active in IntesisBox®: Modbus RTU or Modbus TCP, or both simultaneously.

IntesisBox® continuously polls all signals provided by each indoor unit and maintains the updated values to be served in Modbus.

In the continuous polling of each indoor unit, if no response of a certain device is detected, the corresponding virtual signal inside the gateway will be activated indicating communication error between the gateway and that precise device (see 0).

When a *write* order is done from Modbus in a gateway's write-enabled Modbus address, the corresponding order is sent to the associated Mitsubishi Heavy Industries signal (Superlink).

Each Mitsubishi Heavy Industries Indoor Unit has a unique address (0 to 127). These addresses need to be configured inside IntesisBox® using the LinkBoxMB tool (see 4.2.2).

IntesisBox® is capable of managing up to two simultaneous Modbus master connections.

IntesisBox® includes all hardware needed to connect directly with the Mitsubishi Heavy Industries indoor units connecting with Superlink network.

1.4 Capacity of IntesisBox®

Element	Max.	Notes
Number of indoor units	128 *	Maximum number of AC indoor units that can be controlled
Number of points per indoor unit	14	Modbus addresses per indoor unit
Maximum number of points	1797*	Valid Modbus addresses
Maximum TCP master connections	2	Maximum number of TCP simultaneous Modbus Master connections
Maximum RTU master connections	1	Maximum number of RTU simultaneous Modbus Master connections

Table 1.1 IntesisBox® capacity

* There are two different models of *IntesisBox® Modbus Server – Mitsubishi Heavy Industries AC* each one with different capacity. The table above shows the capacity for the top model (with maximum capacity).

Their order codes are:

- MH-AC-MBS-48:
 - Model supporting up to 48 indoor units
 - For Superlink-I (Previous Superlink) or Superlink-II (New Superlink).
 - Indoor Unit actual address range is 00 to 47
- MH-AC-MBS-128:
 - Model supporting up to 128 indoor units
 - For Superlink-II (New Superlink)
 - Indoor Unit actual address range is 000 to 127

Check available combination of Mitsubishi Heavy Industries Central Control and BMS interface units in the next tables.

In the case of SL2NA or SL3NA, it is necessary to erase registration of non-connected indoor unit. For SL2NA and SL3NA, change is required for the setup deprived of the rights of instruction of Remocon control Lock/Unlock.

New Superlink connections:

MH-AC-MBS-128 MH-AC-KNX-128	SC-LGWNA-A SC-BGWNA-A/B etc.	SC-SL3NA-AE/BE etc.	SC-SL2NA-E etc.	SC-SL1N-E etc.	Max Indoor Units	Address No.
1	Non connect	2	0	0-8	128	000-127
		1	0-2			
		0	0-4			

MH-AC-MBS-48 MH-AC-KNX-48	SC-LGWNA-A SC-BGWNA-A/B etc.	SC-SL3NA-AE/BE etc.	SC-SL2NA-E etc.	SC-SL1N-E etc.	Max Indoor Units	Address No.
1	Non connect	2	0	0-8	48	00-47
		1	0-2			
		0	0-4			

Previous Superlink connections:

MH-AC-MBS-48/128 MH-AC-KNX-48/128	SC-LGWNA-A SC-BGWNA-A/B etc.	SC-SL3NA-AE/BE etc.	SC-SL2NA-E etc.	SC-SL1N-E etc.	Max Indoor Units	Address No.
1	Non connect	Non connect	1	0	32	00-47
			0	1,2		
			0	0		

2. Modbus interface of IntesisBox®

2.1 Description

IntesisBox® acts as a slave device in the Modbus interface. The physical interface can be either Ethernet, if using Modbus TCP, or the EIA485 (or EIA232), if using Modbus RTU.

2.2 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.
- Modbus function 06 (*Single Multiple Holding Registers*) must be used to write Modbus registers.
- As per Modbus standard specification, register contents are always expressed in MSB..LSB (Bid Endian).
- Modbus error codes are fully supported, they will be sent whenever a non-valid Modbus action or address is required (see section 9).

2.3 Modbus RTU

Baud rate can be selected from 1200, 2400, 4800, 9600, 19200 and 38400.

Information structure:

- Data Bits: 8
- Parity Bit: Selectable from *non*, *even*, *odd* or *second stop bit (2stop)*.
- Stop Bit: 1

Modbus slave number can be configured.

Physical connection (EIA232 or EIA485) can also be selected.

Only the lines RX, TX and GND of the EIA232 connector are used (TX and RX for EIA485).

2.4 Modbus TCP

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

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

2.5 Address Map

Address map is fixed for each indoor unit and can be consulted as explained in the following tables. Please, remember that in the tables **R/W** stands for *Read* and *Write*, **R** stands for *Read Only* and **W** stands for *Write Only*.

2.5.1 Modbus addresses related to IntesisBox®

Modbus address (base addr is 1)	Modbus register type (R/W)	Signal description and values
2995	R	Hw Communication Status <ul style="list-style-type: none"> • 0: No Hardware Communication Error • 1: Hardware Communication Error

2.5.2 Modbus addresses related to each Indoor Unit¹

Indoor unit number	Modbus address (base addr is 1)	Modbus register type (R/W)	Signal description and values
0	1	R	Communication Status <ul style="list-style-type: none"> ▪ 0: Communication OK ▪ 1: Communication ERROR
	2	R/W	Indoor Unit On/Off <ul style="list-style-type: none"> ▪ 0: Off ▪ 1: On
	3	R/W	Operation Mode <ul style="list-style-type: none"> ▪ 0: Cool ▪ 1: Heat ▪ 2: Fan ▪ 3: Auto ▪ 4: Dry
	4	R/W	SetPoint Temperature <ul style="list-style-type: none"> ▪ Celsius value (16°C to 30°C)
	5	R/W	Fan Speed <ul style="list-style-type: none"> ▪ 0: Low ▪ 1: Medium ▪ 2: High ▪ 3: Powerful
	6	R/W	Remote Controller Lock/Unlock <ul style="list-style-type: none"> ▪ 0: Remote Controller Locked ▪ 1: Remote Controller Unlocked
	7	R/W	Louver Control ² <ul style="list-style-type: none"> ▪ 0: Swing ▪ 1: Pos1 ▪ 2: Pos2 ▪ 3: Pos3 ▪ 4: Pos4
	8	R	Room Temperature <ul style="list-style-type: none"> ▪ Celsius value (0°C to 30°C)
	9	R	Filter Sign status <ul style="list-style-type: none"> ▪ 0: Off ▪ 1: On
	10	R	Error Code <ul style="list-style-type: none"> ▪ 0: No Error ▪ 0-99: Error Code³
	11	R	Compressor Status <ul style="list-style-type: none"> ▪ 0: Off ▪ 1: On
	12	W	Filter Sign Reset <ul style="list-style-type: none"> ▪ 1: Clear Filter Alarm (When reading, always 0)
	13	W	Remote Controller Error Reset <ul style="list-style-type: none"> ▪ 1: Clear Remote Controller Error (When reading, always 0)
	14	R	Thermo On/Off Status (Inverter Type Only) <ul style="list-style-type: none"> ▪ 0: Off ▪ 1: On
...

¹ Supported number of indoor units varies according to IntesisBox® model

² During transition between positions, **Swing** signal will turn on indicating the Louver is moving

³ See list of indoor unit error codes and their meaning in section 9

Indoor unit number	Modbus address (base addr is 1)	Modbus register type (R/W)	Signal description and values
...
n*	(n*) x 20 + 1	R	Communication Status
	(n*) x 20 + 2	R/W	Indoor Unit On/Off
	(n*) x 20 + 3	R/W	Operation Mode
	(n*) x 20 + 4	R/W	SetPoint Temperature
	(n*) x 20 + 5	R/W	Fan Speed
	(n*) x 20 + 6	R/W	Remote Controller Lock/Unlock
	(n*) x 20 + 7	R/W	Louver Control
	(n*) x 20 + 8	R	Room Temperature
	(n*) x 20 + 9	R	Filter Sign status
	(n*) x 20 + 10	R	Indoor Unit Error Code
	(n*) x 20 + 11	R	Compressor Status
	(n*) x 20 + 12	W	Filter Sign Reset
	(n*) x 20 + 13	W	Remote Control Error Reset
	(n*) x 20 + 14	R	Thermo Status (Inverter Type Only)
...
127 (max number of supported indoor units depends on IntesisBox model)	2541	R	Communication Status
	2542	R/W	Indoor Unit On/Off
	2543	R/W	Operation Mode
	2544	R/W	SetPoint Temperature
	2545	R/W	Fan Speed
	2546	R/W	Remote Controller Lock/Unlock
	2547	R/W	Louver Control
	2548	R	Room Temperature
	2549	R	Filter Sign status
	2550	R	Indoor Unit Error Code
	2551	R	Compressor Status
	2552	W	Filter Sign Reset
	2553	W	Remote Control Error Reset
	2554	R	Thermo Status (Inverter Type Only)

*n is the indoor unit address number.

2.5.3 Modbus addresses related to ALL indoor units

Indoor unit number	Modbus address (base addr is 1)	Modbus register type (R/W)	Signal description and values
ALL	2996	W	All Indoor Units On/Off <ul style="list-style-type: none"> ▪ 0: Off ▪ 1: On
	2997	W	All Indoor Units Operation Mode <ul style="list-style-type: none"> ▪ 0: Cool ▪ 1: Heat ▪ 2: Fan ▪ 3: Auto ▪ 4: Dry
	2998	W	All Indoor Units SetPoint Temperature <ul style="list-style-type: none"> ▪ Celsius value (16°C to 30°C)
	2999	W	All Indoor Units Fan Speed <ul style="list-style-type: none"> ▪ 0: Low ▪ 1: Medium ▪ 2: High ▪ 3: Powerful
	3000	W	All Indoor Units Remote Controller Lock/Unlock <ul style="list-style-type: none"> ▪ 0: Remote Controller Locked ▪ 1: Remote Controller Unlocked

3. IntesisBox® Device Connections

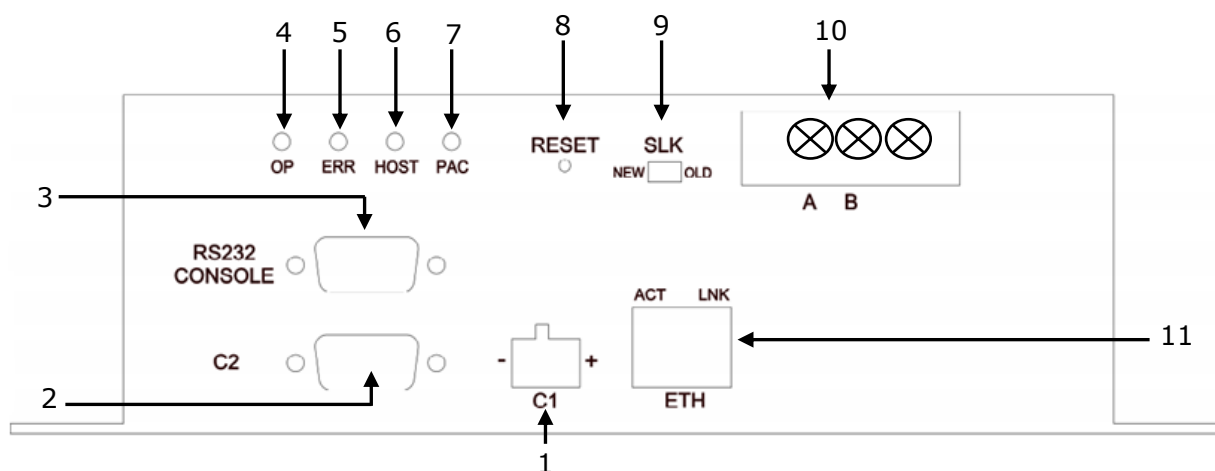


Figure 3.1 IntesisBox® device front view

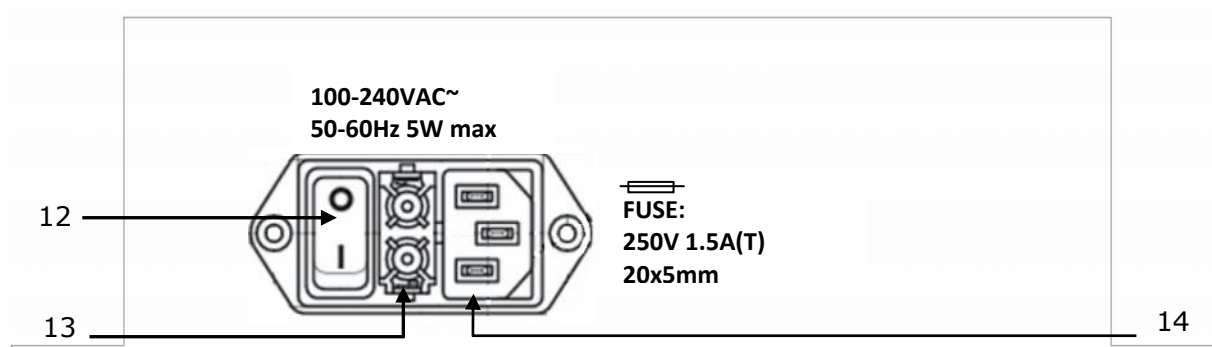


Figure 3.2 IntesisBox® device back view

Next, there is the list with the device physical interface connector's description

- | | |
|-----------------------------------|---|
| 1.- Modbus RTU master EIA485 (C1) | 8.- Reset button (Non supported) |
| 2.- Modbus RTU master EIA232 (C2) | 9.- Superlink selector (SLK)
New: Superlink-II
Old: Superlink-I |
| 3.- Console serial port EIA232 | 10.- A-B connector (for Superlink, no polarity) |
| 4.- Operation LED | 11.- Modbus TCP master Ethernet (ETH) |
| 5.- Error LED | 12.- Power supply On/Off button |
| 6.- Host LED | 13.- Power supply fuse (250V, 1.5A) |
| 7.- Pac LED | 14.- Power supply connector |

3.1 Connect to Mitsubishi Heavy Industries Interface

Use the A-B connector in the right top corner of the front side of the IntesisBox® device in order to connect the Mitsubishi Heavy Industries network (Superlink) to the IntesisBox®. Recommended specifications of the cable for the Superlink are shown as follows:

- Size of cable : 0.75 to 1.25 square mm
- Max length of wiring : total 1000m (loop wiring is not allowed)
- Cable materials :

Twisted Vinyl Cabtyre Cable	VCTF 2 core 0.75 to 1.25 square mm
Twisted Vinyl Cabtyre Cable	VCT 2 core 0.75 to 1.25 square mm
Twisted Vinyl Cable for Control	CVV 2 core 0.75 to 1.25 square mm

Table 3.1 Cable types recommended for Superlink connection

- For prevention of electromagnetic noise malfunctions, parallel wiring with the power line should be avoided

Select the appropriate Superlink mode in the SLK selector. If you are using latest Air Conditioner of the Mitsubishi Heavy Industries network (New Superlink) select NEW, if not select OLD.

LEDs placed in the top left corner will show connection status as follows:

LED	Status	IntesisBox® behavior
OP	Blinking	Power supply OK
ERR	Off	No error
HOST	Blinking	Internal communication OK
PAC	Blinking	Communication with the Superlink network OK

Table 3.2 IntesisBox® LED status information

OP LED behavior must defer depending on the Superlink version, as shown in **Figure 3.3**

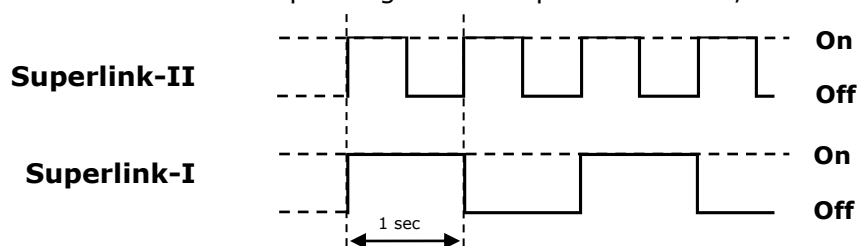


Figure 3.3 OP LED blinking behavior depending on Superlink version

If LEDs (except ERR) are not in the states described above, check section 5.3.

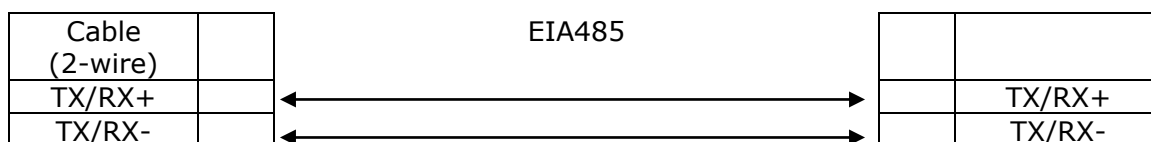
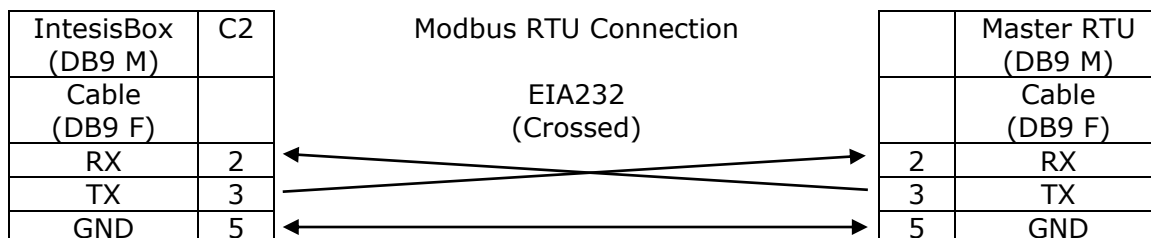
For further information about the Superlink network, look up the Mitsubishi Heavy Industries Manual or contact your nearest Mitsubishi Heavy Industries supplier.

3.2 Connect to Modbus Interface

3.2.1 Connect to Modbus RTU

Connect the communication cable coming from the Modbus RTU network to IntesisBox® device (see **Figure 3.1**). There are 2 existing modes available:

- EIA485 connection: Use the C1 connector (see **Figure 3.1**) if the Modbus interface is a 2-wire EIA485 connector. Connect the + and – to the respective port in the master device and in the IntesisBox® device (polarity matters).
- EIA232 connection: Use the C2 connector (see **Figure 3.1**) if the Modbus interface is point-to-point to one single master.

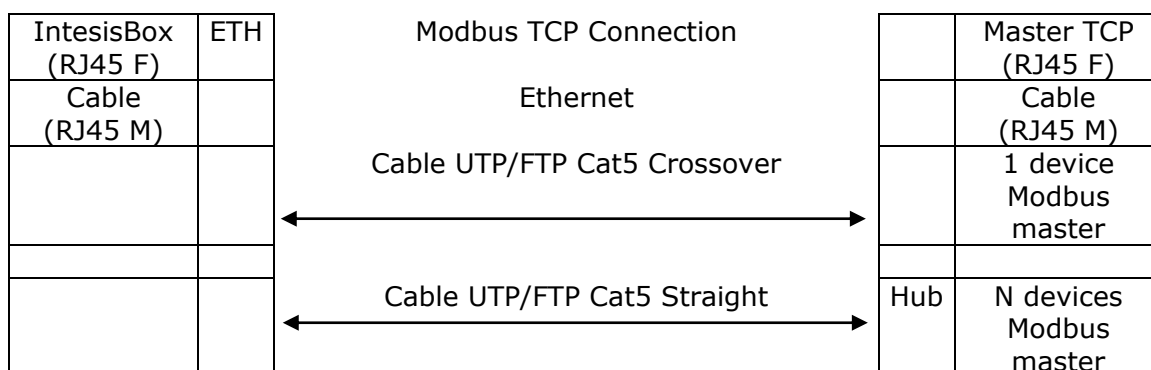


To check connectivity and correct functioning, use LinkBoxMB software (see LinkBoxMB User Manual).

3.2.2 Connect to Modbus TCP

Connect the communication cable coming from the hub, switch or device of the Modbus Ethernet network to the ETH connector from the IntesisBox® device (see **Figure 3.1**). The cable to be used may vary depending on where the IntesisBox® is being connected:

- Connecting directly to a Modbus TCP master device: Crossover Ethernet UTP/FTP CAT5 cable.
- Connecting to a hub or switch of the LAN of the building: Straight Ethernet UTP/FTP CAT5 cable.



In case there is no communication with the IntesisBox®, check that the Modbus TCP devices are operative and reachable from the network connection used by IntesisBox®. You can also check that the IntesisBox® Ethernet interface is sending Pings to its IP address using a PC connected to the same Ethernet network.

3.2.3 Connect to PC (LinkBoxMB)

Connect the IntesisBox® device to the PC serial port using the serial cable provided. One end should be connected to the Console EIA232 port of the IntesisBox® device (see **Figure 3.1**) and the other end to the PC serial port.

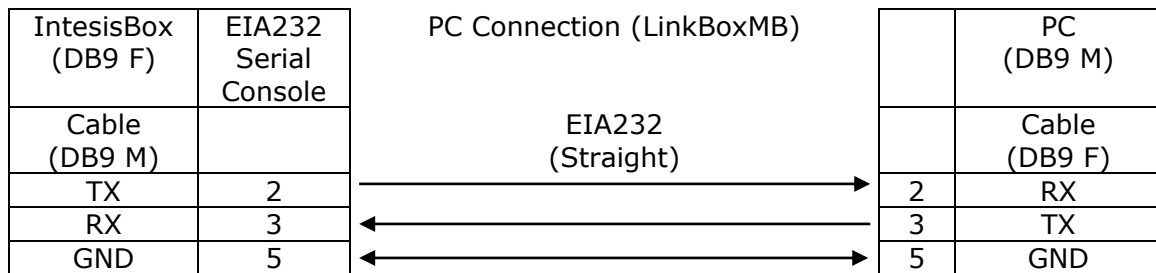


Table 3.6 EIA232 serial connection pin assign

3.3 Power Device

To power up the device, what you need is to plug properly the Power Supply connector to the IntesisBox® device using a proper cable and connecting one end to the power supply connector (see Figure 3.2) and the other end to the power line. After that, just press the power supply On/Off button to turn it on.

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

4.1 Introduction

LinkBoxMB is a Windows® compatible software developed specifically to monitor and configure IntesisBox® Modbus Server series.

The installation procedure and main functions are explained in the *LinkBoxMB User Manual*. This document can be found in the Doc folder, or can be downloaded from the link indicated in the installation sheet supplied with the IntesisBox® device.

In this section, only the specific case of Mitsubishi Heavy Industries indoor unit's integration to Modbus networks will be covered.

4.2 Connections configuration

To configure the IntesisBox®'s connection parameters and to see the points list, press on the **Config** button in the *menu bar* (see Figure 4.1). The *Mitsubishi Heavy Industries Configuration* window will open (see Figure 4.2). For integrations with large number of points, there is available an alternative CSV installation procedure explained in the LinkBoxMB User Manual.

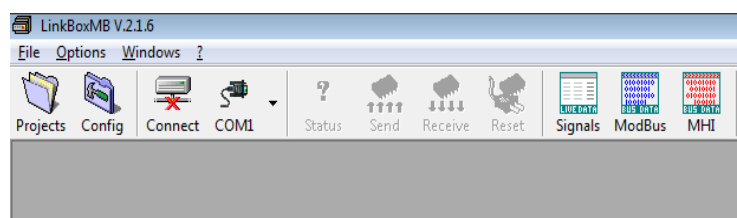


Figure 4.1 LinkBoxMB menu bar

4.2.1 Configuration tab

Select the **Connection** tab to configure the connection parameters. Two subsets of information are shown in this window: Modbus RTU, Modbus TCP and Mitsubishi Heavy Industries interfaces parameters (see Figure 4.2).

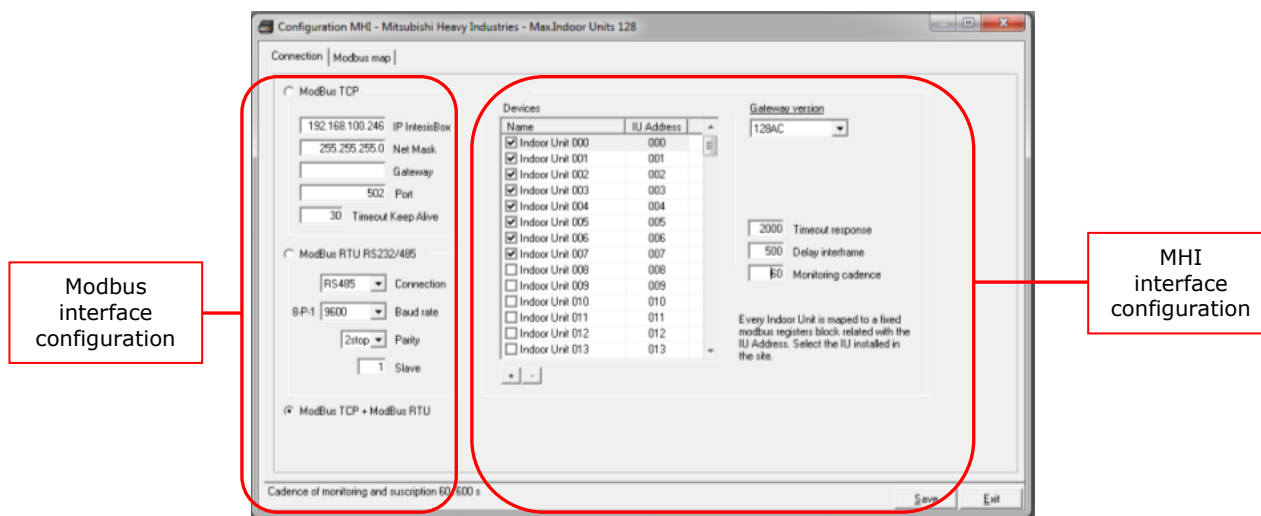


Figure 4.2 LinkBoxMB configuration tab

Next, there is an explanation for each of the configuration parameters in each mode.

- Modbus interface configuration parameters:

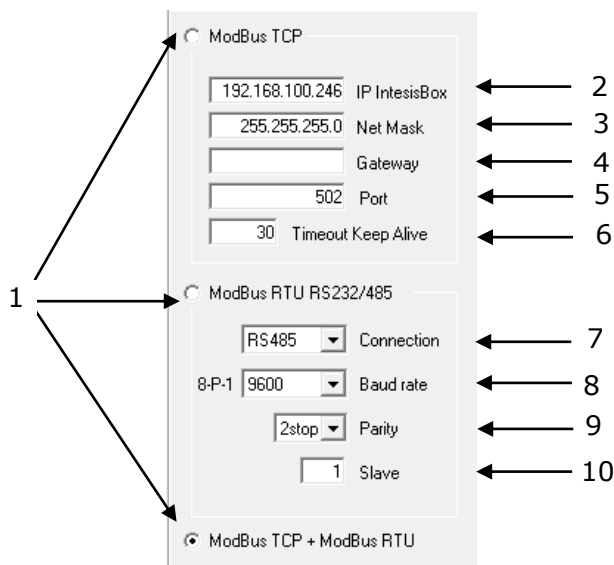


Figure 4.3 Modbus interface configuration

1. Select the type of Modbus communication to use (TCP, RTU or both).

If Modbus TCP is selected, then:

- 2. IP IntesisBox:** Enter the IP address for IntesisBox®.
- 3. Net Mask:** Enter the IP netmask for IntesisBox®.
- 4. Gateway:** Enter the default gateway address for IntesisBox®; leave it blank if no router is needed.
- 5. Port:** Enter the TCP port to use (default for Modbus TCP is 502).
- 6. Timeout Keep Alive:** Enter the time (expressed in seconds) that IntesisBox® will wait, upon no TCP activity, to send a Keep Alive packet. Enter 0 if you don't want IntesisBox® to send any Keep Alive packet (default 30 seconds).

If Modbus RTU is selected, then:

- 7. Connection:** Select the physical media (EIA232 or EIA485)¹.
- 8. Baud rate:** Enter the baud rate of the serial communication.
- 9. Parity:** Enter the byte parity of the serial communication.
- 10. Slave:** Introduce the Slave number for the Modbus interface.

¹ In the LinkboxMB this connection is labeled as RS232 and RS485 respectively.

- Mitsubishi Heavy Industries interface configuration parameters:

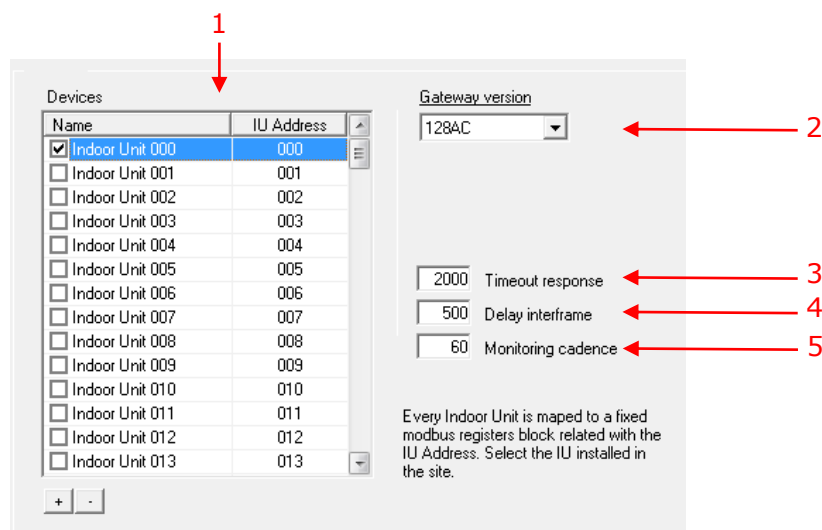


Figure 4.4 Mitsubishi Heavy Industries interface configuration

- 1. Devices:** In this list, you can individually enable each of the 128 indoor units available on the system. The index in the column "Indoor unit" (i.e. the number x in "Indoor Unit xxx") is the reference that will be used later on (in tab "Signals") to refer to this AC indoor unit. You can also change the name of the indoor Unit to facilitate integration tasks.
- 2. Gateway version:** Selection of the *IntesisBox Modbus Server – Mitsubishi Heavy Industries* gateway you are setting up. (128AC for MH-AC-MBS-128, 48AC for MH-AC-MBS-48)
- 3. Timeout response:** Maximum amount of time permitted before activating the Communication Error signal. It is expressed in milliseconds (ms) and ranges can vary from 2000 ms to 10000 ms.
- 4. Delay interframe:** Maximum amount of time permitted between End Of Transmission (EOT) and a new frame. It is expressed in milliseconds (ms) and ranges can vary from 500 ms to 3000 ms.
- 5. Monitoring cadence:** Cadence of monitoring and subscription. It is expressed in seconds (s) and ranges can vary from 60 s to 600 s.

Additional configuration parameters should generally be left to their default value. They only might need to be tuned in some very specific cases (installations with large number of units, scenarios with large bursts of commands sent at once ...)

4.2.2 Modbus map tab

In order to know the Modbus map that is going to be used by the interface, the *Modbus map* tab can be consulted.

Content in this tab is just informative: no information has to be set up.

Address/Formula	R/W	Signal	Values
{ IndoorUnit[0..127] * 20 } + 1	R	Communication status	0-Ok, 1-Error
{ IndoorUnit[0..127] * 20 } + 2	RW	On/Off	0-Off, 1-On
{ IndoorUnit[0..127] * 20 } + 3	RW	Mode	0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry
{ IndoorUnit[0..127] * 20 } + 4	RW	SetPoint	16..30°C
{ IndoorUnit[0..127] * 20 } + 5	RW	Fan speed	0-Lo, 1-Me, 2-Hi, 3-Powerful
{ IndoorUnit[0..127] * 20 } + 6	RW	Remocon Lock	0-Unlock, 1-Lock
{ IndoorUnit[0..127] * 20 } + 7	RW	Louver	0-Swing, 1-Pos, 2-Pos, 3-Pos, 4-Pos
{ IndoorUnit[0..127] * 20 } + 8	R	Room temperature	0..30°C
{ IndoorUnit[0..127] * 20 } + 9	R	Filter Sign status	0-Off, 1-On
{ IndoorUnit[0..127] * 20 } + 10	R	Error Code	0-Not error, 1..99 error code
{ IndoorUnit[0..127] * 20 } + 11	R	Compressor status	0-Off, 1-On
{ IndoorUnit[0..127] * 20 } + 12	W	Filter Sign Reset	1-Reset (Reading always 0)
{ IndoorUnit[0..127] * 20 } + 13	W	Remocon Error reset	1-Reset (Reading always 0)
{ IndoorUnit[0..127] * 20 } + 14	R	Thermo On/Off (Inverter only)	0-Off, 1-On
2995	R	Hw/ Communication Status	0-Ok, 1-Failure
2996	W	On/Off_All	0-Off, 1-On
2997	W	Mode_All	0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry
2998	W	SetPoint_All	16..30°C
2999	W	Fan speed_All	0-Lo, 1-Me, 2-Hi, 3-Powerful
3000	W	Remocon Lock_All	0-Unlock, 1-Lock

Figure 4.5 Modbus signal list

1. **Address Formula:** Formula used by IntesisBox® to define the Modbus address for the point. Use this address (obtained with this formula) to access the point from your Modbus master device.
2. **R/W:** Indicates if the signal is read-only, or if it can be read and written (from the Modbus system point of view).
3. **Signal:** Signal description.
4. **Values:** Possible values for the signal.

See section 2.5 for further detail on address mapping and the possible values on each signal.

4.3 Sending the configuration to IntesisBox®

When the configuration is finished, follow the next steps.

- 1.- Click on **Save** button to save the project to the project folder on your hard disk (more information in LinkBoxMB User Manual).
- 2.- You will be prompted to generate the configuration file to be sent to the gateway.
 - a.- If **Yes** is selected, the binary file (MHI.Lbox) containing the configuration for the gateway will be generated and saved also into the project folder.

b.- If **NO** is selected, remember that the binary file with the project needs to be generated before the IntesisBox® starts to work as expected.

3.- Once in the configuration window again, click on **exit**. Configuration file is ready to be sent to the IntesisBox® device.

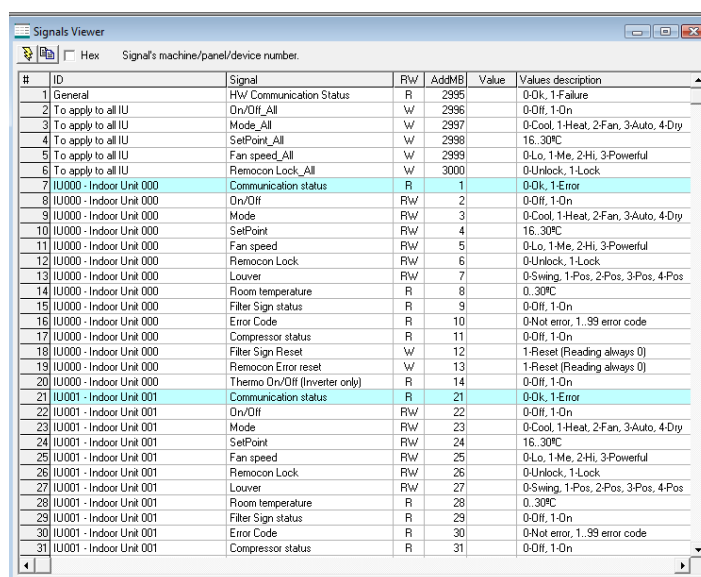
4.- Press the **Send File** button to send the binary file to the IntesisBox® device. The process of file transmission can be monitored in the IntesisBox® Communication Console window. IntesisBox will reboot automatically once the new configuration is loaded.

After any configuration change, do not forget to send the configuration file to the IntesisBox® using button Send File.

4.4 Signals viewer

Once the gateway is running with the correct configuration, to supervise the status of the configured signals, press the **Signals** button on the *menu* bar (see Figure 4.1). The Signals Viewer window will open (see Figure 4.6).

This window shows all signals active within the gateway with its main configuration parameters and its real time value¹ in the **Value** column.



#	ID	Signal	RW	AddrMB	Value	Values description
1	General	HW Communication Status	R	2395		0-Ok, 1-Failure
2	To apply to all IU	On/Off_All	W	2396		0-Off, 1-On
3	To apply to all IU	Mode_All	W	2397		0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry
4	To apply to all IU	SetPoint_All	W	2398		16, 30°C
5	To apply to all IU	Fan speed_All	W	2399		0-Lo, 1-Me, 2-Hi, 3-Powerful
6	To apply to all IU	Remoon Lock_All	W	3000		0-Unlock, 1-Lock
7	IU000 - Indoor Unit 000	Communication status	R	1	1	0-Ok, 1-Error
8	IU000 - Indoor Unit 000	On/Off	R/W	2		0-Off, 1-On
9	IU000 - Indoor Unit 000	Mode	R/W	3		0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry
10	IU000 - Indoor Unit 000	SetPoint	R/W	4		16, 30°C
11	IU000 - Indoor Unit 000	Fan speed	R/W	5		0-Lo, 1-Me, 2-Hi, 3-Powerful
12	IU000 - Indoor Unit 000	Remoon Lock	R/W	6		0-Unlock, 1-Lock
13	IU000 - Indoor Unit 000	Louver	R/W	7		0-Swing, 1-Pos, 2-Pos, 3-Pos, 4-Pos
14	IU000 - Indoor Unit 000	Room temperature	R	8		0, 30°C
15	IU000 - Indoor Unit 000	Filter Sign status	R	9		0-Off, 1-On
16	IU000 - Indoor Unit 000	Error Code	R	10		0-Not error, 1..99 error code
17	IU000 - Indoor Unit 000	Compressor status	R	11		0-Off, 1-On
18	IU000 - Indoor Unit 000	Filter Sign Reset	W	12		1-Reset (Reading always 0)
19	IU000 - Indoor Unit 000	Remoon Error reset	W	13		1-Reset (Reading always 0)
20	IU000 - Indoor Unit 000	Thermo On/Off (Inverter only)	R	14		0-Off, 1-On
21	IU001 - Indoor Unit 001	Communication status	R	21		0-Ok, 1-Error
22	IU001 - Indoor Unit 001	On/Off	R/W	22		0-Off, 1-On
23	IU001 - Indoor Unit 001	Mode	R/W	23		0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry
24	IU001 - Indoor Unit 001	SetPoint	R/W	24		16, 30°C
25	IU001 - Indoor Unit 001	Fan speed	R/W	25		0-Lo, 1-Me, 2-Hi, 3-Powerful
26	IU001 - Indoor Unit 001	Remoon Lock	R/W	26		0-Unlock, 1-Lock
27	IU001 - Indoor Unit 001	Louver	R/W	27		0-Swing, 1-Pos, 2-Pos, 3-Pos, 4-Pos
28	IU001 - Indoor Unit 001	Room temperature	R	28		0, 30°C
29	IU001 - Indoor Unit 001	Filter Sign status	R	29		0-Off, 1-On
30	IU001 - Indoor Unit 001	Error Code	R	30		0-Not error, 1..99 error code
31	IU001 - Indoor Unit 001	Compressor status	R	31		0-Off, 1-On

Figure 4.6 LinkBoxMB Signals Viewer

The signals viewer can be used even though only one system is connected to the IntesisBox®, Modbus or Mitsubishi Heavy Industries AC. Therefore, it becomes convenient for supervision and testing the system.

¹ In case you connect to the IntesisBox® when it's been running for a certain time, you should press the *Refresh* button to get updated values. After pressing *Refresh*, all signal values will keep continuously updated until the connection is closed.

In order to force a specific value to a signal, double-click its row in the table. This will display a dialog in which the desired value can be entered (see Figure 4.7). Changing its value in this way, will make:

- The content of the corresponding Modbus address will be changed to this value.
- If the signal is write-enabled, it will trigger a suitable command to Mitsubishi Heavy Industries AC system.

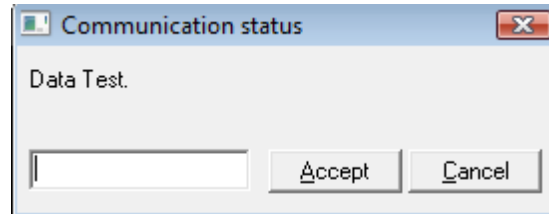


Figure 4.7 **Signal value change window**

4.5 Files

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

PROJECT.INI	INI file containing general information related to the project
MHI.INI	INI file containing information related with the values configured through the "Connection" tab in IntesisBox® configuration
MHI.LBOX	Binary file created from the information in the files described above. This is the file downloaded to the IntesisBox®.

Table 4.1 LinkBoxMB generated files during Project creation

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 the gateway to LinkBoxMB, it can only be downloaded.

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®. If using EIA232 communication, remember to respect the maximum of 15 meters cable distance.

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

- IntesisBox® Modbus Server device with full Mitsubishi Heavy Industries AC compatibility without extra components.
- Standard plug-in power supply 220Vac 50Hz to power IntesisBox® (European plug type).
- Access to LinkBoxMB software download site to configure IntesisBox®.
- Console cable needed to download the configuration to IntesisBox®.
- Product documentation.

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. For your convenience, check external enclosure measures (see 7) before deciding where to place the IntesisBox® device.
3. Connect the communication cable coming from the Modbus master device to the IntesisBox® port. Depending on the type of communication protocol:
 - If EIA232 is used, connect it to C2.
 - If EIA485 is used, connect it to C1.
 - If Ethernet is used, connect it to ETH.

(See 3.2 for more information on connection procedure)

Remember that IntesisBox® can handle up to two simultaneous Modbus master connections.

4. Connect the Superlink network cable to the IntesisBox port marked as AB (see 3.1).
5. Select the appropriate Superlink mode in the SLK selector. If you are using latest Air Conditioner of the Mitsubishi Heavy Industries network select NEW, if not select OLD. Contact your nearest Mitsubishi Heavy Industries supplier in case of doubt.
6. Connect the IntesisBox® device to the power line (see 3.3) and press the On/Off button to turn it on.
7. Connect the communication cable coming from the serial port of your laptop/desktop PC to the IntesisBox® port marked as EIA232 Console (see 3.2.3).
8. Open LinkBoxMB and proceed as explained in section 4.

5.3 Troubleshooting

If IntesisBox® is not working properly or even not working at all, please check the following conditions to be accomplished.

5.3.1 Physical checking

First point to look at to make sure that IntesisBox® is not working properly is to check physical connections:

1.- Make sure that the power plug is correctly connected and current is available in the power line.

2.- Check IntesisBox® LED status:

LED	Status	Explanation	Solution
OP	Off	No power reaching the internal device	Check power connection Check fuse status (see 13 in Figure 3.2)
ERR	Blinking once periodically	Superlink communication failure	Check Superlink cables and terminals (connectors, length of cables, etc.)
HOST	Off	Configuration error	Download the binary file again (see 4.3)
PAC	Off	Communication error in the Superlink network	Check the Mitsubishi Heavy Industries Superlink network and its connections

Table 5.1 IntesisBox® LED status information

5.3.2 Software checking

Once physical connections have been checked, if functioning problems still remain, please use the LinkBoxMB tool to monitor the working status of the device.

- To check the Modbus communication status, click on the **Modbus** button in the *menu bar* (see Figure 4.1).
- To check the MHI communication status, click on the **MHI** button, also in the *menu bar* (see Figure 4.1).
- To check the signal values in the Modbus registers, click on the **Signals** button, also in the *menu bar* (see Figure 4.1).

Further information regarding the monitoring procedure and the information provided in each window can be consulted in the LinkBoxMB Manual.

6. Functional characteristics summary

General	
Max. Number of Mitsubishi Heavy Industries interfaces	Two different versions of IntesisBox® available, supporting a maximum of 128 and 48 indoor units respectively.
Virtual signals	<ul style="list-style-type: none"> One communication error virtual signal per every single Mitsubishi Heavy Industries AC All these virtual signals are available from Modbus.
Modbus interface	
Device type	Slave.
Modbus modes supported	TCP, RTU EIA232 or EIA485.
Modbus TCP configuration parameters	<ul style="list-style-type: none"> IP address. Subnet mask. Default gateway address. TCP port.
Modbus RTU configuration parameters	<ul style="list-style-type: none"> EIA232/EIA485. Baud rate. Parity. Slave number.
Points	
Configuration	AC system related fields. <ul style="list-style-type: none"> Indoor unit main address: Main Address of the indoor each AC indoor unit Modbus memory block relates to.
Supported Modbus function codes	Read functions: <ul style="list-style-type: none"> 3- Read holding registers. 4- Read input registers. Write functions: <ul style="list-style-type: none"> 6- Write single registers. <p><i>If poll records are used to read multiple records, the range of addresses requested must contain valid addresses, otherwise the corresponding Modbus error code will be responded.</i></p>
Modbus data coding	All the point's values are coded in 2 byte registers (even if their possible values are 0 and 1). They are expressed in MSB..LSB format (Big Endian)

7. Mechanical & Electrical characteristics

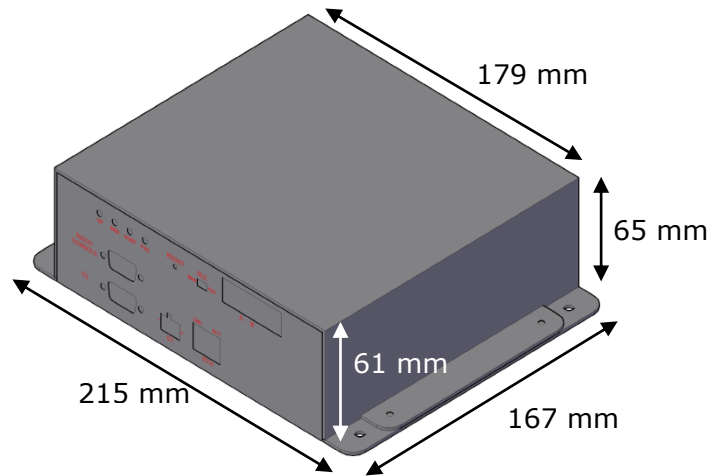


Figure 7.1 External dimensions – Perspective view

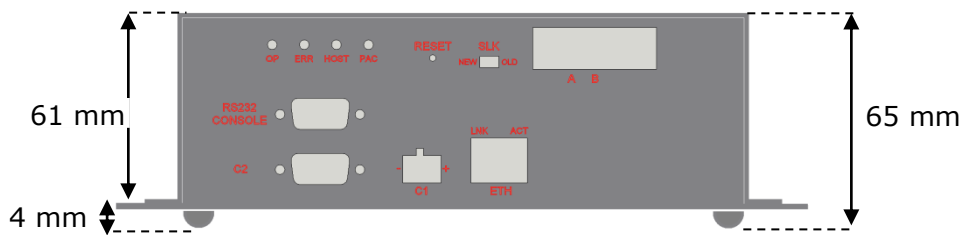


Figure 7.2 External dimensions – Front view

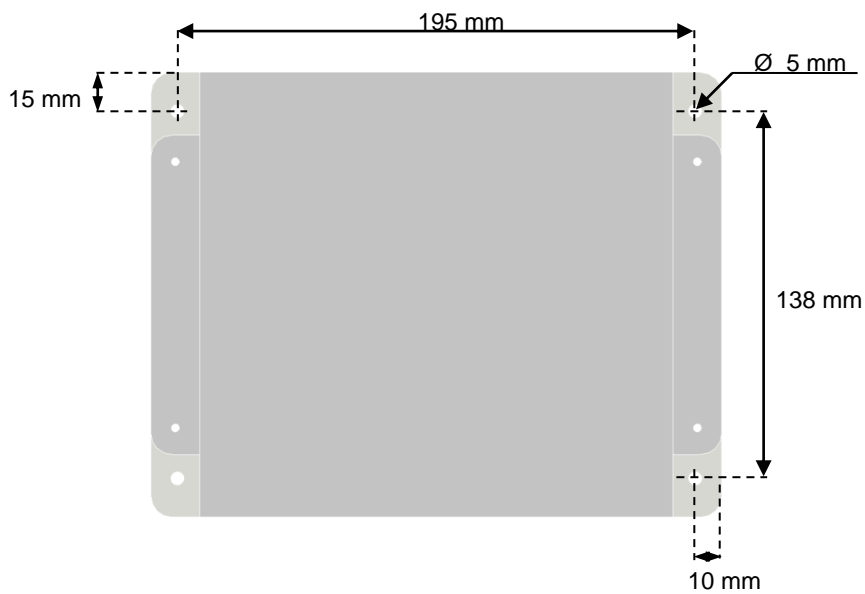


Figure 7.3 Top view¹ (screw holes size)

¹ Device can be installed in any position.

Enclosure	Industrial sheet metal. Size: 215mm x 167mm x 61mm. Weight: 2.025 Kg
Color	Gray metalized.
Power	100 to 240VAC~ 50 to 60Hz 5W max. Power connector: C14 (male) ¹
Fuse	250V 1.5A Dimensions: 20x5mm
Terminal wiring (for low-voltage signals)	Per terminal: solid wires or stranded wires (twisted or with ferrule) 1 core: 0.75 ... 1.25mm ² 2 cores: 0.75 ... 1.25mm ² 3 cores: not permitted
Mounting	Wall (see Figure 7.3)
Modbus TCP port	1 x Ethernet 10Base-T (RJ45).
Modbus RTU ports	1 x Serial EIA232 (DB9 male DTE). SELV 1 x Serial EIA485 (Plug-in screw terminal block 2 poles). SELV
A-B port	1 x Superlink terminals (Plug-in screw terminal block 2 poles "A" "B"). SELV
LED indicators	2 x Ethernet port link and activity (LNK, ACT). 4 x MHI Interface (OP, ERR, HOST, PAC)
Push buttons	1 x Reset Device
Selectors	1 x SLK selector
Console port	EIA232. (DB9 female DCE). SELV
Configuration	Via console port. ²
Firmware	Allows upgrades via console port.
Operational temperature range	0°C to +40°C
Operational humidity range	5% to 95%, non condensing
Protection	IP20 (IEC60529).
RoHS conformity	Compliant with RoHS directive (2002/95/CE).
Norms and standards	CE conformity to EMC directive (2004/108/EC) and Low-voltage directive (2006/95/EC) EN 61000-6-2 EN 61000-6-3 EN 60950-1 EN 50491-3

Table 7.1 IntesisBox® Mechanical and Electrical Characteristics

8. AC Unit Types compatibility

Indoor units compatible with the IntesisBox® Modbus – Server are those included in the Mitsubishi Heavy Industries KX family and so on.

¹ A power cable with connector C14 male 1.6 meters long is supplied with the device.

² Standard cable DB9male-DB9female 1.8 meters long is supplied with the device for connection to a PC COM port for configuring and monitoring the device. The configuration software, compatible with Windows® operating systems, is also supplied.

9. Error codes

This list contains all possible values shown in Modbus registers for "Error Code" for each indoor unit.

Error Code Modbus	Error in Remote Controller	Error Description
0	N/A	No active error
1	E1	Remote controller communication error
2	E2	Duplicated indoor unit address
3	E3	Outdoor unit signal line error
5	E5	Communication error during operation
6	E6	Indoor heat exchanger temperature thermistor anomaly
7	E7	Indoor return air temperature thermistor anomaly
8	E8	Heating overload operation
9	E9	Drain trouble
10	E10	Excessive number of indoor units (more than 17) by controlling one remote controller
12	E12	Address setting error by mixed setting method
14	E14	Communication error between master and slave indoor units
16	E16	Indoor fan motor anomaly
19	E19	Indoor unit operation check, drain motor check setting error
28	E28	Remote controller temperature thermistor anomaly
30	E30	Unmatched connection of indoor and outdoor unit
31	E31	Duplicated outdoor unit address No.
32	E32	Open L3 Phase on power supply at primary side
33	E33	Inverter primary current error
35	E35	Cooling overload operation
36	E36	Discharge pipe temperature error
37	E37	Outdoor heat exchanger temperature thermistor anomaly
38	E38	Outdoor/Ambient air temperature thermistor anomaly
39	E39	Discharge pipe temperature thermistor anomaly
40	E40	High pressure error
41	E41	Power transistor overheat
42	E42	Current cut
43	E43	Excessive number of indoor units connected, excessive total capacity of connection
45	E45	Communication error between inverter PCB and outdoor control PCB
46	E46	Mixed address setting methods coexistent in same network
47	E47	Inverter over-current error
48	E48	Outdoor DC fan motor anomaly
49	E49	Low pressure anomaly
51	E51	Inverter anomaly
53	E53	Suction pipe temperature thermistor anomaly
54	E54	High/Low pressure sensor anomaly
55	E55	Underneath temperature thermistor anomaly
56	E56	Power transistor temperature thermistor anomaly
57	E57	Insufficient in refrigerant amount or detection of service valve closure
58	E58	Anomalous compressor by loss of synchronism
59	E59	Compressor startup failure
60	E60	Rotor position detection failure / Anomalous compressor rotor lock
61	E61	Communication error between the master unit and slave units
63	E63	Emergency stop

Table 9.1 Error codes

In case you detect an error code not listed, contact your nearest MITSUBISHI HEAVY INDUSTRIES technical support service.