

# Modbus RTU interface for infrared HVAC integration

Compatible with IR-enabled AC units, from most brands

## USER MANUAL

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ORDER CODE	LEGACY ORDER CODE
IN485UNI001I100	IN485UNI001I000

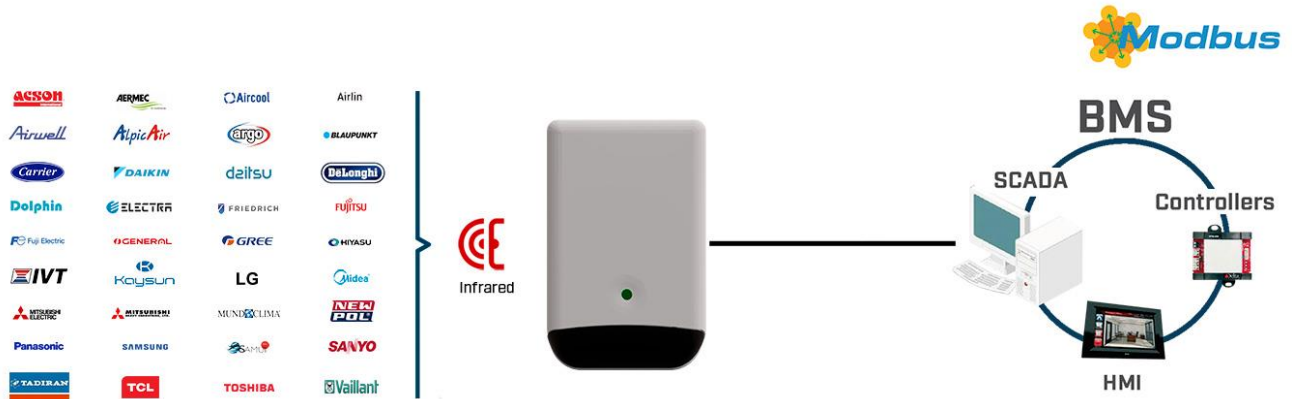
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## 1 Presentation

Intesis gateway IN485UNI001I100 provides full integration of infrared-enabled air conditioners (AC) into Modbus RTU (EIA-485) networks.

Compatible with most AC units equipped with an IR receiver



### Main features

- Reduced dimensions and quick installation
- Compatible with most AC brands, infrared enabled models
- Wall or desktop (surface) mounted. Reduced dimensions for easy installation.
- Direct connection to Modbus RTU over EIA-485 as a slave device
- Up to 63 interfaces can be connected to the Modbus network
- Auto-learn function for quick and easy setup of IR remote control
- Mini USB port for connection to config software. It is also used for power supply
- Power adapter included (EU, UK, USA and AU plugs supplied).
- Simultaneous control of the AC unit both from Modbus and from IR remote controller.

## 2 Quick setup

1. Connect the interface via mini USB to the PC (cable not included, Mini-USB Type Mini B)
2. Configure your device using Intesis MAPS configuration software (Check Intesis MAPS User Manual for detailed description).
3. Install the interface in proximity of the AC indoor unit and connect it to the power supply. Check the interface location that best fits the installation (More at chapter 3. [Device Installation](#) ). Use parrot mode to verify the device location.
4. Connect RS485 to Modbus RTU network.



### IMPORTANT: Power supply

The interface is USB-powered. If not connected to a computer for setting or testing routines from the Config Tool, the USB port should be feeding 5 Volts DC from the power adapter (included)

## 3 Device Installation

This Intesis device is equipped with four infrared (IR) emitters and one IR receiver. Two emitters point at the front, two are 45° oriented, downwards, one for each side. The receiver gets feedback from the IR wireless remote controller, so the AC unit status is reported to the Modbus system.

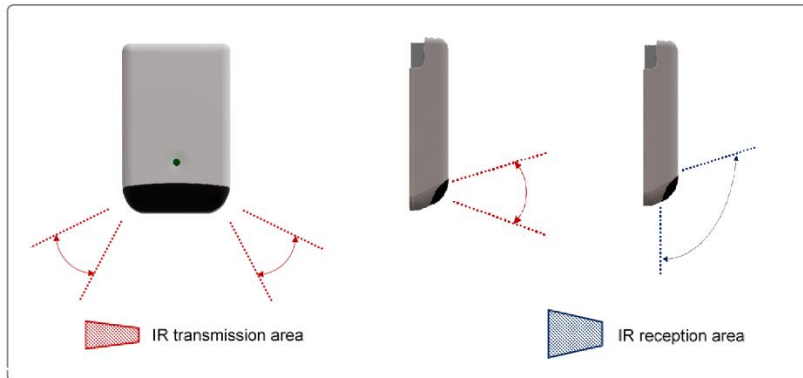


Figure 3.1 Built-in IR emitters and IR receiver

### 3.1 Device emplacement and IR connection

Intesis IN485UNI001I100 is intended for surface mount, either wall or desktop. Different emplacements are acceptable, as shown in figures below.

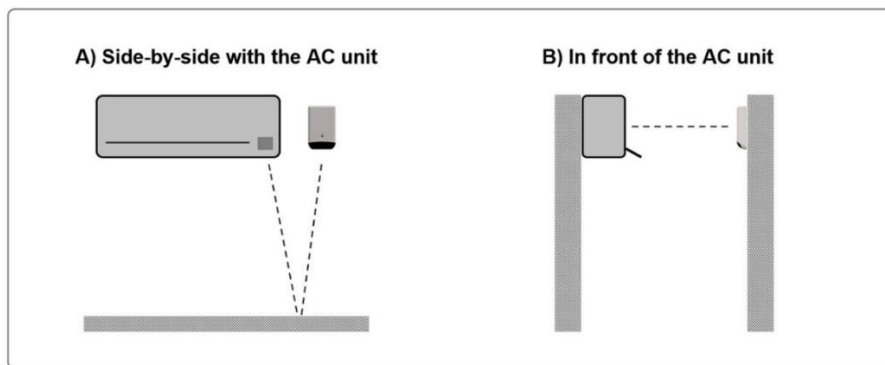


Figure 3.2 Wall mount.

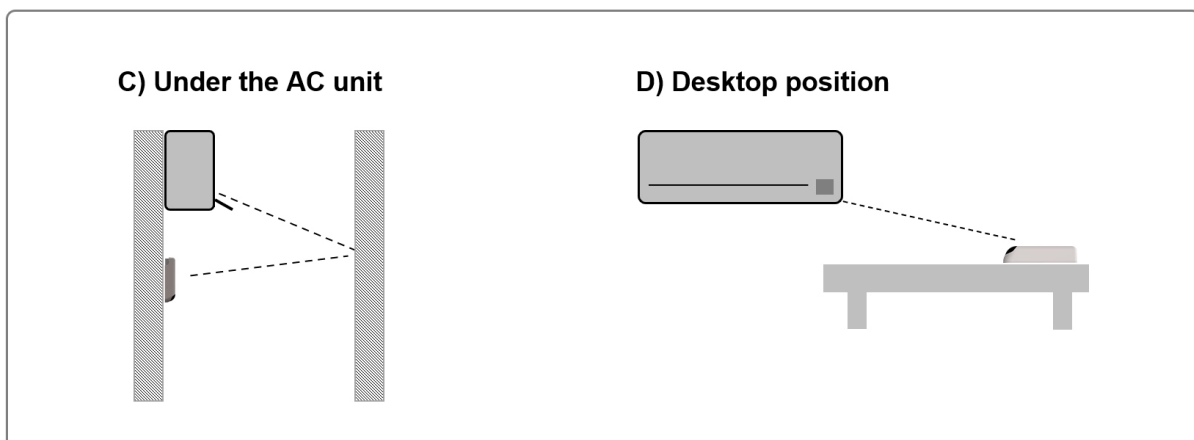


Figure 3.3 Wall / desktop mount.

# Intesis® Modbus – IR Universal AC

**Case A:** Placed side-by-side with the AC unit. The signal will travel from the Intesis device to the AC unit taking advantage of the rebounds on the floor or furniture present in the room.

**Case B:** Placed in front of the AC unit. The signal will travel from the Intesis device directly to the AC unit.

**Case C:** Below the AC unit. In this case, the signal will travel from the Intesis device to the AC unit taking advantage of the rebounds on the wall in front of it or other furniture.

**Case D:** Desktop mount. The signal will travel directly from the Intesis device to the AC unit

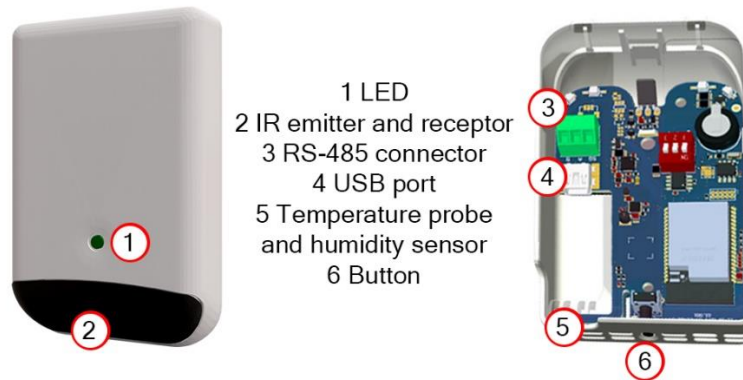


Figure 3.4 Built-in ports and sensors.

## 3.2 Connection to EIA-485

Notice the EIA-485 screw terminal block at the back of the device:

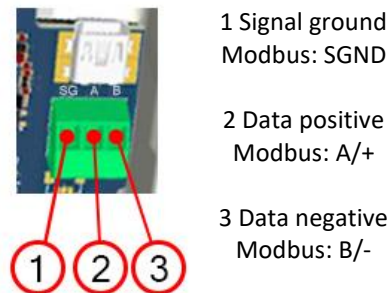


Figure 5: Block-Terminal details

## 3.3 Mini USB port

Use the USB cable to connect the device to a computer running config software, for setting and testing purposes, or to the power adapter (included), for regular operation

## 4 Modbus Interface Specification

### 4.1 Modbus physical layer

IN485UNI001I100 implements a Modbus RTU Slave interface, to be connected to an EIA-485 bus. It performs an 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 standard Modbus big endian notation. the *Modbus big endian* notation.

#### 4.2.1 AC Control and status registers

IN485UNI001I100 has the following Modbus Maps to control and monitor the AC unit. Consider that this table shows the maximum range of values available in every Modbus register and that it will be adapted to the IR control to simulate in every application.

Register Address (protocol address)	Register Address (PLC address)	R/W	Description
0	1	R/W	AC unit On/Off <ul style="list-style-type: none"> <li>0: Off</li> <li>1: On</li> </ul>
1	2	R/W	AC unit Mode <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: Heat</li> <li>2: Dry</li> <li>3: Fan</li> <li>4: Cool</li> </ul>
2	3	R/W	AC unit Fan Speed <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: FS1</li> <li>2: FS2</li> <li>...</li> <li>9: FS9</li> </ul>
3	4	R/W	AC unit Vertical Vane Position <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: Pos1</li> <li>2: Pos2</li> <li>...</li> <li>7: Pos7</li> <li>10: Swing</li> </ul>
4	5	R/W	AC unit Temperature Setpoint <sup>2,3</sup> <ul style="list-style-type: none"> <li>-32768 (Initialization value)</li> <li>16..31 (°C) (0 = undetermined)</li> <li>61..86 (°F) (0 = undetermined)</li> </ul>

<sup>1</sup> Available values will depend on the AC unit mode. Check the AC unit user manual to know the possible values for this register

<sup>2</sup> Magnitude for this register can be adjusted to Celsius x 1°C, Celsius x 10°C (default) or Fahrenheit.

<sup>3</sup> It is not possible turn to x10 the value shown in Fahrenheit.

Register Address (protocol address)	Register Address (PLC address)	R/W	Description
5	6	R	AC unit Ambient Temperature <sup>1</sup> Error! Marcador no definido., 2, 3 <ul style="list-style-type: none"> <li>18..30 (°C) (0 = undetermined)</li> <li>64,4..86 (°F) (0 = undetermined)</li> <li>0x8000 No setpoint sent from the Remote controller</li> </ul>
7	8	R/W	IN485UNI001I100 Disablement <sup>4</sup> <ul style="list-style-type: none"> <li>0: IN485UNI001I100 enabled (Default value)</li> <li>1: IN485UNI001I100 disabled</li> </ul>
8	9	R/W	AC Remote Control Disablement <sup>5</sup> <ul style="list-style-type: none"> <li>0: Remote Control enabled (Default value)</li> <li>1: Remote Control disabled</li> </ul>
9	10	R/W	AC unit Operation Time <ul style="list-style-type: none"> <li>0..65535 (hours). Counts the time the AC unit is in "On" state.</li> </ul>
26	27	R/W	AC unit Horizontal Vane Position <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: Pos1</li> <li>2: Pos2</li> <li>...</li> <li>7: Pos7</li> <li>10: Swing</li> </ul>
27	28	R/W	AC unit Vertical Vane Pulse <sup>1</sup> <ul style="list-style-type: none"> <li>1: Pulse</li> </ul>
34	35	R/W	AC unit Horizontal Vane Pulse <sup>1</sup> <ul style="list-style-type: none"> <li>1: Pulse</li> </ul>
70	71	R	Relative humidity <ul style="list-style-type: none"> <li>0-100% relative humidity</li> </ul>
21	22	R	Max. number of fan speeds Maximum number of fan speeds available.
24	25	R	AC max setpoint <sup>1, 2, 3</sup> <ul style="list-style-type: none"> <li>-32768 (Initialization value)</li> </ul> Upper limit for setpoint setting
25	26	R	AC min setpoint <sup>1, 2, 3</sup> <ul style="list-style-type: none"> <li>-32768 (Initialization value)</li> </ul> Lower limit for setpoint setting
200	201	R/W	Parrot Mode <ul style="list-style-type: none"> <li>0: Not active</li> <li>1: Active</li> </ul>

<sup>4</sup> This value is stored in non-volatile memory



## 4.2.2 AC startup registers

Register Address (protocol address)	Register Address (PLC address)	R/W	Description
1100	1101	R/W	Reset operation at startup: <ul style="list-style-type: none"> <li>0: Don't send status to AC</li> <li>1: Send status to AC</li> </ul>
1101	1102	R/W	AC unit On/Off at startup <ul style="list-style-type: none"> <li>0: Off</li> <li>1: On</li> </ul>
1102	1103	R/W	AC unit Mode at startup <sup>5</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: Heat</li> <li>2: Dry</li> <li>3: Fan</li> <li>4: Cool</li> </ul>
1103	1104	R/W	AC unit Fan Speed at startup <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: FS1</li> <li>2: FS2</li> <li>...</li> <li>9: FS9</li> </ul>
1104	1105	R/W	AC unit Temperature Setpoint at startup <sup>6,7,3</sup> <ul style="list-style-type: none"> <li>-32768 (Initialization value)</li> <li>16..31 (°C) (0 = undetermined)</li> <li>61..86 (°F) (0 = undetermined)</li> </ul>
1105	1106	R/W	AC unit U/D Vane Position at startup <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: Pos1</li> <li>2: Pos2</li> <li>...</li> <li>7: Pos7</li> <li>10: Swing</li> </ul>
1106	1107	R/W	AC unit L/R Vane Position at startup <sup>1</sup> <ul style="list-style-type: none"> <li>0: Auto</li> <li>1: Pos1</li> <li>2: Pos2</li> <li>...</li> <li>7: Pos7</li> <li>10: Swing</li> </ul>

<sup>5</sup> Available values will depend on the AC unit mode. Check the AC unit user manual to know the possible values for this register

<sup>6</sup> Magnitude for this register can be adjusted to Celsius x 1°C, Celsius x 10°C (default) or Fahrenheit.

<sup>7</sup> It is not possible turn to x10 the value shown in Fahrenheit.

## 4.2.3 Device Registers

Register Address (protocol address)	Register Address (PLC address)	R/W	Description															
14	15	R	Modbus RTU baud-rate <ul style="list-style-type: none"> <li>▪ 2400 bps</li> <li>▪ 4800 bps</li> <li>▪ 9600 bps (Default)</li> <li>▪ 19200 bps</li> <li>▪ 38400 bps</li> <li>▪ 57600 bps</li> <li>▪ 76800 bps</li> <li>▪ 115200 bps</li> </ul>															
15	16	R	Modbus Slave Address <ul style="list-style-type: none"> <li>▪ 1..63</li> </ul>															
49	50	R	Device definition (device ID)															
50	51	R	Software version															
97	98	R/W	Block Periodic Sendings <sup>8</sup> <ul style="list-style-type: none"> <li>▪ 0: Non-blocked (Default value)</li> <li>▪ 1: Blocked</li> </ul>															
99	100	R/W	Reset device <ul style="list-style-type: none"> <li>▪ 1: Reset</li> </ul>															
203	204	R	IR Remote version															
204	205	R	IR Remote code															
202	203	R/W	RGB led criteria: <ul style="list-style-type: none"> <li>▪ 0: OFF</li> <li>▪ 1: ON</li> <li>▪ 2: Report only changes</li> </ul>															
206	207	R/W	RGB Led intensity. Values 1...5															
10	11	R	AC unit Alarm Status <ul style="list-style-type: none"> <li>▪ 0: No alarm condition</li> <li>▪ 1: Alarm condition</li> </ul>															
11	12	R	Error Code (IN485UNI001I100 errors) <ul style="list-style-type: none"> <li>▪ 0: No error present</li> <li>▪ Any other: device error:                             <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <thead> <tr> <th>Error value</th> <th>Error MBS</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>65536</td> <td>No error</td> </tr> <tr> <td>-4</td> <td>65532</td> <td>Initialization value</td> </tr> <tr> <td>-15</td> <td>65521</td> <td>Internal error</td> </tr> <tr> <td>-16</td> <td>65520</td> <td>RCFWrongCRC error</td> </tr> </tbody> </table> </li> </ul>	Error value	Error MBS	Description	0	65536	No error	-4	65532	Initialization value	-15	65521	Internal error	-16	65520	RCFWrongCRC error
Error value	Error MBS	Description																
0	65536	No error																
-4	65532	Initialization value																
-15	65521	Internal error																
-16	65520	RCFWrongCRC error																

<sup>8</sup> 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.

## 4.3 Implemented Modbus functions

IN485UNI001I100 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)

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

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

In order to prevent fail status detections by bus receivers 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. The Fail-Safe-Biasing mechanism is enabled by DIP-switch settings

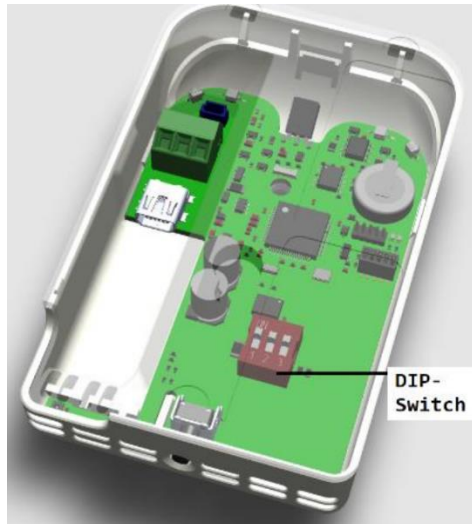
Please check section 5.1 [DIP-switch settings](#) for details

The IN485UNI001I100 device includes an on-board terminator resistor of 120  $\Omega$  that can be connected to the EIA-485 bus by using built-in DIP-switch block. Some Modbus RTU EIA-485 Master devices can provide also internal 120  $\Omega$  terminator resistor and/or fail-safe biasing. Check the technical documentation of the Master devices connected to the EIA-485 network in each case.

## 5 Configuration settings

### 5.1 DIP-switch settings

To access the onboarded DIP-switch block, the enclosure must be opened by bending both frontal tabs (inserting a plane tool tip size <5 mm). This operation must be performed by qualified personnel only



DIP-switch	Description
ON 	EIA-485 bus without a termination resistor
ON 	Internal 120 Ω termination resistor connected to EIA-485 bus
ON 	No bus polarization
ON 	Active bus polarization

Figure 5.8 Onboarded DIP-switch block

### 5.2 Push button functionality

The device is equipped with one push button which performs two different actions:

#### Action 1: AC ON&OFF

AC ON/OFF STATUS	User action	Device action
OFF	1 click	ON+COOL+25°C
OFF	2 clicks	ON+HEAT+21°C
ON	1 or 2 clicks	OFF

When Parrot mode is active, switching ON&OFF the AC is not permitted from this button. Please, exit Parrot mode to enable AC ON&OFF.

#### Action 2: Parrot mode enable / disable

AC ON/OFF STATUS	User action	Device action
ON or OFF	3 clicks	Activate/deactivate Parrot mode

When Parrot mode is enabled, the device will simply emit every IR signal picked at by the receiver, acting as a repeater. Parrot mode is used for testing or troubleshooting to confirm the device location for AC control.

## 5.3 Device LED indicator

The device is equipped with one multicolor LED indicator. Different colors are used to report different operation modes and operation conditions, as described in following tables

### Normal operation

LED COLOR	Blink freq / steady	Device informs...
READ	STEADY	HEAT mode
BLUE	STEADY	COOL mode
BLUE	STEADY	DRY mode
YELLOW	STEADY	AUTO mode
GREEN	STEADY	FAN mode
RED	BLINK 3 times	Command received or sent during HEAT mode
BLUE	BLINK 3 times	Command received or sent during COOL mode
BLUE	BLINK 3 times	Command received or sent during DRY mode
YELLOW	BLINK 3 times	Command received or sent during AUTO mode
GREEN	BLINK 3 times	Command received or sent during FAN mode

### Parrot mode

Parrot mode is a function to find the best device location for its normal operation.

LED COLOR	Blink freq / steady	Device informs...
WHITE	0.5 s ON – 0.5 s OFF	Parrot mode ON

### Auto-learn mode

Autolearn is a function that allows to autoconfigure the native AC infrared remote controller in the IN485UNI001I100 device. This function can be enabled via Intesis Maps only, please, refer to Intesis Maps configuration manual for IN485UNI001I100 to use this function.

LED COLOR	Blink freq / steady	Device informs...
WHITE	STEADY	Device is ready to get an IR frame

### Device connected via USB

LED COLOR	Blink freq / steady	Device informs...
ORANGE	STEADY (low intensity)	USB link performed
ORANGE	STEADY (high intensity)	Intesis Maps communication
MAGENTA	0.5 s ON - 0.5 s OFF	USB communication (FW download in progress)
CYAN	1s ON - 1s OFF (x3)	FW download finished

### Error notification

LED COLOR	Blink freq / steady	Device informs...
RED	Blinking (low intensity)	RCF corruption

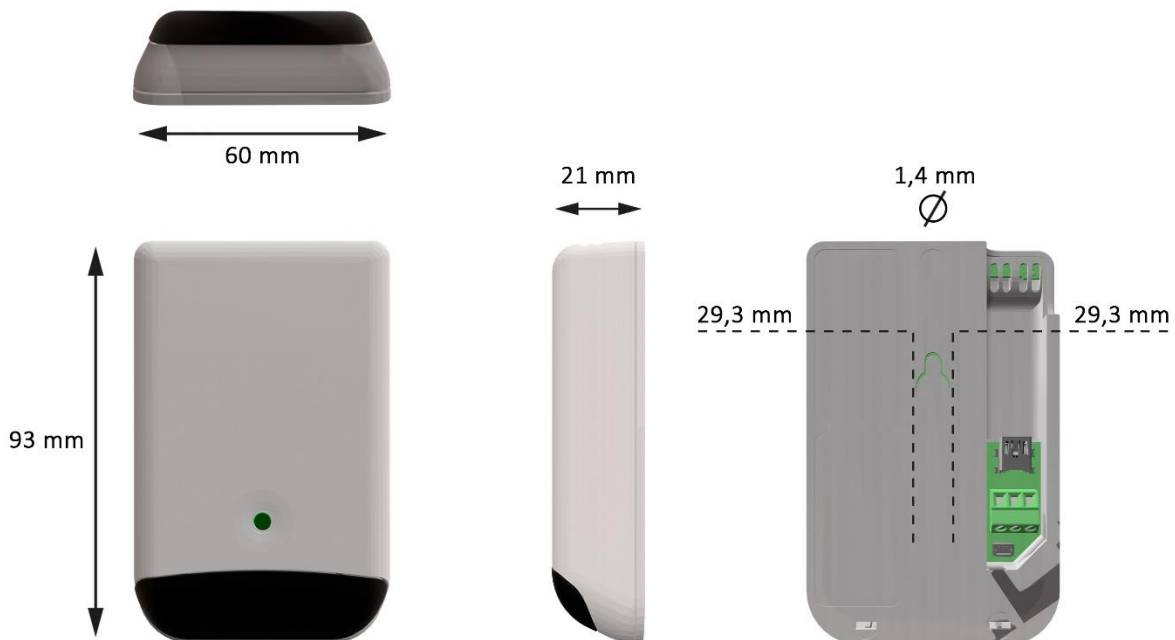
Check Intesis Maps configuration manual to know how to overcome this error.

### 5.4 Intesis® MAPS Config Tool

This interface is configured using Intesis Maps®. You can download this software for free in [www.intesis.com](http://www.intesis.com). Please, review Intesis Maps IN485UNI001I100 user manual to learn how to configure the device using this software.

## 6 Technical Specs

<b>Enclosure</b>	Plastic, type PC (UL 94 V-0) Dimensions: 93 x 60 x 21 mm / 3.7" x 2.3" x 0.8" Color: Light Grey. NCS S 1002-B	<b>Operation Temp</b>	0°C to +60°C
<b>Weight</b>	55 g	<b>Storage Temp</b>	-20°C to +85°C
<b>Mounting</b>	Surface mount (wall or desktop).	<b>Operation humidity</b>	5% to 95%, non-condensing
<b>Terminal Wiring (low-voltage signals)</b>	Per terminal: solid wires or stranded wires (twisted or with shielded termination) 1 core: 0.25mm <sup>2</sup> ... 1 mm <sup>2</sup> 2 cores: 0.25mm <sup>2</sup> ... 0.75 mm <sup>2</sup> 3 cores: 0.25mm <sup>2</sup> ... 0.75 mm <sup>2</sup>	<b>Storage Temp</b>	< 95%, non-condensing
<b>EIA – 485</b>	1 x EIA485 3-pin plug-in screw terminal block: A, B, SG	<b>Protection</b>	IP20 (IEC60529)
<b>USB port</b>	1 x Mini-USB Type Mini B. Power consumption: max. 400mA @ 5 Vdc	<b>LED indicator</b>	1 x external LED – operational status
<b>Buttons</b>	1 x Button		



### 7 List of compatible AC indoor units.

This interface is compatible with almost every AC indoor unit with IR (infrared) control. Check if your AC unit is already integrated in this [link](#).

If your AC unit or IR remote controller were not in the list, contact Intesis TS Team to confirm if the IR remote is already integrated or how to initiate the integration process.