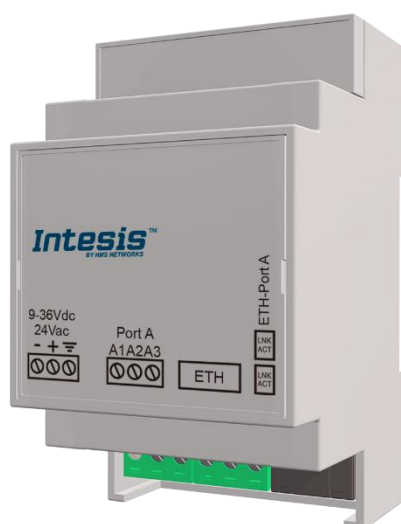


Modbus Server

Open Charge Point Protocol (OCPP)

USER MANUAL

Issue date: 11/2021 r1.5 ENGLISH



Important User Information

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Gateway for the integration of OCPP Charging Points into Modbus TCP or RTU enabled systems and external OCPP Central Systems

ORDER CODES	LEGACY ORDER CODE
INMBSOCP0010100	-
INMBSOCP0200100	-

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1 Description

1.1 Introduction

This document describes how to integrate OCPP devices (EV Chargers) into Modbus TCP and RTU compatible devices and systems, or into an external OCPP Central System (CS), through Intesis Modbus - OCPP gateway. An assumption is made that the user is familiar with Modbus and OCPP technologies and their technical terms.

When working as an OCPP Central System, the gateway enables OCPP signals and operations to be managed by a Modbus controller acting as a closed OCPP system. Alternatively, the gateway can be configured to connect to an External OCPP Central system, providing transparent OCPP communication between EV chargers and the external OCPP CS while reading out valuable information for Modbus supervisory applications.

The gateway acts as a Modbus TCP Server or a Modbus RTU slave in its Modbus interface, allowing a Modbus client/master device to read/write to its internal points. From OCPP standpoint, Intesis gateway parses data from OCPP messages to their corresponding Modbus registers or directly transmits to an External OCPP system. In every OCPP installation, one and only one Central System must be present. Options are:

- Central System implemented in a Modbus enabled control system
- External OCPP Central System, and Modbus supervisory applications.

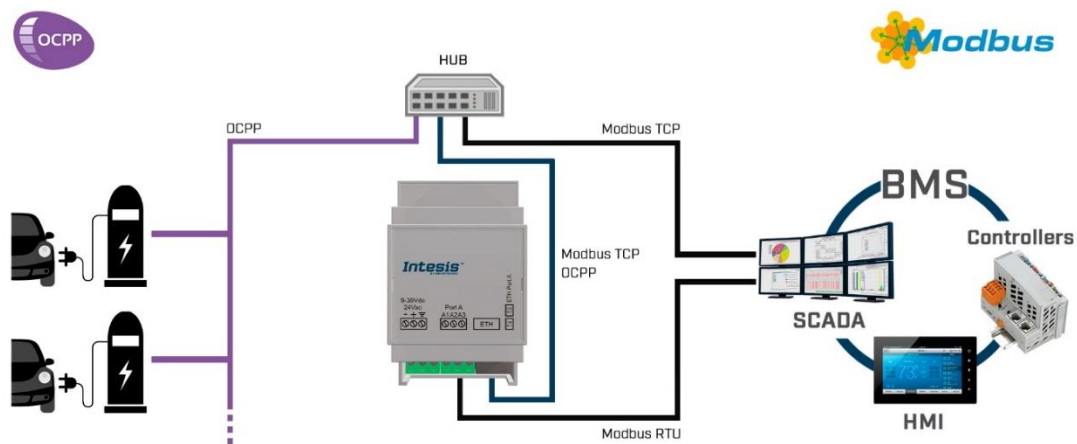


Fig 1.1 Use case 1: Integration of OCPP EV Charging points into a Modbus BMS (TCP or RTU)

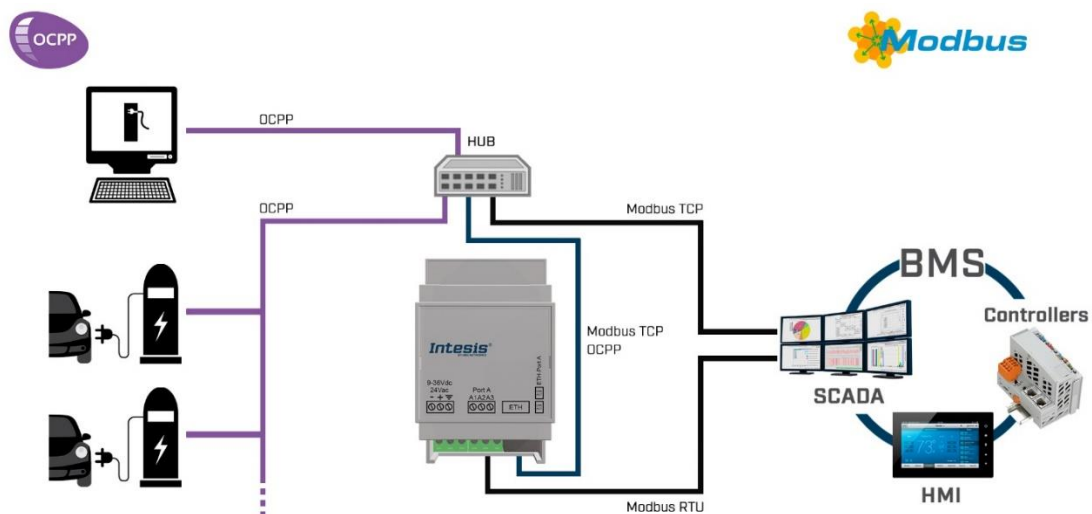


Fig 1.2 Use case 2: Modbus gateway acting as a bridge between an external OCPP Central System and OCPP chargers

1.2 Functionality

The configuration tool for this gateway is Intesis® MAPS software. For a detailed information about the necessary steps to integrate the gateway in a Modbus BMS, please review the *Intesis Configuration Guide* for more information. Available in www.intesis.com

From the OCPP system standpoint, after the start up process, all EV Chargers will try to connect with Intesis gateway (Intesis gateway must be configured as a Central System in the EV Chargers configuration). Only if the gateway has EV Chargers configured will accept the connections. Then EV Chargers will notify any event or update to the gateway.

When working as a Central System, after the start up process, the gateway presents its points as Modbus Registers, to be read or written by a Modbus client/master device using standard Modbus functions. The values received from Modbus are immediately written in an OCPP message and sent to the EV Charger.

When working with an External Central System, the gateway must be configured to connect to the IP of the External Central system to, after the start up process, enable transparent OCPP communication between the EV chargers and the Central System. At the same time, the gateway presents its points as Modbus Registers, to be read by a Modbus client/master device using standard Modbus functions.

1.3 Gateway's capacity

Intesis gateway capacity is detailed below:

Element	Capacity	Notes
Number of OCPP devices	Model INMBSOCP0010100: 1 device	Maximum number of different OCPP devices/chargers the Intesis gateway can communicate to
	Model INMBSOCP0200100: Up to 20 devices	
Connectors per device supported	7	Maximum number of connectors integrable from an OCPP device
OCPP protocol version supported	OCPP 1.6	JSON version implemented
Modbus link layers supported	Modbus RTU (EIA485) Modbus TCP	Those supporting Modbus protocol. Communication over TCP/IP and RTU
Number of Modbus Master devices	Up to 6 TCP connections	Number of Modbus Client devices supported by the device

2 Modbus interface

2.1 Description

Intesis acts as a server device in its Modbus TCP or RTU interface, connecting to the Ethernet port of the gateway or the RS485 port. To access the points and resources of the Intesis from a Modbus client/master device, see details below in this document.

2.2 Functions supported

Modbus functions 01 and 02 (*coils and digital input registers*) can be used to read Modbus registers.

Modbus functions 03 and 04 (*read holding registers and read input registers*) can be used to read Modbus registers.

Modbus functions 05 and 15 (*Single digital Holding Registers and Write Multiple Holding Registers*) can be used to write Modbus registers.

Modbus functions 06 and 16 (*Single Multiple Holding Registers and Write Multiple Holding Registers*) can be used to write Modbus registers.

If *poll records* are used to read or write more than one register, it is necessary that the range of addresses requested contains valid addresses, if not the corresponding Modbus error code will be returned.

All the registers are of 2 bytes, even if they are associated to signals of type bit in the external system, and its content is expressed in MSB..LSB.

Modbus error codes are fully supported; they will be sent whenever a non-valid Modbus action or address is required.

2.3 Modbus TCP

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

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

2.4 Modbus RTU

Connect the communication cable coming from the Modbus network to the port marked as Modbus of Intesis. Connect the EIA485 bus to connectors A3 (B+), A2 (A-) and A1 (SGND). Respect the polarity.

Remember the characteristics of the standard EIA485 bus: maximum distance of 1200 meters, maximum 32 devices connected to the bus, and in each end of the bus it must be a termination resistor of 120 Ω .

2.5 Address Map

The Modbus address map is predefined and it's not configurable. Check the *Configuration Guide* to find a list with all the available registers implemented in the gateway.

2.6 Points definition

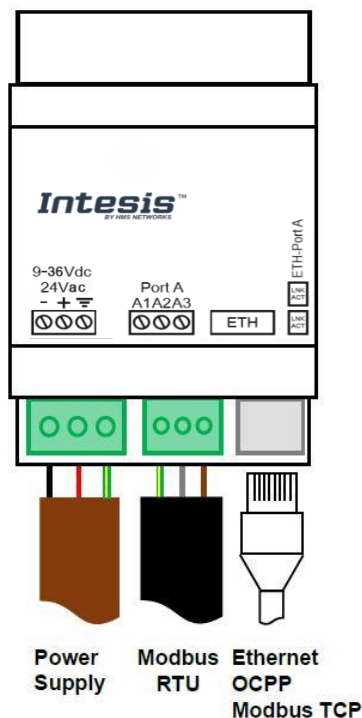
Every point defined in the gateway has the Modbus *Format*, *Point* and *R/W* features associated to it.

Each point defined in Intesis has the following Modbus features associated to it:

Feature	Description
#Bits	One of the following bit lengths can be used: • 1 bit • 16 bits • 32 bits
Data Coding Format	One of the following Modbus data coding formats can be used: • 16/32 unsigned. • 16/32 bits signed (one's complement – C1). • 16/32 bits signed (two's complement – C2). • 16/32 bits Float. • 16/ bits Bitfields. • Error comm
Function code	One of the following Modbus function codes can be used: • 1- Read Coils. • 2- Read Discrete Inputs. • 3- Read Holding Registers. • 4- Read Input Registers. • 5- Write Single Coil. • 6- Write Single Register. • 15- Write Multiple Coils. • 16- Write Multiple Registers.
Byte Order	• Big Endian • Little Endian • Word Inverted Big Endian • Word Inverted Little Endian
Register Address	The Modbus register address inside the slave device for the point.
Bit inside the register	Bit inside the Modbus register (optional). The gateway allows bit decoding from generic 16 bits input/holding Modbus registers. <i>Bit coding into 16 bits input/holding Modbus registers is used for some devices to encode digital values into this type of registers, being these registers normally accessible using Modbus function codes 3 and 4 (read holding/input registers).</i>
Read/Write	0: Read 1: Write 2: Read / Write

3 Connections

Find below information regarding the Intesis connections available.



Power Supply

Must use NEC Class 2 or Limited Power Source (LPS) and SELV rated power supply. Respect polarity applied of terminals (+) and (-). Be sure the voltage applied is within the range admitted (check table below). The power supply can be connected to earth but only through the negative terminal, never through the positive terminal.

Ethernet / Modbus TCP / OCPP

Connect the cable coming from the IP network to the connector ETH of the gateway. Use an Ethernet CAT5 cable. If communicating through the LAN of the building, contact the network administrator and make sure traffic on the port used is allowed through all the LAN path (check the gateway user manual for more information). With factory settings, after powering up the gateway, DHCP will be enabled for 30 seconds. After that time, if no IP is provided by a DHCP server, the default IP 192.168.100.246 will be set

Port Modbus RTU

Connect the EIA485 bus to connectors A3 (B+), A2 (A-) and A1 (SNGD) of Intesis gateway's Port. Respect the polarity.

Note for EIA485 port; Remember the characteristics of the standard EIA485 bus: maximum distance of 1200 meters, maximum 32 devices connected to the bus, and in each end of the bus it must be a termination resistor of 120 Ω Not used.

Fig 3.1 Connections

Ensure proper clearance for cables (see section 6).

Terminal Wiring (for power supply and low-voltage signals)	Per terminal: solid wires or stranded wires (twisted or with ferrule) 1 core: 0.5mm ² ... 2.5mm ² 2 cores: 0.5mm ² ... 1.5mm ² 3 cores: not permitted
Power	1 x Plug-in screw terminal block (3 poles) Positive, Negative, Earth 9-36 VDC / 24 VAC / 50-60 Hz / 0.140 A / 1.7 W
Ethernet	1 x Ethernet 10/100 Mbps RJ45 2 x Ethernet LED: port link and activity
Port	1 x Serial EIA485 (Plug-in screw terminal block 3 poles) A1, A2, A3 (Reference ground or shield) 1500VDC isolation from other ports

3.1 Powering the device

A power supply working with any of the voltage range allowed is needed (check section 5).

WARNING! To avoid earth loops that can damage the gateway and/or any other equipment connected to it, we strongly recommend:

- The use of DC power supplies, floating or with the negative terminal connected to earth. **Never use a DC power supply with the positive terminal connected to earth.**

3.2 Connection to Modbus

3.2.1 Modbus TCP

Connect the communication cable coming from the network HUB or switch to the ETH port of Intesis. The cable to be used shall be a straight Ethernet UTP/FTP CAT5 cable.

3.2.2 Modbus RTU

Connect the communication cable coming from the Modbus network to the port marked as Modbus of Intesis. Connect the EIA485 bus to connectors A3 (B+), A2 (A-) and A1 (SGND). Respect the polarity.

Observe standard EIA485 bus specifications: maximum distance of 1200 meters, maximum of 32 devices connected to the bus, and in each end of the bus it must be a termination 120 Ω resistor.

3.3 Connection to the configuration tool

This action allows the user to have access to configuration and monitoring of the device (more information can be found in the configuration tool User Manual). One method to connect to the PC can be used:

- **Ethernet:** Using gateway's Ethernet port.

4 Set-up process and troubleshooting

4.1 Pre-requisites

It is necessary to have a Modbus TCP client or RTU master device operative and properly connected to the corresponding Modbus port of Intesis and OCPP devices connected to its corresponding ports as well.

An External OCPP system is required in the system if the External OCPP Central System functionality is enabled.

Connectors, connection cables, PC to use the configuration tool and other auxiliary material, if needed, are not supplied by HMS Industrial Networks S.L.U for this standard integration.

Items supplied by HMS Networks for this integration are:

- Intesis gateway.
- Link to download the configuration tool.
- Product documentation.

4.2 Intesis MAPS. Configuration & monitoring tool for Intesis Modbus series

4.2.1 Introduction

Intesis MAPS is a Windows® compatible software developed specifically to monitor and configure Intesis Modbus series. In this document, only the specific case of Modbus OCPP gateway will be covered. The installation procedure and main functions are explained in the *Intesis MAPS User Manual*. This document can be downloaded from Intesis product website at <https://www.intesis.com/>

Please check the *Intesis MAPS User manual* and *Configuration guide* for specific information about the different parameters and how to configure them.

4.2.2 Connection

To configure the Intesis connection parameters press on the **Connection** button in the *menu bar*.

Connection Parameters

Connection Type: ☒ IP ☐ USB Port

Discovered Gateways: IBOX-MBS-OCPP

Description	Value
Gateway Name	IBOX-MBS-OCPP
Serial Number	000K48355
Application Name	IBOX-MBS-OCPP
License	20
License Comments	-
Version	1.0.1.0 RC2
Config file name	IBOX-MBS-OCPP
Last Configuration Date	29/12/2020 13:08:44
MAC Address	CC:3F:1D:02:B5:8E
IP Address	192.168.1.1
Netmask	255.255.255.0
Gateway	0.0.0.0
DHCP	OFF
Current Date Time	-
Gateway Operating Time	0000d 00:01:05

Refresh

Gateway IP : Port: 192.168.1.1:23 Disconnect Connect Pwd: *****

Fig 4.1 MAPS connection settings

4.2.3 Configuration tab

Select the **Configuration** tab to configure the connection parameters. Three subsets of information are shown in this window: General (Gateway general parameters), Modbus slave (Modbus TCP and RTU interface configuration) and OCPP (OCPP configuration and devices parameters).

General

General Configuration

Gateway Name: IBOX-MBS-OCPP

Project Description: Intesis OCPP to Modbus Gateway

Connection

☒ Enable DHCP

IP Address: 192.168.100.246

Netmask: 255.255.255.0

Default Gateway:

Password:

USB Host:

Edit USB Configuration: Edit

Security

Edit Security Configuration: Edit

Fig 4.2 Configuration tab – General Configuration

Modbus Slave

Modbus Configuration

Type: RTU + TCP

Byte Order 32 bits registers: Big Endian

Notification on MB Write: ☒ Always ☐ On Change of Value

TCP Configuration

Port: 502

Keep Alive: 10 mins

RTU Configuration

Connection Type: 485

Baudrate: 9600

Data Type: 8bit / None / 1

Slave Number: 1

Fig 4.3 Configuration tab – Modbus Configuration

OCPP

Gateway Configuration

OCPP Type: ☒ BMS Central System ☐ External Central System

IP: 192.168.100.200

Port: 9000

Check Connection

OCPP Scan

Search Chargers on the Network: Scan

Chargers Configuration

Charger	Charger Id	# Connectors	Description
☐ Charger 13	13	1	
☐ Charger 14	14	1	
☐ Charger 15	15	1	
☐ Charger 16	16	1	
☐ Charger 17	17	1	
☐ Charger 18	18	1	
☐ Charger 19	19	1	
☐ Charger 20	20	1	

Heartbeat Interval: 1 mins

TCP Configuration

Port: 9000

Keep Alive: 10 mins

Smart Charging

Enable Smart Charging Operations: ☐

Smart Charging Operations
Only available under BMS Central System OCPP type

Fig 4.4 Configuration tab – OCPP Configuration

The **OCPP** Configuration window allows for the following settings:

- **OCPP type:** select the OCPP mode for the gateway
 - **BMS Central System:** Gateway and BMS act as an OCPP Central System
 - **External Central System:** Gateway acts as a bridge between an external OCPP CS and OCPP chargers
 - **IP:** The IP of the external OCPP CS
 - **Port:** The port of the external OCPP CS
 - **Check connection.** Press this button to stablish a test connection between the gateway and the External Central System.
- **OCPP Scan.** Press this button to search for OCPP Chargers in your network. Scan function will generate a list of all chargers that are trying to connect with the gateway. – Note that chargers must be configured first to connect to the gateway before they can be discovered with the Scan tool. For more information, please review the *Intesis Configuration Guide*.

Fig 4.5 Scan OCPP network functionality

- **Chargers Configuration:** A list of all available chargers with its corresponding Charger Id and number of connectors. Activating each Charger will change the Signals available in Signals tab. Keep in mind the different capacities for each gateway model.
 - **Heartbeat interval:** Changes the Heartbeat interval time for OCPP messages
- **TCP Configuration port:** Sets the TCP port for the OCPP communication with the OCPP Chargers
- **TCP Keep Alive:** Sets the time of inactivity to send a Keep Alive message (0-disabled)
- **Enable Smart Charging Operations:** Enables the registers necessary to set the charging profile, only available under BMS central system OCPP Type.

4.2.4 Signals

All available OCPP signals, its corresponding Modbus register and other main parameters are listed in the signals tab. More information on each parameter and how to configure it can be found in the Intesis MAPS user manual.

Connection

Configuration *

Signals

Receive / Send

Diagnostic

#	Active	Description	Modbus Slave					OCPP		
			Data L...	Format	Address	Bit	Read / Write	String ...	Charger	Connector
1	☒	Charger information - Charger Communicat...	16	0: Unsigned	100	-	0: Read	-	Charger 1 - fre...	-
2	☒	Charger information - Charge Box Serial Nu...	-	5: String	101	-	0: Read	26	Charger 1 - fre...	-
3	☒	Charger information - Charge Point Serial N...	-	5: String	114	-	0: Read	26	Charger 1 - fre...	-
4	☒	Charger information - Charge Point Vendor	-	5: String	127	-	0: Read	20	Charger 1 - fre...	-
5	☒	Charger information - Charge Point Model	-	5: String	137	-	0: Read	20	Charger 1 - fre...	-
6	☒	Connector 0 - Availability	16	0: Unsigned	613	-	2: Read / Write	-	Charger 1 - fre...	0
7	☒	Connector 0 - status	16	0: Unsigned	614	-	0: Read	-	Charger 1 - fre...	0
8	☒	Connector 0 - errorCode	16	0: Unsigned	615	-	0: Read	-	Charger 1 - fre...	0
9	☒	Connector 0 - L1 Current.Export	32	3: Float	616	-	0: Read	-	Charger 1 - fre...	0
10	☒	Connector 0 - L2 Current.Export	32	3: Float	618	-	0: Read	-	Charger 1 - fre...	0
11	☒	Connector 0 - L3 Current.Export	32	3: Float	620	-	0: Read	-	Charger 1 - fre...	0
12	☒	Connector 0 - Current.Export.Units	16	0: Unsigned	622	-	0: Read	-	Charger 1 - fre...	0
13	☒	Connector 0 - L1 Current.Import	32	3: Float	623	-	0: Read	-	Charger 1 - fre...	0
14	☒	Connector 0 - L2 Current.Import	32	3: Float	625	-	0: Read	-	Charger 1 - fre...	0

Figure 4.6 Intesis MAPS Signals tab

NOTE: Depending on the OCPP mode selected in Configuration, signals list and displayed properties will vary.

4.2.5 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 Intesis MAPS User Manual).
- 2.- You will be prompted to generate the configuration file to be sent to the gateway.
 - a.- If **Yes** is selected, the file 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.- 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.

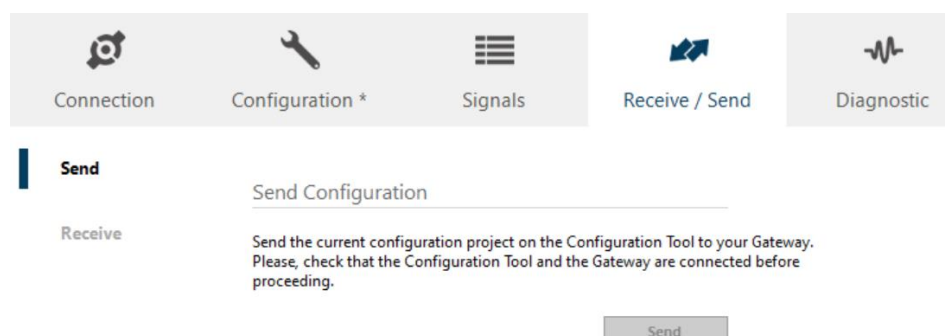


Figure 4.7 Intesis MAPS Receive/Send tab

IMPORTANT! After any configuration change, send the configuration file to the Intesis using button Send File.

4.2.6 Diagnostic

To help integrators in the commissioning tasks and troubleshooting, the Configuration Tool offers some specific tools and viewers.

To start using the diagnostic tools, connection with the Gateway is required.

The Diagnostic section is composed by two main parts: Tools and Viewers.

- **Tools**

Use the tools section to check the current hardware status of the box, log communications into compressed files to be sent to the support, change the Diagnostic panels' view or send commands to the gateway.

- **Viewers**

To check the current status, viewer for the Internal and External protocols signals are available. It is also available a generic Console viewer for general information about communications and the gateway status and finally a Signals Viewer to simulate the BMS behaviour or to check the current values in the system.

The screenshot displays the Intesis MAPS software interface. The top menu bar includes Home, Project, Tools, View, and Help. Below the menu is a toolbar with icons for Connection, Configuration, Signals, Receive / Send, and Diagnostic. The main window is divided into several panes. On the left, there's a 'ToolBox' and a 'Console' pane. The central area is split into a 'Modbus Slave Viewer' and an 'OCPP Viewer'. The rightmost pane is the 'Signals Viewer', which contains a table of signals.

#	Modbus	OCPP	Description	Format	Address	Read / Write	
1			BMS Communication & Time sync - Heartb...	0: Unsigned	0	2: Read / Write	-
2			BMS Communication & Time sync - SECOND	0: Unsigned	1	2: Read / Write	-
3			BMS Communication & Time sync - MINUTE	0: Unsigned	2	2: Read / Write	-
4			BMS Communication & Time sync - HOUR	0: Unsigned	3	2: Read / Write	-
5			BMS Communication & Time sync - DAY	0: Unsigned	4	2: Read / Write	-
6			BMS Communication & Time sync - MONTH	0: Unsigned	5	2: Read / Write	-
7			BMS Communication & Time sync - YEAR	0: Unsigned	6	2: Read / Write	-
8			Charger information - Charger Communicat...	0: Unsigned	100	0: Read	C
9			Charger information - Charge Box Serial Nu...	5: String	101	0: Read	C
10			Charger information - Charge Point Serial N...	5: String	114	0: Read	C
11			Charger information - Charge Point Vendor	5: String	127	0: Read	C
12			Charger information - Charge Point Model	5: String	137	0: Read	C
13			Authorization Registers - Authorization Flag	0: Unsigned	164	0: Read	C
14			Authorization Registers - Id Tag Authorization	5: String	165	0: Read	C
15			Authorization Registers - Authorization proc...	0: Unsigned	177	1: Trigger	C
16			Authorization Registers - Parent Id Tag	5: String	178	1: Trigger	C
17			Authorization Registers - Expiration Date	0: Unsigned	188	1: Trigger	C
18			Authorization Registers - Authorization result	0: Unsigned	190	1: Trigger	C
19			Start Transaction Registers - Start Transactio...	0: Unsigned	194	0: Read	C
20			Start Transaction Registers - Connector ID	0: Unsigned	195	0: Read	C
21			Start Transaction Registers - Id Tag	5: String	196	0: Read	C

At the bottom of the interface, a status bar shows 'Not Connected' on the left and 'BMS Protocol: Modbus Slave | Device Protocol: OCPP | 10:39:05 2020/09/04' on the right.

Figure 4.8 Diagnostic

NOTE: Depending on the OCPP mode selected in Configuration, signals list and displayed properties will vary.

Refer to the Configuration Tool manual for more information.

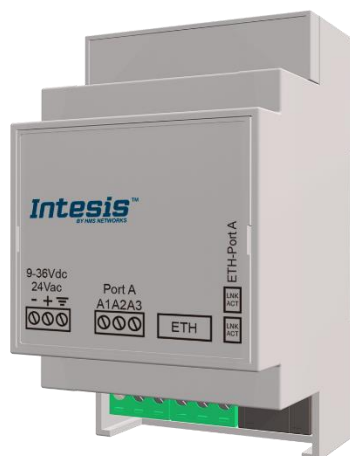
4.3 Set-up procedure

1. Install Intesis MAPS 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. Installation can be on DIN rail or on a stable not vibrating surface (DIN rail mounted inside a metallic industrial cabinet connected to ground is recommended).
3. If using, Modbus RTU, connect the communication cable coming from the EIA485 port of the Modbus RTU installation to the port marked as Port A of Intesis (More details in section 3).
4. Connect the communication cable coming from the Modbus TCP and/or OCPP installations to the port marked as ETH of Intesis gateway (More details in section 3).
5. Power up Intesis. The supply voltage can be 9 to 24 Vdc. Take care of the polarity of the supply voltage applied.

WARNING! To avoid earth loops that can damage Intesis and/or any other equipment connected to it, we strongly recommend:

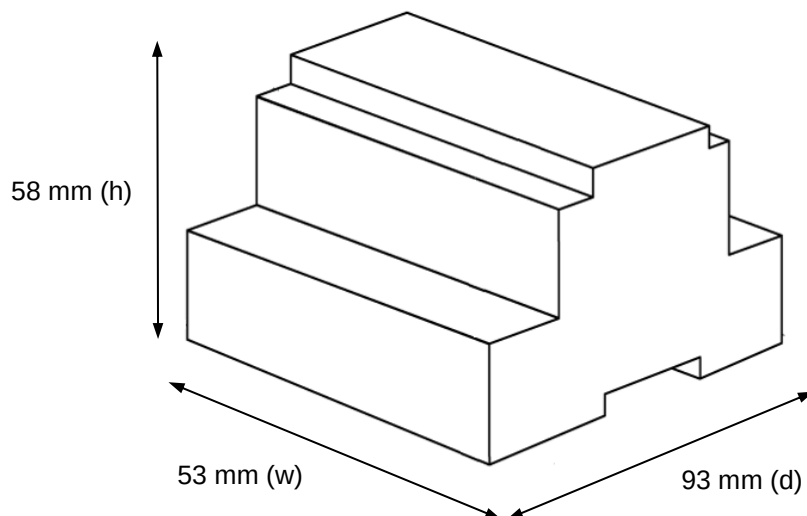
- The use of DC power supplies, floating or with the negative terminal connected to earth. **Never use a DC power supply with the positive terminal connected to earth.**
6. If you want to connect using IP, connect the Ethernet cable from the laptop PC to the port marked as ETH of Intesis (More details in section 3).
 7. Open Intesis MAPS and create a new project by selecting a copy of the one named **INMBSOCPxxx0100**.
 8. Modify the configuration as desired (refer to Configuration Guide for more details) save it and download the configuration file to Intesis as explained in the Intesis MAPS user manual.
 9. Visit the Diagnostic section and check that there is communication activity, some TX frames and some other RX frames. This means that the communication with the Modbus TCP Client device/s and OCPP devices is OK. In case there is no communication activity between Intesis and the OCPP or Modbus devices, check that those are operative: check the baud rate, the communication cable used to connect all devices and any other communication parameter.

5 Electrical & Mechanical Features



Enclosure	Plastic, type PC (UL 94 V-0) Net dimensions (d×w×h): 93x53x58 mm Recommended space for installation (d×w×h): 100x60x70mm Color: Light Grey. RAL 7035
Mounting	Wall. DIN rail EN60715 TH35.
Terminal Wiring (for power supply and low-voltage signals)	Per terminal: solid wires or stranded wires (twisted or with ferrule) 1 core: 0.5mm ² ... 2.5mm ² 2 cores: 0.5mm ² ... 1.5mm ² 3 cores: not permitted
Power	1 x Plug-in screw terminal block (3 poles) Positive, Negative, Earth 9-36 VDC / 24 VAC / 50-60 Hz / 0.140 A / 1.7 W
Ethernet	1 x Ethernet 10/100 Mbps RJ45 2 x Ethernet LED: port link and activity
Port	1 x Serial EIA485 (Plug-in screw terminal block 3 poles) A, B, SGND (Reference ground or shield) 1500VDC isolation from other ports
Operation Temperature	0°C to +60°C
Operational Humidity	5 to 95%, no condensation
Protection	IP20 (IEC60529)

6 Dimensions



Recommended available space for its installation into a cabinet (wall or DIN rail mounting), with space enough for external connections

