# Modbus RTU (EIA-485) Interface for Mitsubishi Heavy Industries air conditioners

**USER MANUAL**

Issue date: 01/2024 r6.4 ENGLISH



# Modbus RTU (EIA-485) Interface for Mitsubishi Heavy Industries air conditioners

| ORDER CODE | LEGACY ORDER CODE |
|---|---|
| INMBSMHI001R000 | MH-RC-MBS-1 |

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# Important User Information

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# 1. Presentation

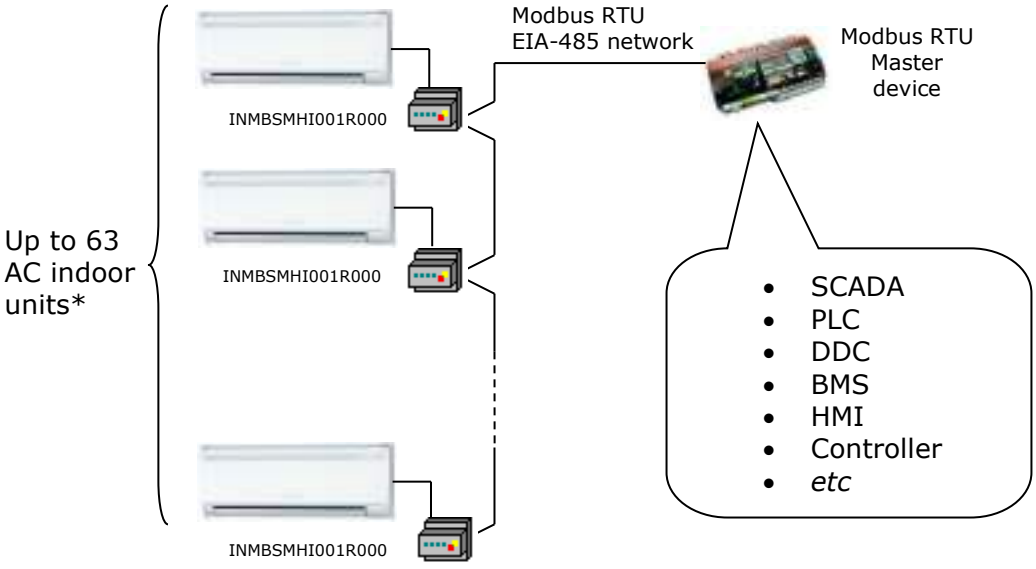



The INMBSMHI001R000 interfaces allow a complete and natural integration of ***Mitsubishi Heavy Industries*** air conditioners into Modbus RTU (EIA-485) networks.

Reduced dimensions. 93 x 53 x 58 mm
3.7" x 2.1" x 2.3"

Quick and easy installation.
*Mountable on DIN rail, wall, or even inside the indoor unit of AC.*

- External power not required.
- Direct connection to Modbus RTU (EIA-485) networks. Up to 63 INMBSMHI001R000 devices can be connected in the same network.
  *INMBSMHI001R000 is a Modbus slave device.*
- Direct connection to the AC indoor unit. Up to 16 AC indoor units can be connected to INMBSMHI001R000, 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 simultaneous use of the AC's remote controls and Modbus RTU.




* Up to 63 Intesis devices can be installed in the same Modbus RTU bus. However, depending on the configured speed, the installation of Modbus Repeaters may be required

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# 2. Connection

The interface comes with a plug-in terminal block of 2 poles to establish direct connection with the AC indoor unit. It comes as well with a plug-in terminal block of 2 poles to establish direct connection with the Modbus RTU EIA-485 network.

## 2.1 Connect to the AC indoor unit

The INMBSMHI001R000 connects directly to the Mitsubishi Heavy Industries XY Bus, which is not provided within the interface. Depending on which controllers are available, the recommended connection' methods are the following ones (details in Figure 2. 1):

- **Wired remote controller available**. Connect the gateway as Slave in parallel with the wired remote controllers (Controller acts as Master).
- **No remote controller available** Connect the gateway directly to the XY bus of the indoor unit as Master when there is no Mitsubishi Heavy Industries Remote Controller.

Maximum XY bus length is 600 m / 1,968.5 ft. The bus has no polarity sensitivity.

***Important:*** If a wired remote controller of the AC manufacturer is connected in the same bus, communication may shut down.

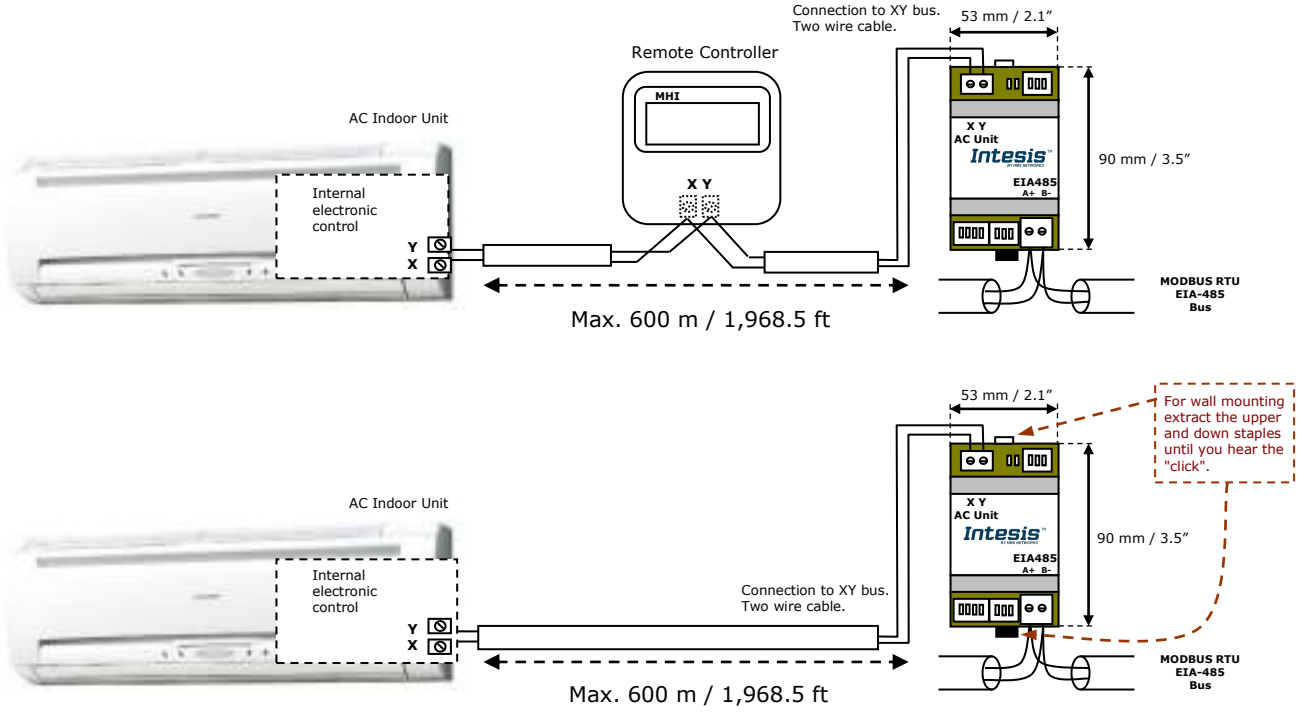



**Figure 2. 1** INMBSMHI001R000 connection diagram

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## 2.2 Connection to the EIA-485 bus

Connect the EIA-485 bus wires to the plug-in terminal block of INMBSMHI001R000 and keep the polarity on this connection (A+ and B-). Make sure that the maximum distance to the bus is 1,200 meters (3,937 ft). Loop or star typologies are not allowed in the case of the EIA-485 bus. A terminator resistor of 120Ω must be present at each end of the bus to avoid signal reflections. The bus needs a fail-safe biasing mechanism (see section 4.6 for more details).

# 3. Quick Start Guide

1. Disconnect the air conditioning from the Mains Power.
2. Attach the interface next to the AC indoor unit (wall mounting) following the instructions of the diagram below or install it inside the AC indoor unit (respect the safety instructions given).
3. Connect the XY bus between the interface and the AC indoor unit following the instructions of the diagram. Screw each bare cable end in the corresponding XY terminals of each device.
4. Connect the EIA-485 bus to the connector *EIA485* of the interface.
5. Close the AC indoor unit.
6. Check the DIP-Switch configuration of the Intesis interface and make sure it matches the current installation's parameters.

   By default, the interface is set to:

   - Modbus Slave Address ➔ 1
   - Modbus baud rate ➔ 9600 bps

   These parameters can be modified from SW4 and SW3 DIP-Switches.

   All other switch positions are set at low level (Off position ▪) by default.

   **NOTE:** All changes on the DIP-Switch configuration require a system power cycle to be applied.

7. Connect the AC system to Mains Power.

   **IMPORTANT:** The Intesis interface requires to be connected to the AC unit (powered) to start communicating.

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# 4. Modbus Interface Specification

## 4.1 Modbus physical layer

INMBSMHI001R000 implements a Modbus RTU (Slave) interface, to be connected to an EIA-485 line. It performs 8N2 communication (8 data bits, no parity and 2 stop bit) with several available baud rates (2400 bps, 4800 bps, 9600 bps -default-, 19200 bps, 38400 bps, 57600 bps, 76800 bps and 115200 bps). It also supports 8N1 communication (8 data bits, no parity and 1 stop bit).

**NOTE:** The gateway automatically detects the communication type (8N2 or 8N1) and sets itself accordingly. No action is needed.

## 4.2 Modbus Registers

All registers are type "16-bit unsigned Holding Register" and they use the *Modbus big endian* notation.

### 4.2.1 Control and status registers

<table>
<tr><th>Register Address (protocol address)</th><th>Register Address (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<ul><li>0: Off</li><li>1: On</li></ul></td></tr>
<tr><td>1</td><td>2</td><td>R/W</td><td>AC unit Mode<ul><li>0: Auto</li><li>1: Heat</li><li>2: Dry</li><li>3: Fan</li><li>4: Cool</li></ul></td></tr>
<tr><td>2</td><td>3</td><td>R/W</td><td>AC unit Fan Speed [1,2]
<table>
<tr><th></th><th colspan="4">Num. of Fan Speeds</th></tr>
<tr><th>Value</th><th>4 (Default)</th><th>3</th><th>2</th><th>1</th></tr>
<tr><td>0</td><td colspan="4">Auto</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 [2]<ul><li>1: Position-1</li><li>2: Position-2</li><li>3: Position-3</li><li>4: Position-4</li><li>10: Swing</li></ul></td></tr>
</table>

[1] Configuration following the Table 4.1 of this document.

[2] Available values will depend on the AC unit mode. Check the AC unit model functions in its User Manual to know the possible values for this register.

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| Register Address (protocol address) | Register Address (PLC address) | R/W | Description |
|---|---|---|---|
| 4 | 5 | R/W | AC unit Temperature Setpoint [2,3,4]<br>▪ -32768 (Initialization value)<br>**ALL MODES (EXCEPT HEAT)**<br>▪ 18..30ºC (ºC/x10ºC)<br>▪ 64..86ºF<br>**HEAT**<br>▪ 16..30ºC (ºC/x10ºC)<br>▪ 61..61ºF |
| 5 | 6 | R | AC unit Temperature reference [2,3,4]<br>▪ -32768 (Initialization value)<br>▪ 10..38ºC (ºC/x10ºC)<br>▪ 50..100ºF |
| 6 | 7 | R/W | Window Contact<br>▪ 0: Closed (Default)<br>▪ 1: Open |
| 7 | 8 | R/W | INMBSMHI001R000 Disablement [5]<br>▪ 0: INMBSMHI001R000 enabled (Default)<br>▪ 1: INMBSMHI001R000 disabled |
| 8 | 9 | R/W | AC Remote Control Disablement [5]<br>▪ 0: Remote Control enabled (Default)<br>▪ 1: Remote Control disabled |
| 9 | 10 | R/W | AC unit Operation Time<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 [6]<br>▪ 0: No active error<br>▪ 65532 (-4): Initialization process (around 2min) before normal operation starts. This error appears in case that INMBSMHI001R000 is set as Master.<br>▪ 65535 (-1): Error in the communication of INMBSMHI001R000 or Remote Controller with the AC unit.<br>▪ Any other error present, see the table at the end of this document. |
| 22 | 23 | R/W | Indoor unit´s ambient temperature from external sensor (at Modbus side) [2,3,4,7]<br>▪ -32768: (Initialization value). No temperature is being provided from an input sensor. There's no input sensor.<br>▪ Any other: (ºC/x10ºC/ºF) |

[3] Magnitude for this register can be adjusted to Celsius x 1ºC, Celsius x 10ºC (default) or Fahrenheit. See section 4.2.3 for more information.

[4] It is not possible turn to x10 the value shown in Fahrenheit.

[5] This value is stored in non-volatile memory

[6] See section 7 for possible error codes and their explanation

[7] See section 4.2.3 for more information

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| Register Address (protocol address) | Register Address (PLC address) | R/W | Description |
|---|---|---|---|
| 23 | 24 | R | AC Real temperature setpoint [2,3,4,7]<br>▪ When the mechanism for "Virtual temperature" is not being applied, the value will be the one in the register 5 (PLC addressing).<br>▪ 16..31ºC (ºC/x10ºC)<br>▪ 60..90ºF |
| 24 | 25 | R | Current AC max setpoint [2,3,4]<br>▪ -32768 (Initialization value)<br>▪ Ranges are specific from Manufacturer |
| 25 | 26 | R | Current AC min setpoint [2,3,4]<br>▪ -32768 (Initialization value)<br>▪ Ranges are specific from Manufacturer |
| 31 | 32 | R | Status (feedback)<br>▪ 0: Not active (Default value)<br>▪ 1: Active (A window is open) |
| 46 | 47 | R | Center/Remote [8]<br>▪ 0: Remocon unlock (Center/Remote)<br>▪ 1: Remocon lock On/Off (Center)<br>▪ 2: Remocon lock All (Center)<br>▪ 3: Remocon Only (Remote) |
| 55 | 56 | R/W | Under voltage counter [5]<br>▪ 0..300(hours) |
| 60 | 61 | R | Outdoor Intake temperature [2,3,4]<br>▪ -32768d: (Initialization value)<br>No temperature's value is being provided outdoor. No virtual temperature is applied.<br>▪ Any other: (ºC/x10ºC/ºF) |
| 65 | 66 | R | Input reference temperature [2,3,4]<br>▪ -32768: (Initialization value). No temperature's value is being provided from an external sensor. No virtual temperature is applied.<br>▪ Any other: (ºC/x10ºC/ºF) |
| 66 | 67 | R | Return Path temperature [2,3,4]<br>▪ -32768 (Initialization value)<br>▪ Any: (ºC/x10ºC/ºF) |
| 97 | 98 | R/W | Block Periodic Sendings [5,9,10]<br>▪ 0: Non-blocked (Default value)<br>▪ 1: Blocked |
| 98 | 99 | R/W | Master/Slave (gateway)<br>▪ 0: Slave<br>▪ 1: Master |

[8] See section 4.2.4 for more information

[9] If the register is configured as "0:Non-blocked", all commands received from Modbus will be sent to the AC system. If "1: Blocked", commands from Modbus will only be sent to the AC system if they differ from the previous value.

[10] This register applies to firmware version 0.14 onwards

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### 4.2.2 Configuration Registers

| Register Address (protocol address) | Register Address (PLC address) | R/W | Description |
|---|---|---|---|
| 13 | 14 | R/W | "Open Window" switch-off timeout [11]<br>▪ 0..30 (minutes)<br>▪ Factory setting: 30 (minutes) |
| 14 | 15 | R | Modbus RTU baud-rate<br>▪ 2400bps<br>▪ 4800bps<br>▪ 9600bps (Default)<br>▪ 19200bps<br>▪ 38400bps<br>▪ 57600bps<br>▪ 76800bps<br>▪ 115200bps |
| 15 | 16 | R | Modbus Slave Address<br>▪ 1..63 |
| 21 | 22 | R | Max number of fan speeds |
| 45 | 46 | W | Error reset<br>▪ 1: Reset |
| 48 | 49 | R | Switch value |
| 49 | 50 | R | Device ID: 0x0F00 |
| 50 | 51 | R | Software version |
| 81 | 82 | R | Error address<br>▪ Provides the indoor unit number which is providing error |
| 99 | 100 | W | Reset<br>▪ 1: Reset |

While the initialization is ongoing, some Modbus registers will indicate an undetermined value. Once the normal operation starts, they will acquire its corresponding value. It is important to keep in mind that any change done during the initialization process will not have effect until it has been finished.

[11] Once window contact is open, a count-down to switch off the AC Unit will start from this configured value.

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### 4.2.3 Considerations on Temperature Registers

- **AC unit temperature setpoint (R/W)**
  (register 4 – in Protocol address / register 5 – in PLC address):
  This is the adjustable temperature setpoint value that must be required by the user. This register can be read (Modbus function 3 or 4) or written (Modbus functions 6 or 16). A remote controller connected to the Mitsubishi Heavy Industries indoor unit will report the same temperature setpoint value as this register, but only will happen when no AC unit´s external reference is provided from INMBSMHI001R000 (see detail for register 22/23 below).

- **AC unit temperature reference (R)**
  (register 5 – in Protocol address / register 6 – in PLC address):
  This register reports the temperature that is currently used by the Mitsubishi Heavy Industries indoor unit as the reference of its own control loop. Depending on the configuration of the indoor unit, this value can be the temperature reported by the sensor on the return path of the Mitsubishi Heavy Industries indoor unit or the sensor of its remote controller. It is a read-only register (Modbus functions 3 or 4).

- **AC unit external temperature reference (Modbus) (R/W)**
  (register 22 – in Protocol address / register 23 – in PLC address):
  This register allows us to provide an external temperature's sensor from the Modbus side. Mitsubishi Heavy Industries indoor unit does not allow on devices like INMBSMHI001R000 to provide directly temperature to be used as a reference of the control loop of the AC indoor unit. In order to overcome this limitation and enable the usage of an external temperature sensor (i.e.from Modbus side), INMBSMHI001R000 applies the following mechanism (only if "external temperature's reference" is being used):

  - After a couple of values have been entered in the "AC unit external temperature's reference" (register 22/23) and "AC unit temperature set point" (register 4/5), INMBSMHI001R000 is going to estimate the temperature chosen implied (e.g. if a "temperature setpoint (register 4/5)" of **22ºC**, and an "external temperature reference (register 22/23)" of **20ºC** are entered, INMBSMHI001R000 will assume that the user is demanding a **+2ºC** increase in temperature).

  - By knowing at any time the ambient temperature currently used by the indoor unit to control its own operation (register 5/6), INMBSMHI001R000 can calculate the required temperature setpoint needed to apply the decrease/increase on the real temperature and reach the temperature chosen by the user (following the example above, if INMBSMHI001R000 reads an "ambient temperature" (register 5/6) of **24ºC** in the indoor unit, it will apply a final setpoint of **24ºC + 2ºC = 26ºC**).

  - At this moment, each time that INMBSMHI001R000 detects a change on the ambient temperature reported by the indoor unit (register 5/6), it will also change the required setpoint, in order to keep the temperature required by the user at any time. If we follow the last example, if INMBSMHI001R000 receives a new temperature´s value coming from the indoor unit of **25ºC**, INMBSMHI001R000 will automatically adjust the temperature setpoint required of the AC indoor unit to **25ºC + 2ºC = 27ºC**).

  - In general, INMBSMHI001R000 is constantly applying the "*Virtual Temperature*" formula:

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$$S_{AC} = S_u - ( T_u - T_{AC} )$$

Where:

$S_{AC}$ - setpoint value currently applied to the indoor unit
$S_u$ - setpoint value (register 4/5)
$T_u$ - external temperature reference written at Modbus side (register 22/23)
$T_{AC}$ - ambient temperature that the indoor unit is using as the reference of its own control loop (register 5/6)

When INMBSMHI001R000 detects a change in any of the values of $\{ S_u , T_u , T_{AC} \}$, it will send the new setpoint ($S_{AC}$) to the indoor unit.

- After the startup, the value for "external temperature's reference" (register 22/23) has a value -32768 (0x8000). This value means that no external temperature reference is being provided through INMBSMHI001R000. In this scenario, the AC indoor unit is going to use its own Return Path temperature from the sensor (register 66/67) as a reference of its own control loop. This process happens if the INMBSMHI001R000 has role as Master or as Slave.

- When the mechanism of "*Virtual Temperature*" is applied, the temperature setpoint's value shown by the Remote Controller or other Control System from Mitsubishi Heavy Industries connected to the indoor unit may show a different value from the value shown in register 4/5.

- If it is desired to use the temperature's reading from the Remote Control as the external temperature reference ($T_u$ ,register 22/33), the Remote Controller must be configured as Master, and the Mitsubishi Heavy Industries AC indoor unit must have the option "*thermostat sensor in the Remote Controller*" as activated. This configuration is done via a Mitsubishi Heavy Industries Remote Controller connected to the indoor unit and must be done by Mitsubishi Heavy Industries authorized installers while the AC is being installed.

- When INMBSMHI001R000 is set as "Master" of XY bus, the external temperature's sensor connected to Modbus RTU EIA-485 network provides directly the value currently applied to the indoor unit ( $S_{AC}$ ), and the process of the Virtual temperature is not applied. In this case, the Remote Controller or any other Control System connected from Mitsubishi Heavy Industries is not able to send the external temperature reference's value to the register 22/23.

- **AC Real temperature setpoint (R)**
  (register 23 – In Protocol address / register 24 – in PLC address)**:**
  As it has been detailed on the previous point, the real temperature setpoint in the indoor unit and the temperature setpoint requested from INMBSMHI001R000 might differ (when a value in register 22/23 – "external temperature reference" is entered). This register always informs about the current temperature setpoint which is being used by the indoor unit – it is also includes the temperature setpoint that will be shown by an additional remote controller from Mitsubishi Heavy Industries connected to the indoor unit, if it is present on the system.

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Moreover, notice that temperature's values of all these four registers are expressed according to the temperature´s format configured through its onboard DIP-Switches (See "4.3 - DIP-switch Configuration Interface"). These 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).

### 4.2.4 Special behavior – Center/Remote

The Center/Remote register is a feature of the INMBSMHI001R000 related to the control, and it can be set to four different options:

- 0: **Remote unlock** (Center/Remote). The indoor unit is being controlled by a BMS (Building Management System controlled across to Modbus RTU Master device) and it can be managed from the BMS, the Remote Controller or the INMBSMHI001R000.
- 1: **Remote lock On/Off** (Center). The indoor unit is being controlled by a BMS (Building Management System controlled across to Modbus RTU Master device) and it can only be managed by the BMS. In this situation, the INMBSMHI001R000 is disabled for the On/Off function.
- 2: **Remote lock All** (Center). The indoor unit is being controlled by a BMS (Building Management System controlled from Modbus RTU Master device) and it can only be managed by the BMS. In this case, the INMBSMHI001R000 keeps its status as disabled, like when the device disablement register (7/8) is set to 1.
- 3: **Remote** (Remote). The indoor unit is not being controlled by any BMS (Building Management System controlled from Modbus RTU Master device). It can be managed from the Remote Controller or the INMBSMHI001R000.

For more information about this setting, please check your Mitsubishi Heavy Industries manual.

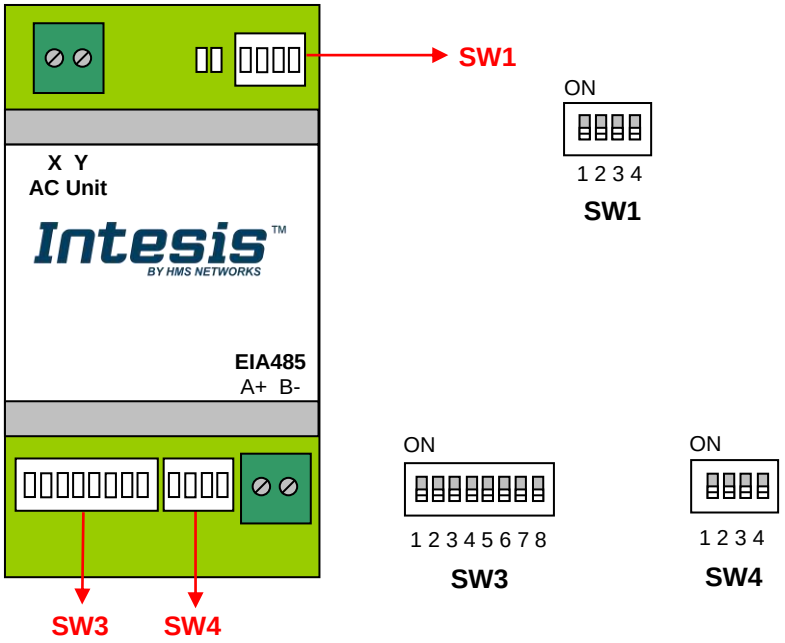
For firmware version 0.8 backwards (Check the register 50/51 of other firmware versions). The values could be as follows:

- 0: **Remote unlock** (Center/Remote). The indoor unit is being controlled by a BMS (Building Management System controlled from Modbus RTU Master device) and it can be managed from the BMS, the Remote Controller or the INMBSMHI001R000.
- 1: **Remote lock** (Center). The indoor unit is being controlled by a BMS (Modbus RTU Master device) and it can only be managed by the BMS (Building Management System controlled from Modbus RTU Master device). In this case, the INMBSMHI001R000 keeps its status as disabled, like when the device disablement register (7/8) is set to 1.
- 2: **Remote** (Remote). The indoor unit is not being controlled by any BMS (Building Management System controlled from Modbus RTU Master device). It can be managed from the Remote Controller or the INMBSMHI001R000

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## 4.3 DIP-switch Configuration Interface

All the configuration values on INMBSMHI001R000 can be written and read from Modbus interface. Otherwise, some of them can also be setup from its on-board DIP-switch interface.
The device has DIP-switches SW1, SW3 and SW4 on the following locations:




The following tables apply to the interface´s configuration through DIP-switches:

**SW1 –** AC indoor unit's features

| SW1-P1..4 | Description |
|---|---|
|  | Slave - A Mitsubishi Heavy Industries Controller must be present in XY bus, configured as Master (Default value) |
|  | Master – Mitsubishi Heavy Industries Controller not needed in XY bus. If it exists, it must be configured as Slave |
|  | Indoor unit has 1 Fan Speed |
|  | Indoor unit has 2 Fan Speeds |
|  | Indoor unit has 3 Fan Speeds |
|  | Indoor unit has 4 Fan Speeds (Default value) |
|  | Indoor unit has no Vanes |
|  | Indoor unit has Vanes (Default Value) |

**Table 4.1** SW1: AC indoor unit´s features

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**SW3/SW4 –** Baud rate configuration

| SW3-P7..8 | SW4-P3 | Description |
|---|---|---|
|  |  | 2400bps |
|  |  | 4800bps |
|  |  | 9600bps (Default value) |
|  |  | 19200bps |
|  |  | 38400bps |
|  |  | 57600bps |
|  |  | 76800bps |
|  |  | 115200bps |

**Table 4.2** SW3-SW4: Modbus baud rate

**SW4 –** Degrees/Decidegrees (x10), temperature magnitude (ºC/ºF) and EIA-485 termination resistor.

| SW4-P1..2-4 | Description |
|---|---|
|  | Temperature values in Modbus register are represented in degrees (x1) (Default value) |
|  | Temperature values in Modbus register are represented in decidegrees (x10) |
|  | Temperature values in Modbus register are represented in Celsius degrees (Default value) |
|  | Temperature values in Modbus register are represented in Fahrenheit degrees |
|  | EIA-485 bus without termination resistor (Default value) |
|  | Internal termination resistor of 120Ω connected to EIA-485 bus |

**Table 4.3** SW4: Temperature and termination resistor configuration

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**SW3 –** Modbus Slave address

| *Add* | SW3-P1..6 | *Add* | SW3-P1..6 | *Add* | SW3-P1..6 | *Add* | SW3-P1..6 | *Add* | SW3-P1..6 |
|---|---|---|---|---|---|---|---|---|---|
| 0 |  | 13 |  | 26 |  | 39 |  | 52 |  |
| 1 |  | 14 |  | 27 |  | 40 |  | 53 |  |
| 2 |  | 15 |  | 28 |  | 41 |  | 54 |  |
| 3 |  | 16 |  | 29 |  | 42 |  | 55 |  |
| 4 |  | 17 |  | 30 |  | 43 |  | 56 |  |
| 5 |  | 18 |  | 31 |  | 44 |  | 57 |  |
| 6 |  | 19 |  | 32 |  | 45 |  | 58 |  |
| 7 |  | 20 |  | 33 |  | 46 |  | 59 |  |
| 8 |  | 21 |  | 34 |  | 47 |  | 60 |  |
| 9 |  | 22 |  | 35 |  | 48 |  | 61 |  |
| 10 |  | 23 |  | 36 |  | 49 |  | 62 |  |
| 11 |  | 24 |  | 37 |  | 50 |  | 63 |  |
| 12 |  | 25 |  | 38 |  | 51 |  | | |

**Table 4.4** SW3: Modbus slave address

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## 4.4 Implemented Functions

INMBSMHI001R000 implements the following standard Modbus functions:

- *3: Read Holding Registers*
- *4: Read Input Registers*
- *6: Write Single Register*
- *16: Write Multiple* Registers (Despite this function is allowed, the interface does not allow to write operations on more than 1 register with the same request, this means that length field should be always be 1 when this function is being used in case of writing)

## 4.5 Device LED indicator

The device includes two LED indicators to show all the possible operational states. In the following table there are written the indicators which can be performed and their meaning.

**L1 (green LED)**

| Device status | LED indication | ON / OFF Period | Description |
|---|---|---|---|
| During not normal operation | LED blinking | 500ms ON / 500ms OFF | Communication error |
| During normal operation | LED flashing | 100ms ON / 1900ms OFF | Normal operation (configured and working properly) |

**L2 (red LED)**

| Device status | LED indication | ON / OFF Period | Description |
|---|---|---|---|
| During not normal operation | LED Pulse | 3sec ON / --- OFF | Under voltage |

**L1 (green LED) & L2 (red LED)**

| Device status | LED indication | ON / OFF Period | Description |
|---|---|---|---|
| During normal operation | LED Pulse | 5sec ON / --- OFF | Device Start-up |
| During not normal operation | LED alternatively blinking | 500ms ON / 500ms OFF | Flash checksum not OK |

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## 4.6 EIA-485 bus. Termination resistors and Fail Safe Biasing mechanism

EIA-485 bus requires a 120Ω terminator resistor at each end of the bus to avoid signal reflections.

In order to prevent fail status detected by the receivers, which are *"listening" the bus,* when all the transmitters' outputs are in three-state (high impedance), it is also required a fail-safe biasing mechanism. This mechanism provides a safe status (a correct voltage level) in the bus when all the transmitters' outputs are in three-state. This mechanism must be supplied by the Modbus Master.

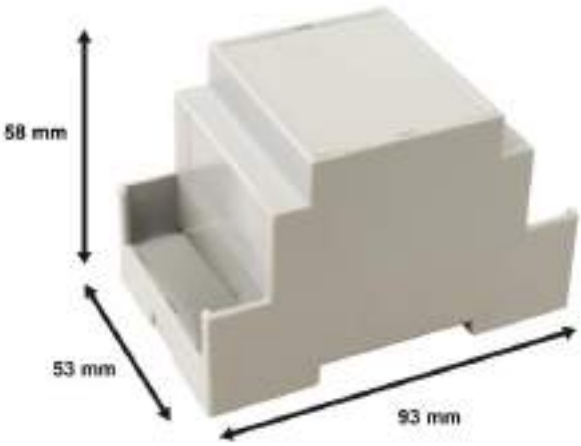
The INMBSMHI001R000 device includes an on-board terminator resistor of 120Ω that can be connected to the EIA-485 bus by using DIP-switch SW4.

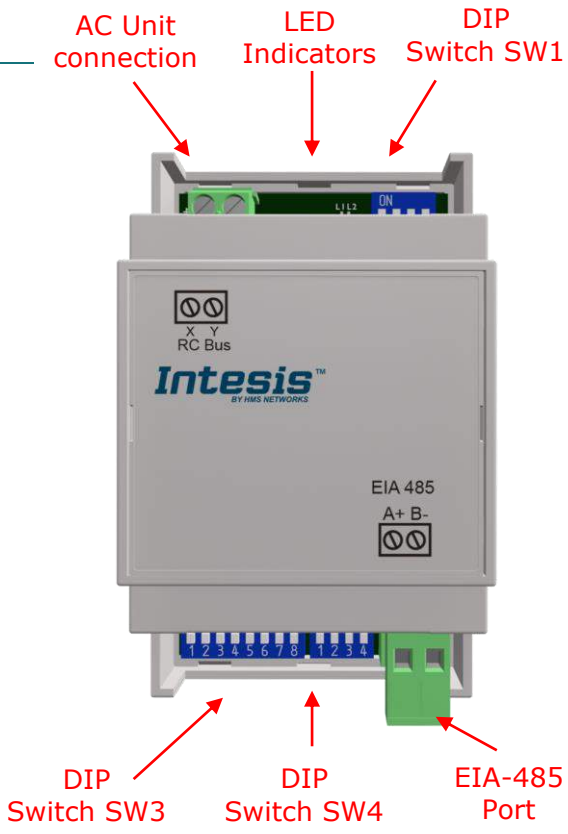
Some Modbus RTU EIA-485 Master devices can provide also internal 120Ω terminator resistor and/or fail safe biasing mechanism (Check the technical documentation of the Master device connected to the EIA-485 network in each case).

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# 5. Mechanical and electrical features

| | | | |
|---|---|---|---|
| Enclosure | Plastic, type PC (UL 94 V-0)<br>Net dimensions (dxwxh):<br>93 x 53 x 58 mm / 3.7" x 2.1" x 2.3"<br>Color: Light Grey. RAL 7035 | Operation Temperature | 0ºC to +60ºC |
| Weight | 85 g. | Stock Temperature | -20ºC to +85ºC |
| Mounting | Wall<br>DIN rail EN60715 TH35. | Operational Humidity | <95% RH, non-condensing |
| Terminal Wiring (for low-voltage signals) | For terminal: solid wires or stranded wires (twisted or with ferrule)<br>1 core: 0.5mm²… 2.5mm²<br>2 cores: 0.5mm²… 1.5mm²<br>3 cores: not permitted | Stock Humidity | <95% RH, non-condensing |
| Modbus RTU port | 1 x Serial EIA485 Plug-in screw terminal block (2 poles):<br>A, B<br>Compatible with Modbus RTU EIA-485 networks | Isolation voltage | 1500 VDC |
| AC unit port | 1 x XY bus Plug-in screw terminal block (2 poles):<br>X, Y<br>Compatible with Mitsubishi Heavy Industries networks | Isolation resistance | 1000 MΩ |
| Switch 1 (SW1) | 1 x DIP-Switch for AC features | Protection | IP20 (IEC60529) |
| Switch 3 (SW3) | 1 x DIP-Switch for Modbus RTU settings | LED indicators | 2 x Onboard LED - Operational status |
| Switch 4 (SW4) | 1 x DIP-Switch for extra functions | | |




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# 6. List of supported AC Unit Types.

A list of Mitsubishi Heavy Industries indoor unit model's references compatible with INMBSMHI001R000 and its available features can be found on this link:

https://www.intesis.com/docs/compatibilities/inxxxmhi001rx00_compatibility

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# 7. 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 |
| 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 (-4) | N/A | Initialization process (around 2min) before normal operation starts. This error appears in case that INMBSMHI001R000 is set as Master. |
| 65535 (-1) | N/A | Communication error of INMBSMHI001R000 or Remote controller with the AC unit. |

In case to detect an error code not listed, contact your closest Mitsubishi Heavy Industries technical support service.

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