

# Modbus Server

## Mitsubishi Heavy Industries Air Conditioning

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

### USER MANUAL

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## Important User Information

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

| ORDER CODE      | LEGACY ORDER CODE |
|-----------------|-------------------|
| INMBSMHI048O000 | MH-AC-MBS-48      |
| INMBSMHI128O000 | MH-AC-MBS-128     |



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## 1. Description

### 1.1 Introduction

*Intesis™ 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 *Intesis™ Modbus Server* acts as a Modbus slave in the Modbus interface, allowing the Modbus master read and write in the Modbus registers. Moreover, *Intesis™* 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 *Intesis™*:

- 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)

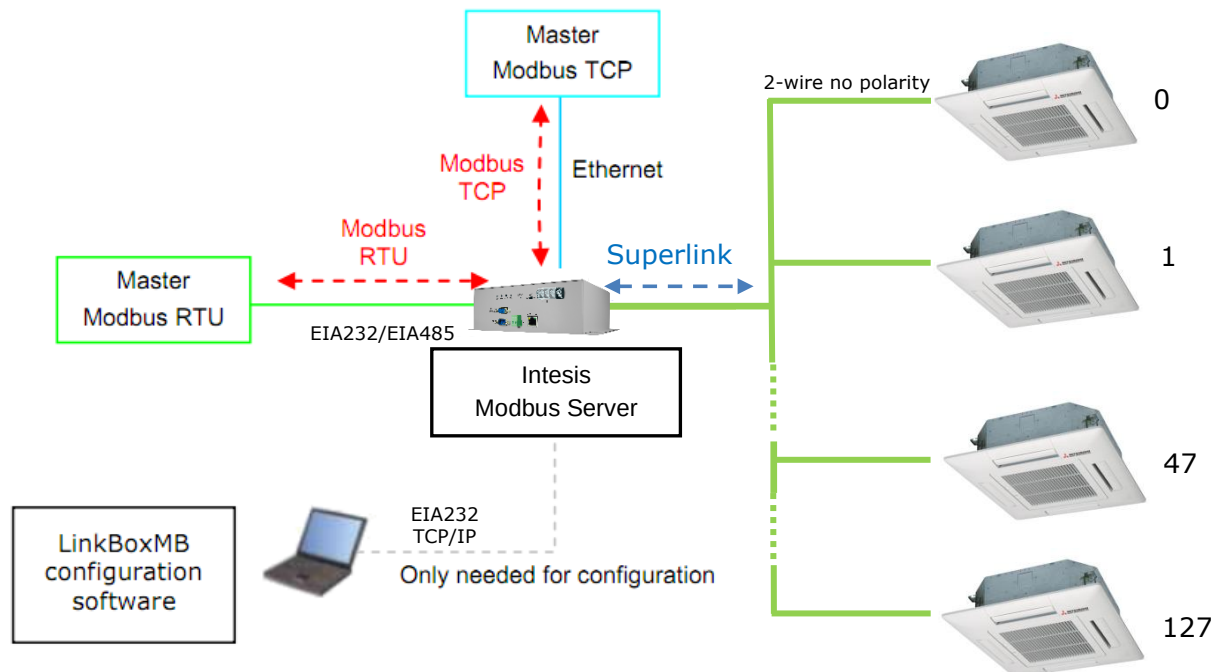
Apart from these, the *Intesis™* also implements some extra signals (functions):

- For **all indoor units<sup>1</sup>** 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)

<sup>1</sup> 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 Intesis™

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

Intesis™ 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 Intesis™ using the LinkBoxMB tool (see 4.2.2).

Intesis™ is capable of managing up to two simultaneous Modbus master connections.

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

## 1.4 Capacity of Intesis™

| 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** Intesis™ capacity

\* There are two different models of *Intesis™ 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:

- INMBSMHI0480000:
  - 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
- INMBSMHI1280000:
  - 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:

| INMBSMHI1280000<br>INKNXMHI1280000 | SC-LGWNA-A<br>SC-BGWNA-A/B<br>etc. | SC-SL3NA-AE/BE<br>etc. | SC-SL2NA-E<br>etc. | SC-SL1N-E<br>etc. | Max<br>Indoor<br>Units | Address<br>No. |
|------------------------------------|------------------------------------|------------------------|--------------------|-------------------|------------------------|----------------|
| 1                                  | Non connect                        | 2<br>1<br>0            | 0<br>0-2<br>0-4    | 0-8               | 128                    | 000-127        |

| INMBSMHI0480000<br>INKNXMHI0480000 | SC-LGWNA-A<br>SC-BGWNA-A/B<br>etc. | SC-SL3NA-AE/BE<br>etc. | SC-SL2NA-E<br>etc. | SC-SL1N-E<br>etc. | Max<br>Indoor<br>Units | Address<br>No. |
|------------------------------------|------------------------------------|------------------------|--------------------|-------------------|------------------------|----------------|
| 1                                  | Non connect                        | 2<br>1<br>0            | 0<br>0-2<br>0-4    | 0-8               | 48                     | 00-47          |

### Previous Superlink connections:

| INMBSMHI---O000<br>INKNXMHI---O000 | SC-LGWNA-A<br>SC-BGWNA-A/B<br>etc. | SC-SL3NA-AE/BE<br>etc. | SC-SL2NA-E<br>etc. | SC-SL1N-E<br>etc. | Max<br>Indoor<br>Units | Address<br>No. |
|------------------------------------|------------------------------------|------------------------|--------------------|-------------------|------------------------|----------------|
| 1                                  | Non connect                        | Non connect            | 1<br>0<br>0        | 0<br>1,2<br>0     | 32<br>48               | 00-47          |

## 2. Modbus interface of Intesis™

### 2.1 Description

Intesis™ 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 (Big 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 Intesis™ 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 Intesis™

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

2.5.2 Modbus addresses related to each Indoor Unit<sup>1</sup>

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

<sup>1</sup> Supported number of indoor units varies according to Intesis™ model<sup>2</sup> During transition between positions, **Swing** signal will turn on indicating the Louver is moving<sup>3</sup> See list of indoor unit error codes and their meaning in section 9

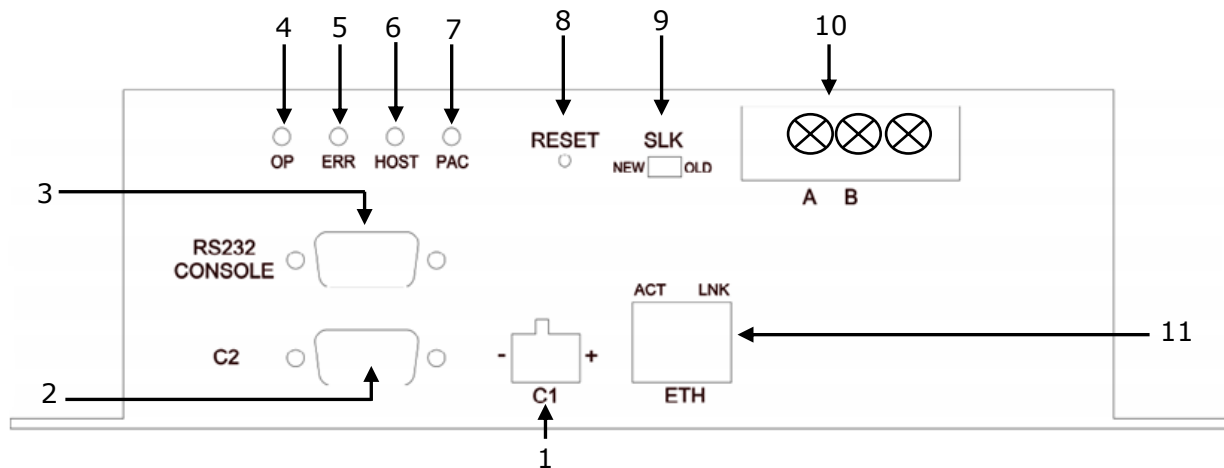
|                                                                        |                 | (R/W) |                                    |
|------------------------------------------------------------------------|-----------------|-------|------------------------------------|
| ...                                                                    | ...             | ...   | ...                                |
| 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<br>(max number of supported indoor units depends on Intesis 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.

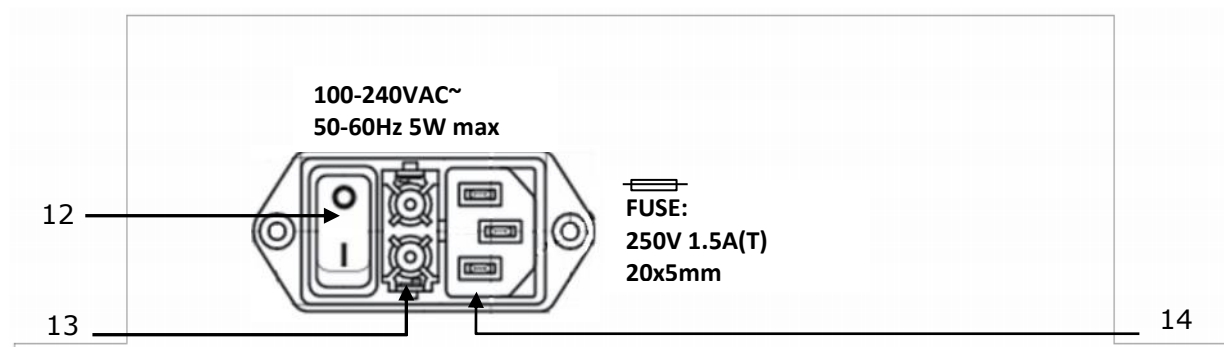
### 2.5.3 Modbus addresses related to ALL indoor units

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

### 3. Intesis™ Device Connections



**Figure 3.1** Intesis™ device front view



**Figure 3.2** Intesis™ 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)<br>New: Superlink-II<br>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 Intesis™ device in order to connect the Mitsubishi Heavy Industries network (Superlink) to the Intesis™. 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

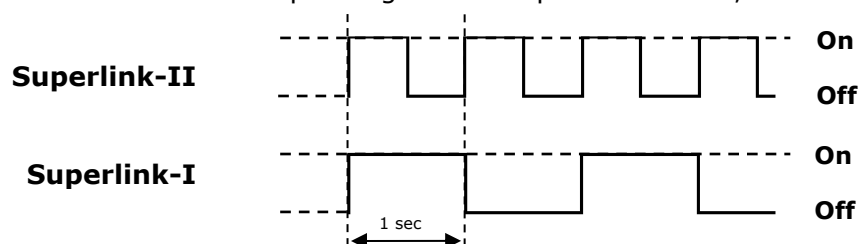
Select the appropriate Superlink mode in the SLK selector. If you are using latest Air Conditioner of the Mitsubishi Heavy Industries network (New Superlink) select NEW, if not select OLD.

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

| LED  | Status   | Intesis™ 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** Intesis™ 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.

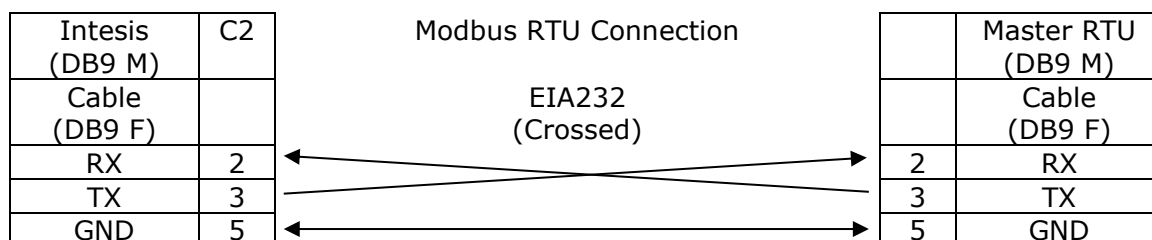
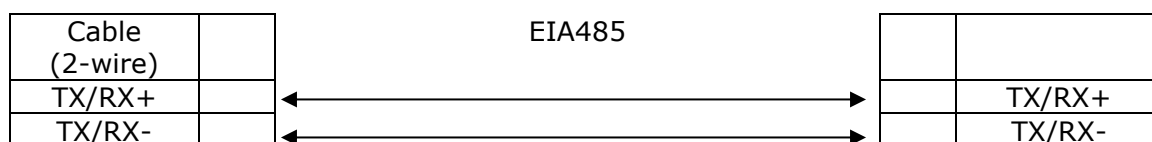
For further information about the Superlink network, look up the Mitsubishi Heavy Industries Manual or contact your nearest Mitsubishi Heavy Industries supplier.

### 3.2 Connect to Modbus Interface

#### 3.2.1 Connect to Modbus RTU

Connect the communication cable coming from the Modbus RTU network to Intesis™ 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 Intesis™ 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.

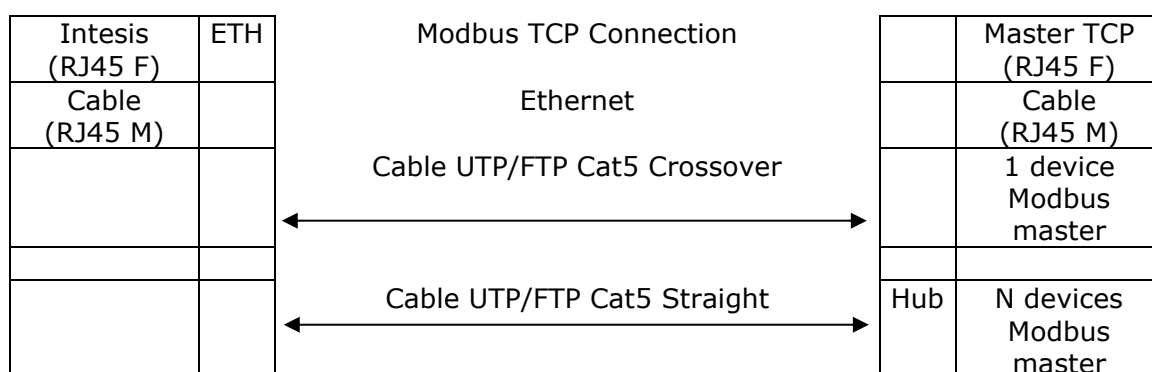
**Table 3.3** EIA232 cable pin assign**Table 3.4** EIA485 cable pin assign

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 Intesis™ device (see **Figure 3.1**). The cable to be used may vary depending on where the Intesis™ is being connected:

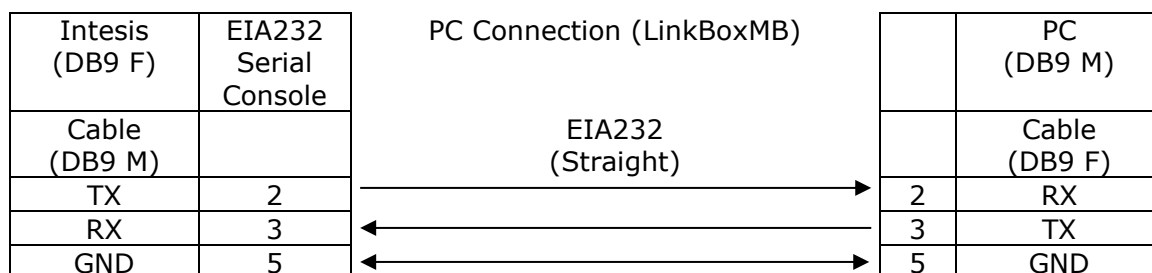
- Connecting directly to a Modbus TCP master device: Crossover Ethernet UTP/FTP CAT5 cable.
- Connecting to a hub or switch of the LAN of the building: Straight Ethernet UTP/FTP CAT5 cable.

**Table 3.5** TCP cable connection

In case there is no communication with the Intesis™, check that the Modbus TCP devices are operative and reachable from the network connection used by Intesis™. You can also check that the Intesis™ 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 Intesis™ device to the PC serial port using the serial cable provided. One end should be connected to the Console EIA232 port of the Intesis™ 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 Intesis™ 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 Intesis™ Modbus Server series

### 4.1 Introduction

LinkBoxMB is a Windows® compatible software developed specifically to monitor and configure Intesis™ 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 Intesis™ 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 Intesis™'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.

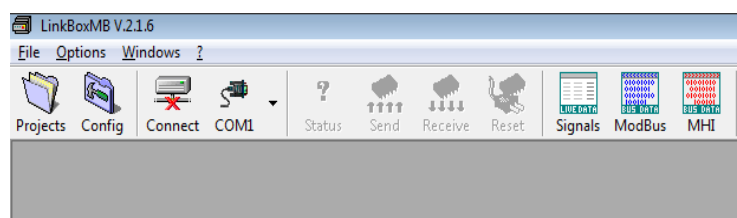


Figure 4.1 LinkBoxMB menu bar

#### 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).

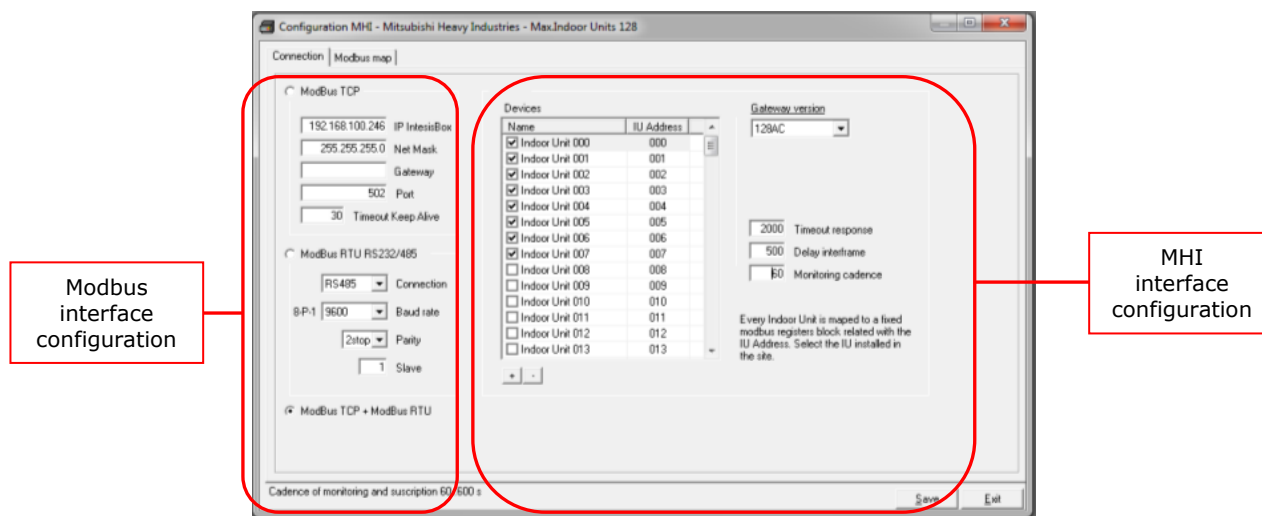


Figure 4.2 LinkBoxMB configuration tab

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

- Modbus interface configuration parameters:

The screenshot shows a configuration window for Modbus communication. It has three radio buttons at the top: 'ModBus TCP', 'ModBus RTU RS232/485', and 'ModBus TCP + ModBus RTU'. The 'ModBus TCP' option is selected. Below these are several input fields. To the right of the window, numbers 2 through 10 are listed with arrows pointing to specific fields. A large number '1' is on the left with three arrows pointing to the three radio buttons.

| Field              | Value           | Label              | Number |
|--------------------|-----------------|--------------------|--------|
| IP IntesisBox      | 192.168.100.246 | IP IntesisBox      | 2      |
| Net Mask           | 255.255.255.0   | Net Mask           | 3      |
| Gateway            |                 | Gateway            | 4      |
| Port               | 502             | Port               | 5      |
| Timeout Keep Alive | 30              | Timeout Keep Alive | 6      |
| Connection         | RS485           | Connection         | 7      |
| Baud rate          | 9600            | Baud rate          | 8      |
| Parity             | 2stop           | Parity             | 9      |
| Slave              | 1               | Slave              | 10     |

**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 Intesis:** Enter the IP address for Intesis™.

**3. Net Mask:** Enter the IP netmask for Intesis™.

**4. Gateway:** Enter the default gateway address for Intesis™; 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 Intesis™ will wait, upon no TCP activity, to send a Keep Alive packet. Enter 0 if you don't want Intesis™ to send any Keep Alive packet (default 30 seconds).

If Modbus RTU is selected, then:

**7. Connection:** Select the physical media (EIA232 or EIA485)<sup>1</sup>.

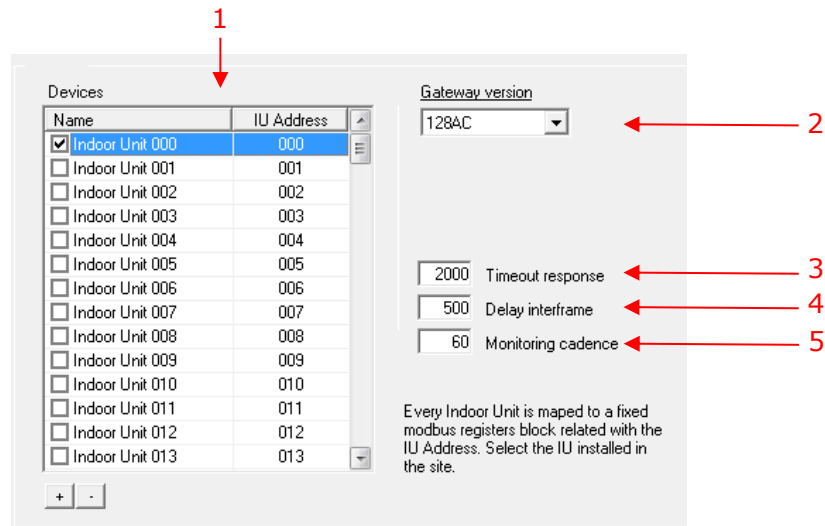
**8. Baud rate:** Enter the baud rate of the serial communication.

**9. Parity:** Enter the byte parity of the serial communication.

**10. Slave:** Introduce the Slave number for the Modbus interface.

- Mitsubishi Heavy Industries interface configuration parameters:

<sup>1</sup> In the LinkboxMB this connection is labeled as RS232 and RS485 respectively.



**Figure 4.4** Mitsubishi Heavy Industries interface configuration

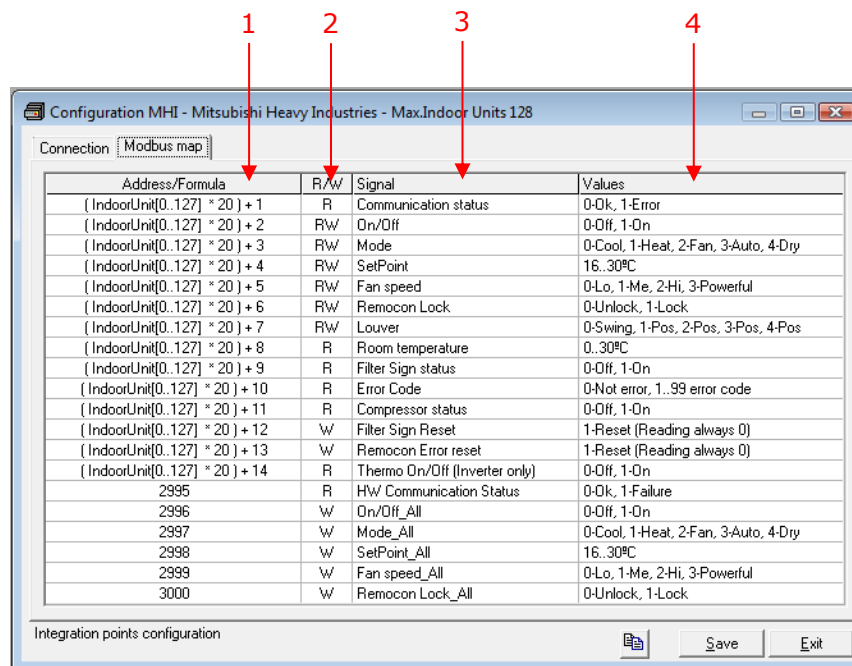
- 1. Devices:** In this list, you can individually enable each of the 128 indoor units available on the system. The index in the column "Indoor unit" (i.e. the number x in "Indoor Unit xxx") is the reference that will be used later on (in tab "Signals") to refer to this AC indoor unit. You can also change the name of the indoor Unit to facilitate integration tasks.
- 2. Gateway version:** Selection of the *Intesis Modbus Server – Mitsubishi Heavy Industries* gateway you are setting up. (128AC for INMBSMHI128O000, 48AC for INMBSMHI048O000)
- 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  | R/W | On/Off                        | 0-Off, 1-On                          |
| ( IndoorUnit[0..127] * 20 ) + 3  | R/W | Mode                          | 0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry |
| ( IndoorUnit[0..127] * 20 ) + 4  | R/W | SetPoint                      | 16..30°C                             |
| ( IndoorUnit[0..127] * 20 ) + 5  | R/W | Fan speed                     | 0-Lo, 1-Me, 2-Hi, 3-Powerful         |
| ( IndoorUnit[0..127] * 20 ) + 6  | R/W | Remocon Lock                  | 0-Unlock, 1-Lock                     |
| ( IndoorUnit[0..127] * 20 ) + 7  | R/W | 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 Intesis™ 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 Intesis™

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 Intesis™ starts to work as expected.
- 3.- Once in the configuration window again, click on **exit**. Configuration file is ready to be sent to the Intesis™ device.

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

**After any configuration change, do not forget to send the configuration file to the Intesis™ 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 value<sup>1</sup> in the **Value** column.

| #  | ID                      | Signal                        | R/W | AddrMB | Value | Values description                   |
|----|-------------------------|-------------------------------|-----|--------|-------|--------------------------------------|
| 1  | General                 | HW Communication Status       | R   | 2355   |       | 0-Ok, 1-Failure                      |
| 2  | To apply to all IU      | On/Off_All                    | W   | 2356   |       | 0-Off, 1-On                          |
| 3  | To apply to all IU      | Mode_All                      | W   | 2357   |       | 0-Cool, 1-Heat, 2-Fan, 3-Auto, 4-Dry |
| 4  | To apply to all IU      | SelfPoint_All                 | W   | 2358   |       | 16, 30°C                             |
| 5  | To apply to all IU      | Fan speed_All                 | W   | 2359   |       | 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      |       | 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 | SelfPoint                     | 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 | SelfPoint                     | 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                          |

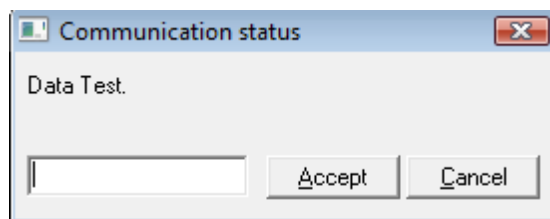
**Figure 4.6** LinkBoxMB Signals Viewer

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

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.

<sup>1</sup> In case you connect to the Intesis™ 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.

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 Intesis™ configuration |
| MHI.LBOX    | Binary file created from the information in the files described above. This is the file downloaded to the Intesis™.       |

**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 Intesis™. 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 HMS Networks for this standard integration. Items supplied by HMS Networks for this integration are:

- Intesis™ Modbus Server device with full Mitsubishi Heavy Industries AC compatibility without extra components.
- Standard plug-in power supply 220Vac 50Hz to power Intesis™ (European plug type).
- Access to LinkBoxMB software download site to configure Intesis™.
- Console cable needed to download the configuration to Intesis™.
- 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 Intesis™ in the desired installation site. For your convenience, check external enclosure measures (see 7) before deciding where to place the Intesis™ device.
3. Connect the communication cable coming from the Modbus master device to the Intesis™ 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 Intesis™ can handle up to two simultaneous Modbus master connections.

4. Connect the Superlink network cable to the Intesis 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 Intesis™ 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 Intesis™ port marked as EIA232 Console (see 3.2.3).
8. Open LinkBoxMB and proceed as explained in section 4.



## 5.3 Troubleshooting

If Intesis™ 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 Intesis™ 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 Intesis™ LED status:

| LED  | Status                      | Explanation                                  | Solution                                                                    |
|------|-----------------------------|----------------------------------------------|-----------------------------------------------------------------------------|
| OP   | Off                         | No power reaching the internal device        | Check power connection<br>Check fuse status (see 13 in Figure 3.2)          |
| ERR  | Blinking once perdioidicaly | 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** Intesis™ 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).

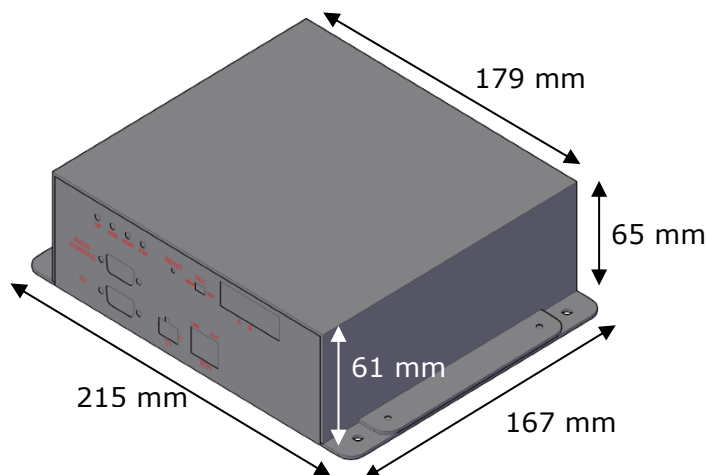
Further information regarding the monitoring procedure and the information provided in each window can be consulted in the LinkBoxMB Manual.

## 6. Functional characteristics summary

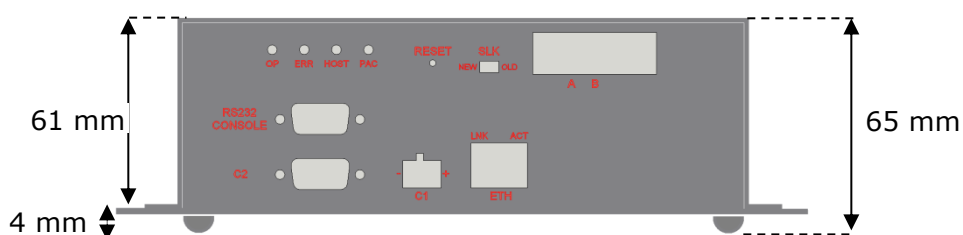
|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Max. Number of Mitsubishi Heavy Industries interfaces | Two different versions of Intesis™ available, supporting a maximum of 128 and 48 indoor units respectively.                                                                                                                                                                                                                                                                                                                                 |
| Virtual signals                                       | <ul style="list-style-type: none"> <li>One communication error virtual signal per every single Mitsubishi Heavy Industries AC</li> </ul> <p>All these virtual signals are available from Modbus.</p>                                                                                                                                                                                                                                        |
| <b>Modbus interface</b>                               |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Device type                                           | Slave.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Modbus modes supported                                | TCP, RTU EIA232 or EIA485.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Modbus TCP configuration parameters                   | <ul style="list-style-type: none"> <li>IP address.</li> <li>Subnet mask.</li> <li>Default gateway address.</li> <li>TCP port.</li> </ul>                                                                                                                                                                                                                                                                                                    |
| Modbus RTU configuration parameters                   | <ul style="list-style-type: none"> <li>EIA232/EIA485.</li> <li>Baud rate.</li> <li>Parity.</li> <li>Slave number.</li> </ul>                                                                                                                                                                                                                                                                                                                |
| <b>Points</b>                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Configuration                                         | <p>AC system related fields.</p> <ul style="list-style-type: none"> <li>Indoor unit main address: Main Address of the indoor each AC indoor unit Modbus memory block relates to.</li> </ul>                                                                                                                                                                                                                                                 |
| Supported Modbus function codes                       | <p>Read functions:</p> <ul style="list-style-type: none"> <li>3- Read holding registers.</li> <li>4- Read input registers.</li> </ul> <p>Write functions:</p> <ul style="list-style-type: none"> <li>6- Write single registers.</li> </ul> <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)                                                                                                                                                                                                                                                                                        |



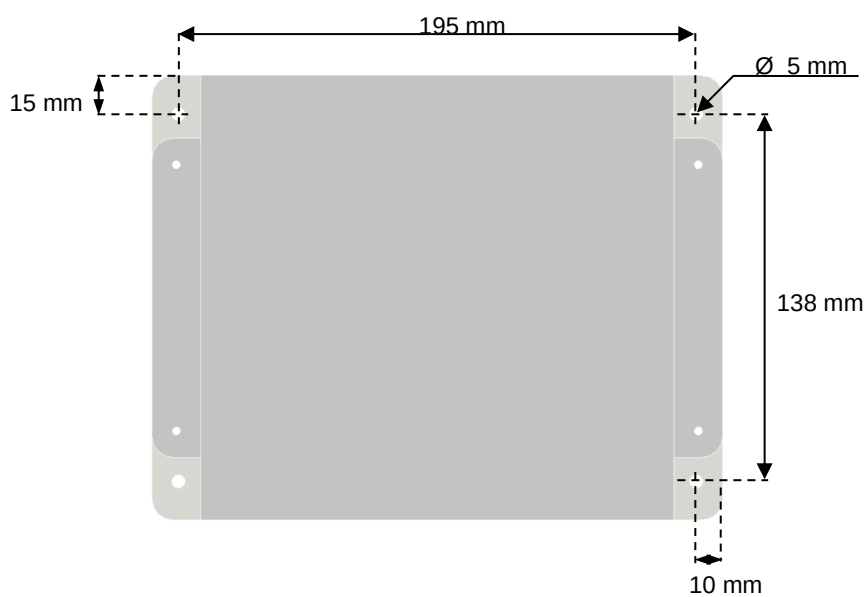
## 7. Mechanical & Electrical characteristics



**Figure 7.1** External dimensions – Perspective view



**Figure 7.2** External dimensions – Front view



**Figure 7.3** Top view<sup>1</sup> (screw holes size)

<sup>1</sup> Device can be installed in any position.

|                                              |                                                                                                                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enclosure                                    | Industrial sheet metal.<br>Size: 215mm x 167mm x 61mm.<br>Weight: 2.025 Kg                                                                                                       |
| Color                                        | Gray metalized.                                                                                                                                                                  |
| Power                                        | 100 to 240VAC~<br>50 to 60Hz<br>5W max.<br>Power connector: C14 (male) <sup>1</sup>                                                                                              |
| Fuse                                         | 250V<br>1.5A<br>Dimensions: 20x5mm                                                                                                                                               |
| Terminal wiring<br>(for low-voltage signals) | Per terminal: solid wires or stranded wires (twisted or with ferrule)<br>1 core: 0.75 ... 1.25mm <sup>2</sup><br>2 cores: 0.75 ... 1.25mm <sup>2</sup><br>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<br>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).<br>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. <sup>2</sup>                                                                                                                                                   |
| 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)<br>EN 61000-6-2<br>EN 61000-6-3<br>EN 60950-1<br>EN 50491-3                                  |

**Table 7.1** Intesis™ Mechanical and Electrical Characteristics

## 8. AC Unit Types compatibility

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

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

<sup>2</sup> 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.