# IntesisBox®

## MH-RC-MBS-1 v.0.11

MODBUS RTU (RS-485) Interface for MITSUBISHI HEAVY INDUSTRIES air conditioners.

User's Manual

Issue Date: 12/2015
r5

Order Code: **MH-RC-MBS-1**

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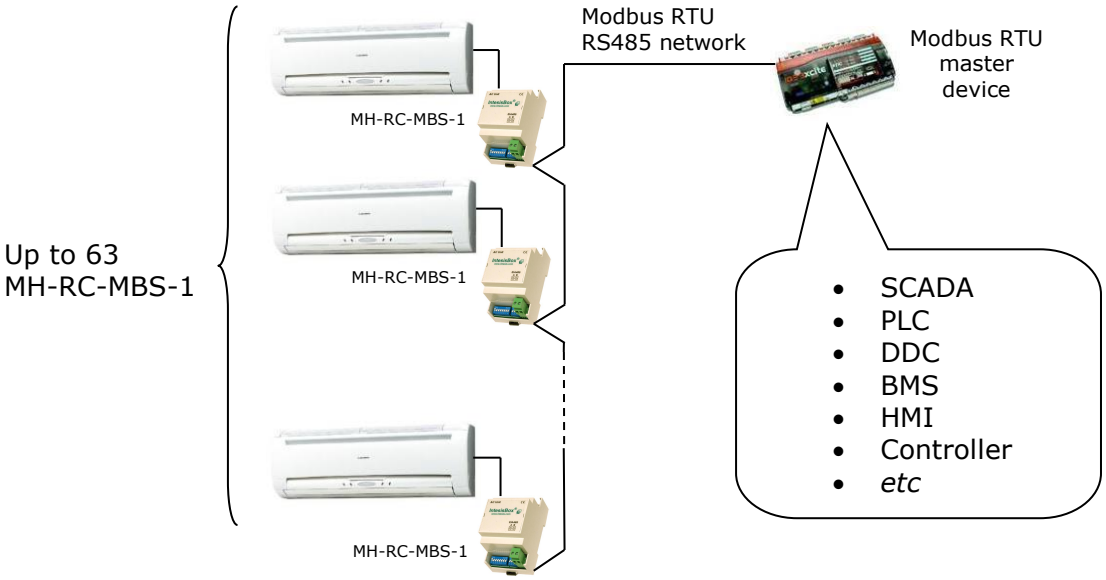
# 1. Presentation


The MH-RC-MBS-1 interface allows a complete and natural integration of ***MITSUBISHI HEAVY INDUSTRIES*** air conditioners into Modbus RTU (RS-485) networks.

Compatible with optional part SC-BIKN-E (more information in section 5).

- Reduced dimensions. 93 x 53 x 58 mm.
- Quick and easy installation.
  *Mountable on DIN rail, wall, or even inside the indoor unit in some models of AC.*
- External power not required.
- Direct connection to MODBUS RTU (RS-485) networks. Up to 63 MH-RC-MBS-1 devices can be connected in the same network.
  *MH-RC-MBS-1 is a Modbus slave device.*
- Direct connection to the AC indoor units. Up to 16 AC indoor units can be connected to MH-RC-MBS-1, controlling them as one (not individually).
- Configuration from both on-board DIP-switches and MODBUS RTU.
- Total Control and Supervision.
- Real states of the AC unit's internal variables.
- Allows using simultaneously the IR and wired remote controls and MODBUS RTU.



# 2. Connection

## 2.1 Connection of the interface to the AC indoor unit

The MH-RC-MBS-1 connects directly to the MITSUBISHI HEAVY INDUSTRIES two wire X/Y bus. Depending on which controllers are available the recommended connection methods are the following (details in Figure 2.1):

- **Wired remote control available**. Connect the gateway as Slave in parallel with the wired remote controllers (Wall controller acts as master).
- **Infrared remote control available**. Connect the gateway as Master in parallel with the infrared remote controller (Infrared receiver) as Slave.
- **No remote control available** Connect the gateway directly to the X/Y bus of the indoor unit as Master when there is no MITSUBISHI HEAVY INDUSTRIES remote controller.

Disconnect mains power from the AC unit and use a 2 wire cable with a diameter of 2mm$^2$ for the connection of MH-RC-MBS-1, MITSUBISHI HEAVY INDUSTRIES remote controller and its corresponding indoor unit. Screw the suitably peeled cable ends in the corresponding X/Y terminals of each device, as summarized in Figure 2.1.

Maximum X/Y bus length is 600 meters, cable has no polarity.

## 2.2 Connection of the interface to Modbus

Use the EIA485 connector in the MH-RC-MBS-1 to connect to the Modbus network.

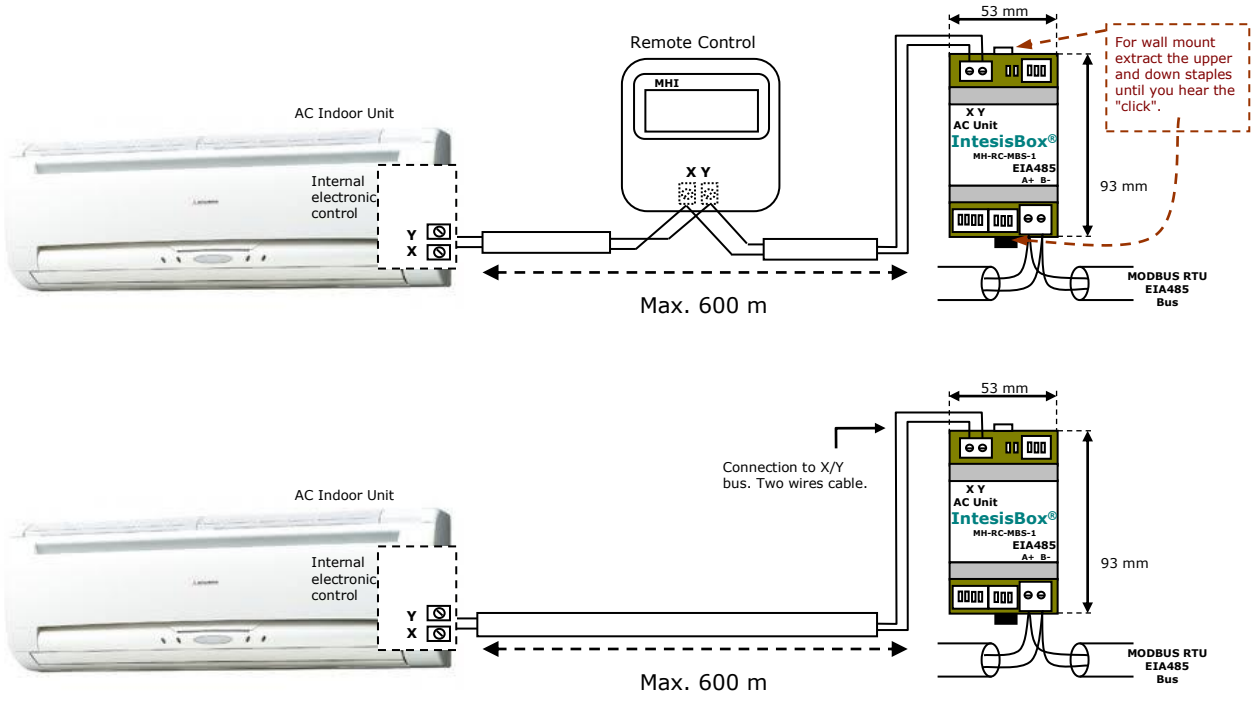



**Figure 2.1** MH-RC-MBS-1 Connection diagrams

## 2.3 Power-up

After the MH-RC-MBS-1 is properly connected, AC unit's main power can be connected again.

Then it will start an initialization process which can take around 2 minutes before the normal operation starts.

During this process, the master of the X/Y bus will show an indication of the initialization. In case that the MH-RC-MBS-1 is configured as master, the Modbus register "error code" will be set to 65532 (see section 6). This error will be reset once the initialization is finished.

While the initialization is ongoing, some Modbus registers will indicate an undetermined value (see section 3.2). Once the normal operation starts, they will acquire its corresponding value.

It is important to bear in mind that changes made during the initialization process will not have effect until it finishes.

# 3. Modbus Interface Specification

## 3.1 Modbus physical layer

MH-RC-MBS-1 implements a MODBUS RTU (slave) interface, to be connected to an RS-485 line. It performs 8N2 (8N1-compatible) communication (8 data bits, no parity and 2 stop bit) with several available baudrates (2400 bps, 4800, 9600 bps -default- and 19200 bps).

## 3.2 Modbus Registers

All registers are of type "16-bit unsigned register", in standard Modbus' big endian notation. The registers are accessible as "Holding registers" or "Inputs registers".

### 3.2.1 Control and status registers

<table>
<tr><th>Register Addr (protocol address)</th><th>Register Addr (PLC address)</th><th>R/W</th><th>Description</th></tr>
<tr><td>0</td><td>1</td><td>R/W</td><td>AC unit On/Off<br>▪ 0: Off<br>▪ 1: On</td></tr>
<tr><td>1</td><td>2</td><td>R/W</td><td>AC unit Mode<br>▪ 0: Auto<br>▪ 1: Heat<br>▪ 2: Dry<br>▪ 3: Fan<br>▪ 4: Cool</td></tr>
<tr><td>2</td><td>3</td><td>R/W</td><td>AC unit Fan Speed[1]
<table>
<tr><th></th><th colspan="4">Num. of Fan Speeds</th></tr>
<tr><th>Val.</th><th>4 (default)</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td>0</td><td colspan="4">Undetermined</td></tr>
<tr><td>1</td><td>Low</td><td>Low</td><td>Low</td><td>High</td></tr>
<tr><td>2</td><td>Mid</td><td>Mid</td><td>High</td><td>-</td></tr>
<tr><td>3</td><td>High</td><td>High</td><td>-</td><td>-</td></tr>
<tr><td>4</td><td>Powerful</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>3</td><td>4</td><td>R/W</td><td>AC unit Vane Position[1]<br>▪ 0: Undetermined<br>▪ 1…4: Pos. 1 … Pos. 4<br>▪ 10: Swing</td></tr>
<tr><td>4</td><td>5</td><td>R/W</td><td>AC unit Temperature Setpoint[2]<br>▪ 16..30 (ºC) (0 = undetermined)<br>▪ 61..86 (ºF) (0 = undetermined)</td></tr>
<tr><td>5</td><td>6</td><td>R</td><td>AC unit Ambient Temperature[2]</td></tr>
<tr><td>6</td><td>7</td><td>R/W</td><td>Window Contact[3]<br>▪ 0: Closed<br>▪ 1: Open</td></tr>
<tr><td>7</td><td>8</td><td>R/W</td><td>Device Disablement[3,4]<br>▪ 0: MH-RC-MBS-1 enabled<br>▪ 1: MH-RC-MBS-1 disabled</td></tr>
</table>

[1] Configurable according to Table 3.1

[2] Magnitude for this register can be adjusted through DIP switch (Check table 3.4). Usually range temperature runs from 18º to 30º Celsius degrees. It is only working from 16ºC to 30ºC when indoor unit is on Heat mode.

| Register Addr (protocol address) | Register Addr (PLC address) | R/W | Description |
|---|---|---|---|
| 8 | 9 | R/W | Remote Controller Disablement[3,4]<br>▪ 0: Remote Controller enabled<br>▪ 1: Remote Controller disabled |
| 9 | 10 | R/W | AC unit Operation Time[4]<br>▪ 0..65535 (hours). Counts the time the AC unit is in "On" state. |
| 10 | 11 | R | AC unit Alarm Status<br>▪ 0: No alarm condition<br>▪ 1: Alarm condition |
| 11 | 12 | R | Error Code<br>Information in section 6 |
| 22 | 23 | R/W | External Sensor Temperature[3]<br>Can be ºC or ºF, x1 or x10<br>0x8000 (32768d) means "no input sensor" |
| 23 | 24 | R | AC setpoint temperature<br>▪ This register will show the actual temp setpoint in the indoor unit.<br>▪ When mechanism for "virtual temperature" (see section 3.5.2) is not being applied, this register will show same value as register 5. |
| 43 | 44 | W | Filter reset<br>▪ 1: Filter reset |
| 44 | 45 | R | Filter status<br>▪ 0: OK<br>▪ 1: Filter cleaning |
| 45 | 46 | W | Error reset<br>▪ 1: Error reset |
| 46 | 47 | R | Center/Remote[3]<br>▪ 0: Remote unlock (Center/Remote)<br>▪ 1: Remote lock On/Off (Center/Remote)<br>▪ 2: Remote lock All (Center/Remote)<br>▪ 3: Remote (Remote) |
| 60 | 61 | R | Outdoor Unit Ambient Temperature[5]<br>▪ This register will show the actual ambient temperature measured by the outdoor unit.<br>▪ Can be ºC or ºF, x1 or x10 |

[3] See explanation of this functionality in section 3.5
[4] This value is stored in non-volatile memory
[5] This register is only available on firmware versions 0.11 and onwards. Current firmware version can be checked on register 50 (Protocol addressing

### 3.2.2 Configuration Registers

| Register Addr (protocol address) | Register Addr (PLC address) | R/W | Description |
|---|---|---|---|
| 13 | 14 | R/W | "Open Window" switch-off timeout[4,6]<br>▪ 0..30 (minutes)<br>▪ Factory setting: 30 (minutes) |
| 14 | 15 | R | Modbus RTU baudrate (bps)[7]<br>▪ 2400<br>▪ 4800<br>▪ 9600<br>▪ 19200 |

[6] Once window contact is open, a count-down to switch off the AC Unit will start from this configured value
[7] Configurable through S3 (See Table 3.3 and Table 3.2)

| Register Addr (protocol address) | Register Addr (PLC address) | R/W | Description |
|---|---|---|---|
| 15 | 16 | R | Device's Modbus slave address[7]<br>▪ 1..63 |
| 21 | 22 | R | Max number of fan speeds[1]<br>▪ 1..4: must be configured according to the number of fan speeds supported by the AC unit |
| 49 | 50 | R | Device Identification<br>MH-RC-MBS-1: 0x0F00 |
| 50 | 51 | R | Software version |

### 3.2.3 Considerations on MH-RC-MBS-1 temperature registers

MH-RC-MBS-1 implements three registers containing temperature values:

- **AC unit Temperature Setpoint (R/W)** (register 5 – in PLC addressing): This is the adjustable temperature setpoint meant to be required by the user. This register can be read (Modbus function 3 or 4) or written (Modbus functions 5 or 16). A remote controller connected to the X/Y bus of the MHI indoor unit will report the same temperature setpoint value as this register – except in those cases where MH-RC-MBS-1 is set as "Slave" and a value is provided in External Sensor Temperature register (see register 23 below and description for Virtual Temperature procedure in 3.5.2)

- **AC unit Ambient Temperature (R)** (register 6 – in PLC addressing): This register shows the temperature reported by the sensor placed in the return path temperature of the MHI indoor unit. If the master of the X/Y bus (either the remote controller or MH-RC-MBS-1) is configured in order to send an ambient temperature to the indoor unit, the indoor unit will use this value instead of its own and it will become the value shown in this register. It is a read-only register (Modbus functions 3 or 4).

- **AC unit External Sensor Temperature (R/W)** (register 23 – in PLC addressing): This register allows providing an external temperature reference from Modbus side. Depending on the role of MH-RC-MBS-1, a different behavior will be performed:

  a) Master: if an external temperature is provided through this register, indoor unit will use it as reference for its temperature control loop.

     - Register value after MH-RC-MBS-1 startup is -32768, which means that no temperature reference is provided to the AC indoor unit. In that case, AC indoor unit will use its own return path temperature sensor as reference for its control loop.

  b) Slave: MH-RC-MBS-1 will use its own temperature control loop in order to control the indoor unit through the Temperature Setpoint register; this procedure is called Virtual Temperature. See description in section 3.5.2.

     - Register value after MH-RC-MBS-1 startup is -32768, which means that no temperature reference is provided from Modbus side. In that case, AC indoor unit will use either its return path temperature or the temperature sent by the master of X/Y bus as reference for its control loop.

Additionally, note that temperature values all these three registers are expressed according to the temperature format configured through its onboard DIP-Switches (See "3.3 DIP-switch Configuration Interface"). Following formats are possible:

- Celsius value: Value in Modbus register is the temperature value in Celsius (i.e. a value "22" in the Modbus register must be interpreted as 22ºC)
- Decicelsius value: Value in Modbus register is the temperature value in decicelsius (i.e. a value "220" in the Modbus register must be interpreted as 22.0ºC)
- Fahrenheit value: Value in Modbus register is the temperature value in Fahrenheit (i.e. a value "72" in the Modbus register must be interpreted as 72ºF (~22ºC).

## 3.3 DIP-switch Configuration Interface

In this section the values of the configuration switches and their meaning are specified:

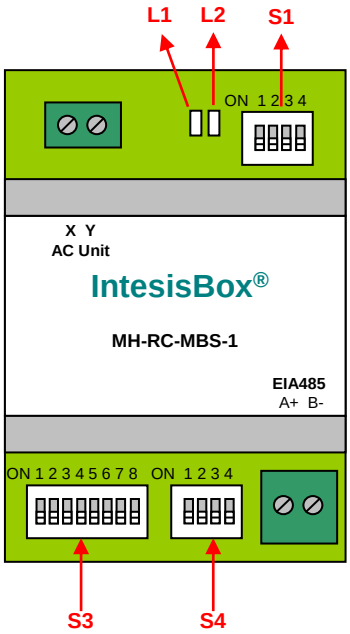



**Figure 3.1** MH-RC-MBS-1

**S1** – AC unit configuration: Master/Slave, Fan Speeds and Vanes

| Binary value $b_3...b_0$ | Decimal value | Switches 1 2 3 4 | Description |
|---|---|---|---|
| 0xxx | 0 | ↓ x x x | Slave (default value) – A MITSUBISHI HEAVY INDUSTRIES Controller must be present in X/Y, configured as Master. |
| 1xxx | 1 | ↑ x x x | Master in X/Y bus – MITSUBISHI HEAVY INDUSTRIES Controller not needed in X/Y. If existing, it must be configured as Slave. |
| x00x | 0 | x ↓ ↓ x | Indoor unit has 1 Fan Speeds |
| x01x | 1 | x ↓ ↑ x | Indoor unit has 2 Fan Speeds |
| x10x | 2 | x ↑ ↓ x | Indoor unit has 3 Fan Speeds |
| x11x | 3 | x ↑ ↑ x | Indoor unit has 4 Fan Speeds (default value)[8] |
| xxx0 | 0 | x x x ↓ | Indoor unit has no Vanes |
| xxx1 | 1 | x x x ↑ | Indoor unit has Vanes (default value) |

**Table 3.1** S1 Switch configuration

[8] Fan speed DIP-switch must be configured according to the number of fan speeds supported by the AC unit

**S3** – Modbus protocol: Slave address and baudrate

| Add | Switches 1 2 3 4 5 6 7 8 | Add | Switches 1 2 3 4 5 6 7 8 | Add | Switches 1 2 3 4 5 6 7 8 | Add | Switches 1 2 3 4 5 6 7 8 |
|---|---|---|---|---|---|---|---|
| 0 | ↓ ↓ ↓ ↓ ↓ ↓ x x | 16 | ↓ ↓ ↓ ↓ ↑ ↓ x x | 32 | ↓ ↓ ↓ ↓ ↓ ↑ x x | 48 | ↓ ↓ ↓ ↓ ↑ ↑ x x |
| 1* | ↑ ↓ ↓ ↓ ↓ ↓ x x | 17 | ↑ ↓ ↓ ↓ ↑ ↓ x x | 33 | ↑ ↓ ↓ ↓ ↓ ↑ x x | 49 | ↑ ↓ ↓ ↓ ↑ ↑ x x |
| 2 | ↓ ↑ ↓ ↓ ↓ ↓ x x | 18 | ↓ ↑ ↓ ↓ ↑ ↓ x x | 34 | ↓ ↑ ↓ ↓ ↓ ↑ x x | 50 | ↓ ↑ ↓ ↓ ↑ ↑ x x |
| 3 | ↑ ↑ ↓ ↓ ↓ ↓ x x | 19 | ↑ ↑ ↓ ↓ ↑ ↓ x x | 35 | ↑ ↑ ↓ ↓ ↓ ↑ x x | 51 | ↑ ↑ ↓ ↓ ↑ ↑ x x |
| 4 | ↓ ↓ ↑ ↓ ↓ ↓ x x | 20 | ↓ ↓ ↑ ↓ ↑ ↓ x x | 36 | ↓ ↓ ↑ ↓ ↓ ↑ x x | 52 | ↓ ↓ ↑ ↓ ↑ ↑ x x |
| 5 | ↑ ↓ ↑ ↓ ↓ ↓ x x | 21 | ↑ ↓ ↑ ↓ ↑ ↓ x x | 37 | ↑ ↓ ↑ ↓ ↓ ↑ x x | 53 | ↑ ↓ ↑ ↓ ↑ ↑ x x |
| 6 | ↓ ↑ ↑ ↓ ↓ ↓ x x | 22 | ↓ ↑ ↑ ↓ ↑ ↓ x x | 38 | ↓ ↑ ↑ ↓ ↓ ↑ x x | 54 | ↓ ↑ ↑ ↓ ↑ ↑ x x |
| 7 | ↑ ↑ ↑ ↓ ↓ ↓ x x | 23 | ↑ ↑ ↑ ↓ ↑ ↓ x x | 39 | ↑ ↑ ↑ ↓ ↓ ↑ x x | 55 | ↑ ↑ ↑ ↓ ↑ ↑ x x |
| 8 | ↓ ↓ ↓ ↑ ↓ ↓ x x | 24 | ↓ ↓ ↓ ↑ ↑ ↓ x x | 40 | ↓ ↓ ↓ ↑ ↓ ↑ x x | 56 | ↓ ↓ ↓ ↑ ↑ ↑ x x |
| 9 | ↑ ↓ ↓ ↑ ↓ ↓ x x | 25 | ↑ ↓ ↓ ↑ ↑ ↓ x x | 41 | ↑ ↓ ↓ ↑ ↓ ↑ x x | 57 | ↑ ↓ ↓ ↑ ↑ ↑ x x |
| 10 | ↓ ↑ ↓ ↑ ↓ ↓ x x | 26 | ↓ ↑ ↓ ↑ ↑ ↓ x x | 42 | ↓ ↑ ↓ ↑ ↓ ↑ x x | 58 | ↓ ↑ ↓ ↑ ↑ ↑ x x |
| 11 | ↑ ↑ ↓ ↑ ↓ ↓ x x | 27 | ↑ ↑ ↓ ↑ ↑ ↓ x x | 43 | ↑ ↑ ↓ ↑ ↓ ↑ x x | 59 | ↑ ↑ ↓ ↑ ↑ ↑ x x |
| 12 | ↓ ↓ ↑ ↑ ↓ ↓ x x | 28 | ↓ ↓ ↑ ↑ ↑ ↓ x x | 44 | ↓ ↓ ↑ ↑ ↓ ↑ x x | 60 | ↓ ↓ ↑ ↑ ↑ ↑ x x |
| 13 | ↑ ↓ ↑ ↑ ↓ ↓ x x | 29 | ↑ ↓ ↑ ↑ ↑ ↓ x x | 45 | ↑ ↓ ↑ ↑ ↓ ↑ x x | 61 | ↑ ↓ ↑ ↑ ↑ ↑ x x |
| 14 | ↓ ↑ ↑ ↑ ↓ ↓ x x | 30 | ↓ ↑ ↑ ↑ ↑ ↓ x x | 46 | ↓ ↑ ↑ ↑ ↓ ↑ x x | 62 | ↓ ↑ ↑ ↑ ↑ ↑ x x |
| 15 | ↑ ↑ ↑ ↑ ↓ ↓ x x | 31 | ↑ ↑ ↑ ↑ ↑ ↓ x x | 47 | ↑ ↑ ↑ ↑ ↓ ↑ x x | 63 | ↑ ↑ ↑ ↑ ↑ ↑ x x |

**Table 3.2** S3 Modbus Slave address

| Binary value $b_0...b_7$ | Decimal value | Switches 1 2 3 4 5 6 7 8 | Description |
|---|---|---|---|
| xxxxxx00 | 0 | x x x x x x ↓ ↓ | 2400bps |
| xxxxxx10 | 1 | x x x x x x ↑ ↓ | 4800bps |
| xxxxxx01 | 2 | x x x x x x ↓ ↑ | 9600bps (- default value) |
| xxxxxx11 | 3 | x x x x x x ↑ ↑ | 19200bps |

**Table 3.3** S3 Modbus baudrate

**S4 –** Temperature and termination: Degrees/Decidegrees (x10), temperature magnitude (ºC/ºF) and EIA485 termination resistor

| Binary value $b_0...b_3$ | Decimal value | Switches 1 2 3 4 | Description |
|---|---|---|---|
| 0xxx | 0 | ↓ x x x | Temperature values in Modbus register are represented in degrees (x1) (default value) |
| 1xxx | 1 | ↑ x x x | Temperature values in Modbus register are represented in decidegrees (x10) |
| x0xx | 0 | x ↓ x x | Temperature values in Modbus register are represented in Celsius degrees (default value) |
| x1xx | 1 | x ↑ x x | Temperature values in Modbus register are represented in Fahrenheit degrees |
| xxx0 | 0 | x x x ↓ | EIA485 bus without termination resistor (default value) |
| xxx1 | 1 | x x x ↑ | Internal termination resistor of 120Ω connected to EIA485 bus** |

**Table 3.4** S4 Temperature and termination configuration

* Default value
** Only in the interfaces connected at both ends of the bus must be activated the termination resistor, not in the rest. The EIA485 bus can be biased through internal jumpers JP1. See section 3.7.



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## 3.4 Implemented Functions

MH-RC-MBS-1 implements the following standard MODBUS functions:

- 3: Read Holding Registers
- 4: Read Input Registers
- 6: Write Single Register
- 16: Write Multiple Registers (Although this function is allowed, the interface does not allow write operations of more than 1 register with the same request, this means that length field should always be 1 when using this function for writes)

The maximum number of registers that can be read in a single request is 100.

## 3.5 Special behaviors

### 3.5.1 Window contact

The MH-RC-MBS-1 has the functionality of automatically control the turning off of the AC indoor unit depending on the state of the window contact register.

The AC indoor unit will be turned OFF and if the window contact register indicates "window opened" for a certain period of time (default value: 30 minutes).

If the AC unit is turned on through either the remote controller or the On/Off register and the window contact is still indicating "window opened", it will restart the countdown of the 30 minutes and after that it will turn OFF the AC unit again.

If the window contact register is indicating "window closed", this functionality will have no effect to the normal operation.

### 3.5.2 External temperature sensor. Virtual temperature.

As master of the X/Y bus, the MH-RC-MBS-1 will always send the temperature of the external temperature sensor directly to the AC unit. This temperature will become the AC unit's temperature.

As slave of the X/Y bus, if there is an external temperature sensor, it will send a different set point temperature to the AC unit from the one entered by the user. Its calculation is described below.

Four temperatures are involved:

- Set point temperature: set point temperature sent to the AC unit ($S$)
- Return path temperature: ambient temperature sent by the AC unit ($T_r$)
- Virtual set point temperature: set point temperature requested by the user (setpoint register). ($S_v$)
- Virtual ambient temperature: ambient temperature measured by the external temperature sensor. ($T_v$)

The set point temperature sent to the AC indoor unit is calculated with the following formula:

$$S = S_v - ( T_v - T_r )$$

### 3.5.3 Device disablement

If the device disablement register is set to 1, it will not allow the MH-RC-MBS-1 to change the state of the AC unit. All the Modbus registers will show the current state of the AC unit as if they were "Read Only registers".

### 3.5.4 Remote controller disablement

When the remote controller is disabled, changes made by the remote controller will be corrected by the MH-RC-MBS-1 setting the previous value. In this way, the MH-RC-MBS-1 will prevent the remote controller from changing the state of the AC unit.

### 3.5.5 Center/Remote

The Center/Remote register can be set to four[1] different values:

- 0: **Remote unlock** (Center/Remote). The indoor unit is being controlled by a BMS and it can be managed from the BMS, the remote controller or the MH-RC-MBS-1.
- 1: **Remote lock On/Off** (Center). The indoor unit is being controlled by a BMS and it can only be managed by the BMS. In this situation, the MH-RC-MBS-1 is disabled for the On/Off functions.
- 2: **Remote lock All** (Center). The indoor unit is being controlled by a BMS and it can only be managed by the BMS. In this situation the MH-RC-MBS-1 is disabled, like when the device disablement register is set to 1.
- 3: **Remote** (Remote). The indoor unit is **not** being controlled by any BMS. It can be managed from the remote controller or the MH-RC-MBS-1.

For more information about this settings, please check your Mitsubishi Heavy Industries manuals.

[1] For firmware version 0.8 or below, values could be as follows:

- 0: **Remote unlock** (Center/Remote). The indoor unit is being controlled by a BMS and it can be managed from the BMS, the remote controller or the MH-RC-MBS-1.
- 1: **Remote lock** (Center). The indoor unit is being controlled by a BMS and it can only be managed by the BMS. In this situation the MH-RC-MBS-1 is disabled, like when the device disablement register is set to 1.
- 2: **Remote** (Remote). The indoor unit is **not** being controlled by any BMS. It can be managed from the remote controller or the MH-RC-MBS-1.

**NOTE:** Current firmware version can be checked on register 50 (Protocol addressing).

## 3.6 Device LED indicator

The device includes two LED indicators (check Figure 3.1) to signal its different possible operational states. Their meaning is explained in this section:

| L1 (green) | | | |
|---|---|---|---|
| **Operation** | **ON** | **OFF** | **Meaning** |
| Blinking | 500 ms | 500 ms | Error |
| Flashing | 100 ms | 1900 ms | Normal operation (configured and working) |

| L2 (red) | | | |
|---|---|---|---|
| **Operation** | **ON** | **OFF** | **Meaning** |
| Pulse | 3 sec | -- | Undervoltage |

| L1 (green) & L2 (red) | | | |
|---|---|---|---|
| **Operation** | **ON** | **OFF** | **Meaning** |
| Pulse | 5 sec | -- | Device start-up |
| Alternate blinking | 500 ms | 500 ms | Flash checksum not OK |

## 3.7 RS485 bus. Termination resistors and Fail Safe Biasing mechanism

RS485 bus requires a 120Ω terminator resistor at each end of the bus to avoid signal reflections.

**The MH-RC-MBS-1 device includes an on-board terminator resistor of 120Ω that can be connected to the RS485 bus by using DIP-switch (**
Table 3.4).

A fail safe biasing circuit has also been included in the board of MH-RC-MBS-1, it can be connected to the RS485 bus by placing the internal double jumper JP1 (see details in Figure 3.2). This fail safe biasing of the RS485 bus must only be supplied by one of the devices connected to the bus.

*Some Modbus RTU RS485 master devices can provide also internal 120Ω terminator resistor and/or fail safe biasing (consult the technical documentation of the master device connected to the RS485 network in every case).*

Location of jumper and DIP-switches for RS485 bus Termination resistor or Fail Safe Biasing selection:

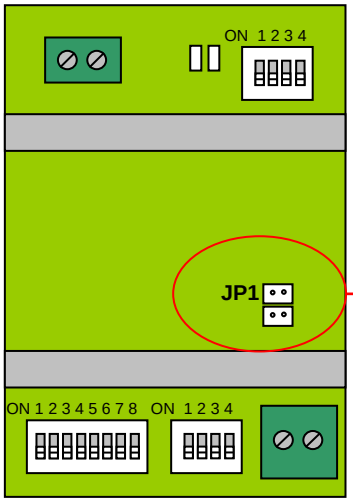



**Figure 3.2** Fail Safe jumper

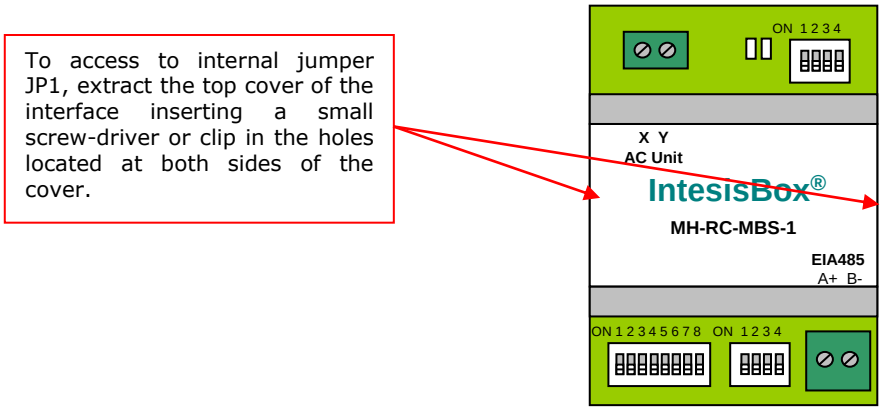
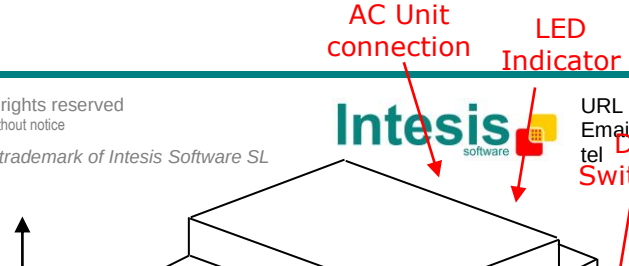



**Figure 3.3** Accessing the jumper

## 4. Specifications

| | |
|---|---|
| Dimensions: | *93 x 53 x 58 mm* |
| Weight: | *85 g* |
| Consumption Current: | *80 mA* |
| Operating Temperature: | *-40 . . . 85ºC* |
| Stock Temperature: | *-40 . . . 85ºC* |
| Operating Humidity: | *<95% RH, non-condensing* |
| Stock Humidity: | *<95% RH, non-condensing* |
| Isolation voltage: | *1000 VDC* |
| Isolation resistance: | *1000 MΩ* |
| Modbus Media: | *Compatible with Modbus RTU - RS485 networks* |



## 5. AC Unit Types Compatibility

A list of Mitsubishi Heavy Industries indoor unit model references compatible with MH-RC-MBS-1 and their available features can be found in:

http://www.intesis.com/pdf/IntesisBox_MH-RC-xxx-1_AC_Compatibility.pdf

## 6. Error Codes

| 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 |

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| 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 |
| 65532 | N/A | Initialization process. See section 2.3 |
| 65535 | N/A | Communication error between MH-RC-MBS-1 and AC unit / Remote controller |

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