ENGLISH

Configuration Guide for Samsung EHS and Hydro Units

700 Series Controller - IN780CTROXS0000 Cascade Controller

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Intesis MAPS

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1. Introduction to Intesis MAPS

Intesis MAPS© is a software tool for configuring and monitoring the Intesis® Cascade Controller. Intesis MAPS has been designed and developed in-house, assuring an up-to-date tool to get all the potential of the Intesis Cascade Controller.

NOTE
Intesis MAPS is compatible with Windows® 7 and higher.

The design of this configuration tool focuses on four main pillars:

- A user-friendly interface.
- Multiple ways to create your project:
  - From scratch, using a template.
  - Importing data from your computer.
  - Downloading the settings from an already configured cascade controller.
- Full linkage between the cascade controller and the Samsung EHS or Samsung VRF (DVM) + Hydro unit installation.
- Real-time monitoring of the Samsung EHS or Samsung VRF (DVM) + Hydro unit installation.

2. Prerequisites

To configure the cascade controller, you need:

- The items supplied by HMS Networks:
  - Intesis IN780CTR0XSO000 Cascade Controller
  - Cascade controller documentation:
    - Installation guide
    - User manual
- A PC to run the Intesis MAPS configuration tool.

RECOMMENDED REQUIREMENTS:

- OS: Windows 11
- Display resolution:
  - minimum supported: 1280×720 at 100% scaling (no scaling applied)
  - Recommended resolution: 1920×1080
    (Optimized for 100% scaling; higher scaling may cause layout issues)
- Storage: Minimum 1 GB free space
- RAM: 4 GB

- A compatible USB Type-C cable.

NOTICE
You can use an Ethernet cable instead (not included).

3. Installation

Downloading the software

1. Enter the Intesis MAPS webpage.
2. Click the **Download now** button. The page will scroll down to the download form.
3. Fill out the form.

> **NOTICE**
> You can review the privacy policy section for more information about how HMS processes the form data.

4. Click the **Download** button.
5. A .zip file will be downloaded to your PC.

Installing the software

1. Click the .zip file to open it.
2. Double-click the EXE file.
3. The Intesis MAPS Setup Wizard will guide you through the steps required to install Intesis MAPS on your PC:
   a. Read the license agreement and select **I Agree**.
   b. Select the installation folder.
4. Once the installation is completed, click the **Close** button.

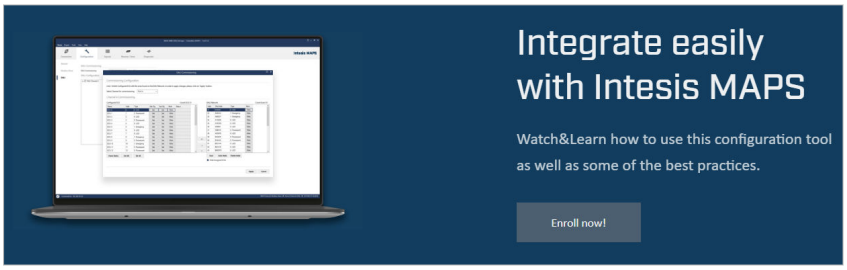
4. First steps in Intesis MAPS

Upon launching Intesis MAPS, you will be greeted with the home screen. This window is divided into two sections: The **Getting Started** column on the left and the **Latest News and Updates** section in the main body.

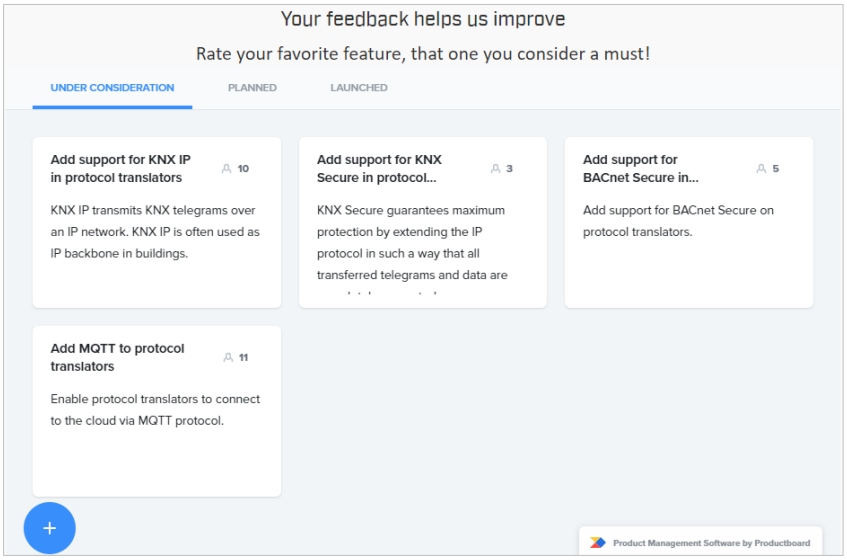
4.1. Latest News and Updates

Through this section, you can:

- Get access to an Intesis MAPS online course.



- Get information about features under consideration for implementation, planned, or recently launched in the features board of the middle section.



NOTE

Click a feature to expand it and rate it. To share a feature, expand it, click the icon, and click on **Copy private link**.

This board also gives the option to submit ideas and suggestions for future features. To submit an idea, click the button and fill out the form.

- You can also enter the HMS Support Portal by clicking the **HMS Support Portal** button at the bottom section.

4.2. Getting Started

This section allows direct access to some of the most commonly used features of Intesis MAPS. These are:

NEWS

- **Latest News and Updates**: Click this option to load the **Latest News and Updates** section.

START

- **Create New Project**: Click this option to open the **New Project** menu.

> **NOTE**
> To know more about creating a new project, consult the section Create a New Project from a Template.

- **Load Project**: Click this option to load an Intesis MAPS project (.ibmaps file) to Intesis MAPS.

1. Use the new dialog to look for the file and select it.
2. Click **Open** or double-click the file.
3. The project will be loaded to Intesis MAPS.

> **NOTE**
> For more information about file management, consult the section Saving, Opening, Importing, and Exporting the Project (page 10).

- **Get Project from Device**: Click this option to import the Intesis MAPS project file (.ibmaps file) directly from a cascade controller.

1. Connect the cascade controller to the computer.

> **NOTE**
> For more information on connecting the cascade controller to your computer, consult the section Connection Tab (page 32).

2. On the **Discovered Devices** dialog, select the way you connected the cascade controller:
   a. **IP**: If you are using the **Ethernet Port** of the cascade controller.
   b. **USB**: If you are using the **USB-C** port of the cascade controller.
3. Select the cascade controller name (for IP) or the computer COM port (for USB) from the list.

> **NOTICE**
> If the cascade controller name or the computer COM port does not appear, click the **Refresh** button.
>
> If the problem persists, ensure the cascade controller and the computer are correctly connected.

4. Once selected, the options on the right will autofill.
5. Click **Import Project**.
6. Once downloaded, use the **Save file** dialog to type a name for the file and select a folder to save it.

- **Config IP settings**: This section lists the discovered devices in the network. Select a cascade controller from the list to check its properties and to gain direct access to the **Identify** and **Edit** functions.

> **NOTE**
> These two functions are covered in the section Connection Tab (page 32).

- **Import Project From USB Host**: Opens a file browser to select an Intesis MAPS project file in USB MAPS Project format (.exmaps) to load.

> **NOTE**
> This feature does not apply to the cascade controller. For more information about file management, consult the section Saving, Opening, Importing, and Exporting the Project (page 10).

RECENT

- **Recent**: A list of up to the last five projects loaded is available here. To load one of these last projects, click on its name.

> **NOTICE**
> To find out the location of a project, hover the cursor over it, and the corresponding path will appear as a tooltip.

IMPORT

- **Import Project From Linkbox**: This special function allows the use of old Linkbox projects in Intesis MAPS.

> **NOTE**
> This feature does not apply to the cascade controller.

UPDATES

- **Update Gateway Firmware**: Use this option to check for updates and load a new firmware version to your gateway.

> **NOTE**
> For more information on connecting the cascade controller to your computer, consult the section Connection Tab (page 32).

> **NOTE**
> Once a project has been loaded, a firmware manager is also available through the **Tools - Firmware** option in the top menu.

1. Click **Update Gateway Firmware**.
2. On the **Discovered Devices** dialog, select the way you connected the gateway to your computer:
   a. **IP**: If you are using the **Ethernet Port** of the gateway.
   b. **USB**: If you are using the **USB-C** port of the gateway.

3. Select the gateway name (for IP) or the computer COM port (for USB) from the list.

> **NOTICE**
> If the gateway name or the computer COM port does not appear, click the **Refresh** button.
>
> If the problem persists, ensure the gateway and the computer are correctly connected.

4. Once selected, the options on the right will autofill.
5. Click **Update Firmware**.

> **NOTICE**
> if the device is connected via IP, you may need to enter the corresponding password. See Connection (page 14)

6. The **Firmware Manager** dialog offers two options to update the gateway's firmware:
   - You have a file with the new firmware version stored locally on your computer:
     a. Click the **Update from File** button.
     b. Select the desired file from your computer.
     c. Click **Open**.
     d. The Firmware Manager displays the current status to the left and the update information to the right. Confirm that the information shown in the **Gateway model** row matches, and then press the **Send** button.
   - You want to update the firmware online:
     a. Click the **Check for Update** button.
     b. The Firmware Manager displays the current status to the left and the latest firmware available online to the right. Confirm that the information shown in the **Gateway model** row matches, and then press the **Send** button.

- **Software Update**: Click this option to update Intesis MAPS.
  - If you are already using the latest version available, a dialog appears informing you that the software is up to date.
  - If there is a new version available, a dialog will show the information about the new version and three options:
    - **Skip this version**: Click this option to avoid the software update.

> **IMPORTANT**
> Each new version of Intesis MAPS includes improvements, issue fixes, support for new products, etc. It is recommended to keep the software up to date.

    - **Remind me later**: When clicking this option, a new dialog appears, allowing you to select the time lapse for the reminder or to download the update now.
    - **Update**: The new software version will be downloaded to your computer, and the setup wizard will be launched.

LANGUAGE

- **Select language**: Click this option to change the language.

1. Select a language from the dialog.
2. Click **Save**.
3. To apply the new selected language, close Intesis MAPS and re-open it.

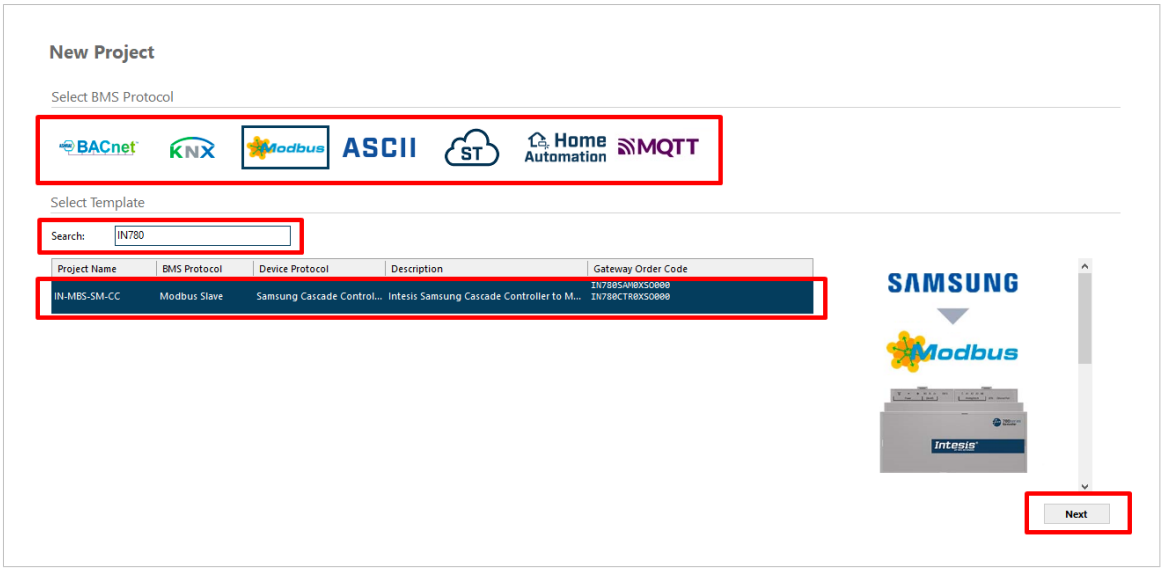
5. Create a New Project from a Template

1. Open Intesis MAPS.
2. Click **Create New Project** in the **Start** menu on the left.
   You can create a project from scratch using a template. To find the appropriate template, filter the search by:
   - Clicking Modbus on the protocol logos.
   - Typing the order code in the **Search** field.

     NOTE
     The order code is printed on the silver label placed on the cascade controller's right side.

   - Looking for the **Project Name** on the list: IN-MBS-SM-CC.

Figure 1. Three possibilities for the template selection



3. Select the desired template.
4. Click **Next** or **double-click the template** on the list.

NOTE
Templates are just a starting point for the configuration of the cascade controller. After selecting a template, further configuration is necessary to adapt it to your current installation.

6. Saving, Opening, Importing, and Exporting the Project

While working on your project with Intesis MAPS, an asterisk appears on the **Configuration** tab, as shown in this picture below:

Figure 2. The Configuration tab showing an asterisk

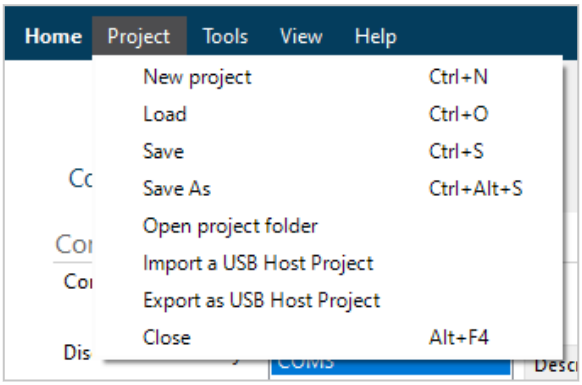
This asterisk reminds you that you have made changes to the project but have not saved them or sent the project to the cascade controller yet. To know how to send your project to the cascade controller, see Receive/Send Tab (page 36).

- **SAVING YOUR INTESIS MAPS PROJECT**

> **IMPORTANT**
> Remember to save your project periodically to keep your changes.

1. Click **Project**.

Figure 3. Project tab from the top menu



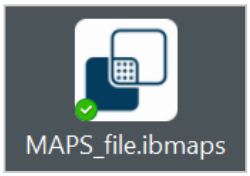
2. Click **Save** or **Save As**.

> **TIP**
> Instead, you can use the shortcut **Ctrl+S** (Save) or **Ctrl+Alt+S** (Save As).

3. On the **Save file** menu, type a **File name** and select where to save the file.
4. Click **Save**.

- **OPENING AN INTESIS MAPS PROJECT FROM YOUR COMPUTER**

> **TIP**
> Double-click a .ibmaps file saved in your computer to open it in Intesis MAPS automatically. The project will open in a new instance of Intesis MAPS, even if another instance is already open.



1. Click **Project**.
2. Click **Load**.
3. On the emergent window, select the desired file from your computer.
4. Click **Open**.

- **IMPORTING AND EXPORTING A USB HOST PROJECT**

> **NOTE**
> These two functions in the **Project** menu use the .expmaps file format, primarily used to load a project via USB to the Intesis gateways that support it. Since the Intesis Cascade Controller doesn't have a USB storage port, these two functions can be safely ignored, and the regular **Save** and **Load** functions should be used instead.

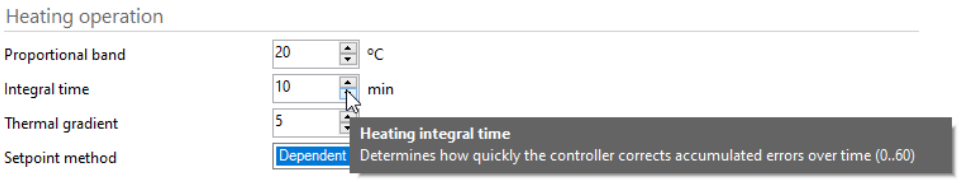
7. Main Menu Overview

Figure 4. Intesis MAPS main menu

The following sections provide an overview of the five tabs that compose the Intesis MAPS main menu. Through these options, you will configure your project, send it to the cascade controller, and monitor that everything works fine using the **Diagnostic** tab.

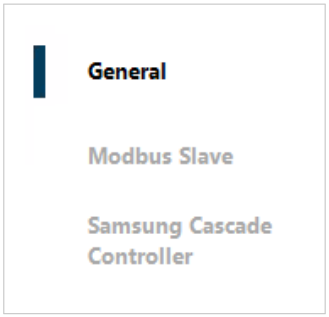
TIP
Tooltip: Hover the cursor over a field, and a message will appear indicating the purpose of the parameter.

Figure 5. Example of a tooltip



8. Configuration Tab

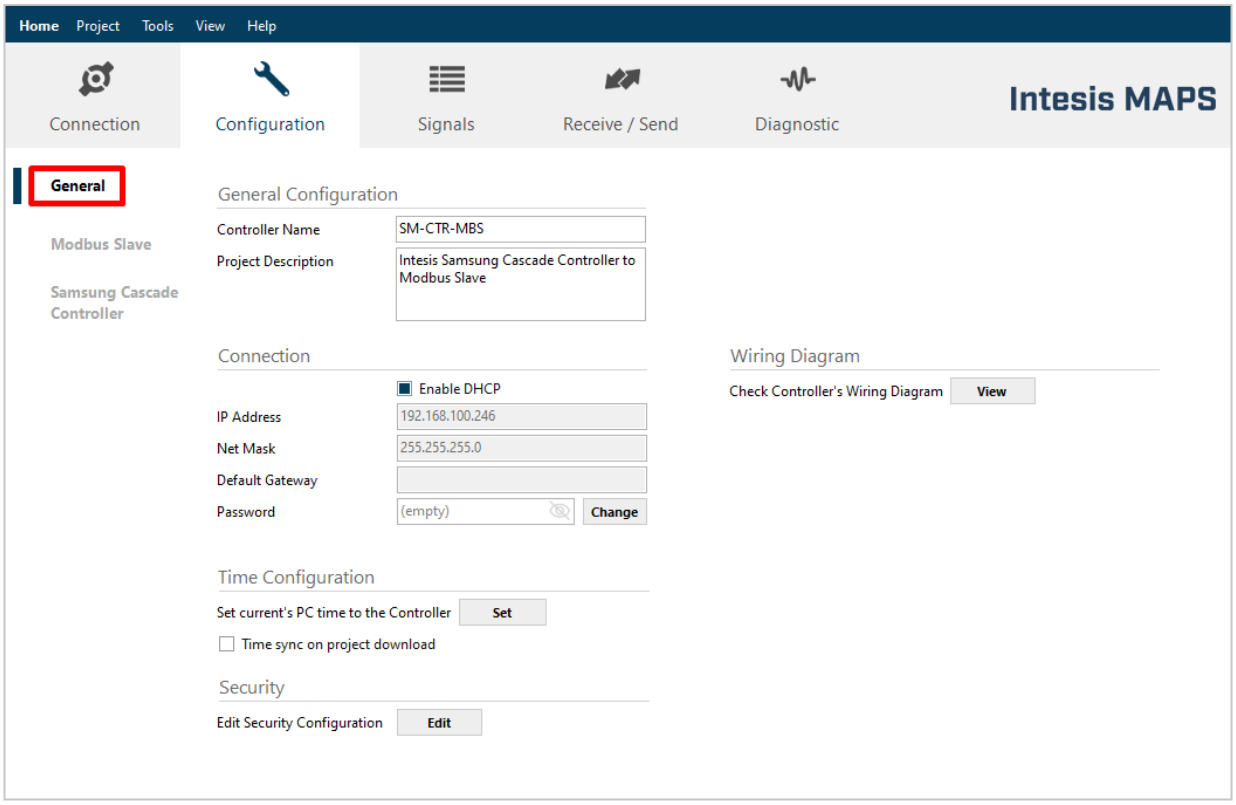
Find a menu with three options on the left side of the **Configuration** tab:



- **General**: Configure the general parameters of the cascade controller.
- **Modbus Slave:** If you are integrating the cascade controller into a building management system (BMS), use this option to configure the parameters for the Modbus BMS.
- **Samsung Cascade Controller**: Detect and configure available heat pump units on the bus, select the operating mode, and configure accordingly.

8.1. General Configuration Menu

Figure 6. General configuration menu on the Configuration tab



Use this menu to configure some general parameters of the cascade controller.

8.1.1. General Configuration

- **Controller Name**: Type a descriptive name for your cascade controller (max. 32 characters).
- **Project Description**: Type a short description of your project (max. 255 characters).

8.1.2. Connection

NOTE
When commissioning the cascade controller for the first time, DHCP will be enabled for 30 seconds. During that time, an IP address will be automatically assigned to the cascade controller if there is a DHCP server. If there is no DHCP, you can type an IP address of your choice. After that time, the default **IP address 192.168.100.246** will be automatically set.

You can find this default IP address written in the installation guide: **Communication ports** table → **Ethernet**.

- **Enable DHCP**: Use this option for networks that have a DHCP server.
  Uncheck this option to unlock the following parameters:
  - **IP Address**: Assign a fixed IP address for the cascade controller.
  - **Net Mask**: Set the cascade controller's IP netmask.
  - **Default Gateway**: Type the IP for the default gateway.

    NOTE
    The **Default Gateway** parameter is a networking concept that refers to the IP address of the device (usually a router) that serves as the access point for sending data from the local network to other networks, including the Internet. Therefore, this field only needs to be filled in if the Intesis Cascade Controller to be configured is connected outside the local network.

- **Preferred DNS Server**: Type the DNS server IP address.
- **Alternate DNS Server**: Type the IP address of an alternative DNS server.

  NOTE
  The cascade controller connects with this alternative DNS server if there is no communication with the **Preferred DNS Server**.

- **Password**. Use this option to visualize the cascade controller's password and set a new one.

  IMPORTANT
  Change the default password before sending the project to the cascade controller. Follow the instructions below.

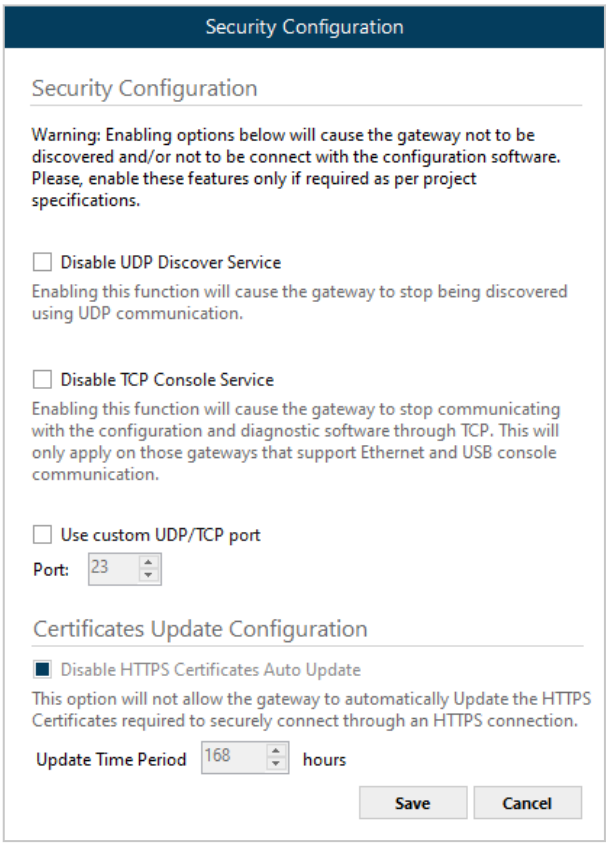
  1. Click the **Change** button.
  2. Enter a new password. Enter it twice to avoid typographical errors. Once the text in the **New Password** and **Confirm Password** fields matches, the **OK** button will become active, allowing you to confirm the new password.
  3. Go to the **Receive/Send** tab.
  4. In the **Send** menu, click the **Send** button.
  5. Go to the **Connection** tab.
  6. Select the cascade controller from the **Discovered Gateways** window.
  7. Click **Connect**.

8.1.3. Security

- **Edit Security Configuration**: Click the **Edit** button to open the **Security Configuration** window.

> **IMPORTANT**
> We recommend keeping the predetermined configuration.

Figure 7. Security Configuration options



- **Security Configuration**:
  - **Disable UPD Discover Service** (disabled by default): The cascade controller is not discoverable through UDP communication.
  - **Disable TCP Console Service** (disabled by default): The cascade controller stops communicating with the configuration and diagnostic software through TCP. This only applies to devices supporting connection to the PC via both Ethernet and console ports.
  - **Use custom UDP/TCP port** (disabled by default): Select this option if you want to manually define the port used to connect to the cascade controller via the IP connection type. Available range: 0 .. 100.
- **Certificates Update Configuration**:
  - **Disable HTTPS Certificates Auto Update** (enabled by default): Automatic updates for the HTTPS certificates are not allowed.

> **NOTICE**
> This option does not apply to the cascade controller and therefore cannot be changed.

Click **Save** to save the changes.

8.1.4. Time Configuration

- **Set current PC time to the controller**: Connect the cascade controller to your PC and click the **Set** button to set the cascade controller's time with your PC's current time.
- **Time sync on project download** (disabled by default): When enabled, the clock on the Cascade Controller is set to the time on your PC when a project is downloaded to it.

This cascade controller supports Network Time Protocol (NTP) time servers. To define a time server, check the **Enable Time Configuration** checkbox and use the following parameters:

- **Time Zone**: Select the correct time zone for your project.
- **NTP Server**: You can define an NTP server using either an IPv4 address or a domain name.

  NOTICE
  The domain name format requires an operative DNS server. This server must be defined manually when DHCP is disabled. See Connection (page 14).

- **NTP Time Period**: Select the interval, in minutes, at which the cascade controller synchronizes its internal clock with the NTP server. Valid range: 1 to 65535 minutes. Default value: **100 minutes**.

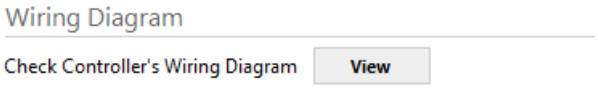
TIP
Having configured this section, synchronization with the NTP server can be triggered at any time through the **Console** viewer in the **Diagnostic** tab. To do so, enter **ntpsync** in the console. The possible responses are:

- **NTP - Success [timestamp]**: Synchronization successful. Gateway time updated to *[timestamp]*.
- **NTP - Error [error description]**: Synchronization failed. Reason: *[error description]*.

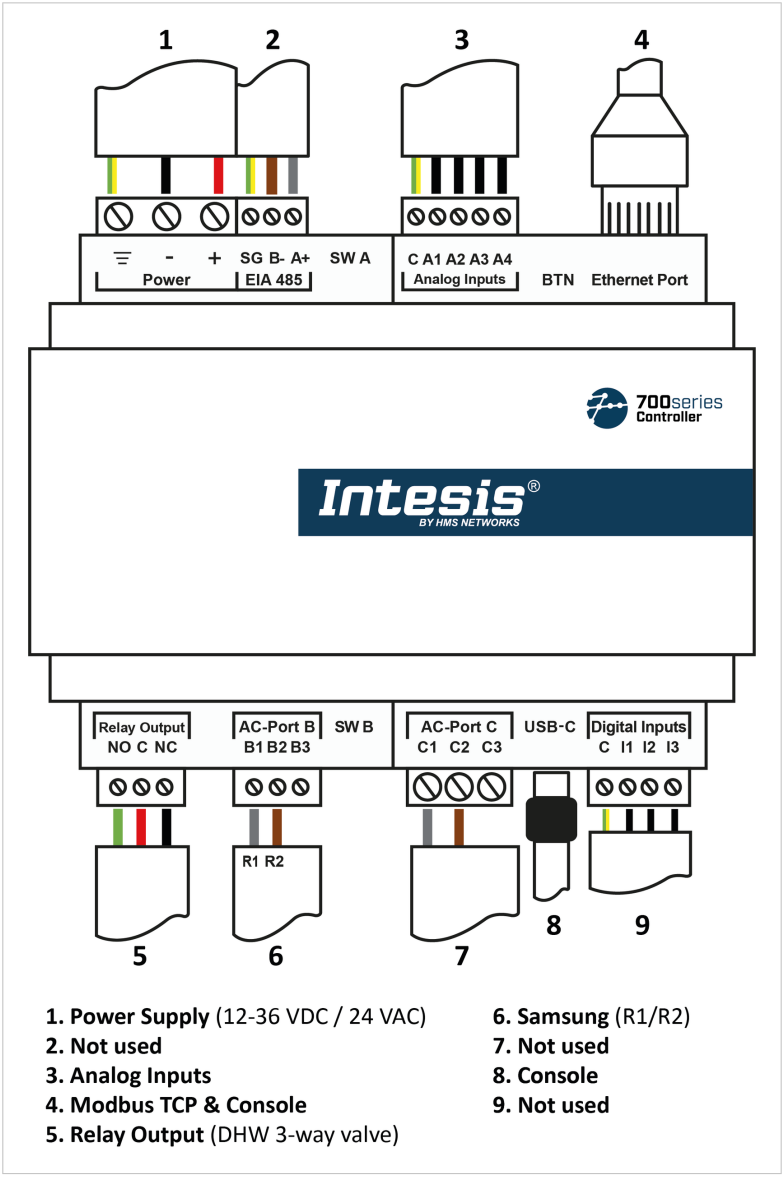
For more information about the **Diagnostic** tab, see Diagnostic Tab (page 37).

8.1.5. Wiring Diagram

Figure 8. Wiring Diagram on the General configuration section



- **Check Controller's Wiring Diagram**: Click the **View** button to open the schematic image on how to wire the cascade controller.



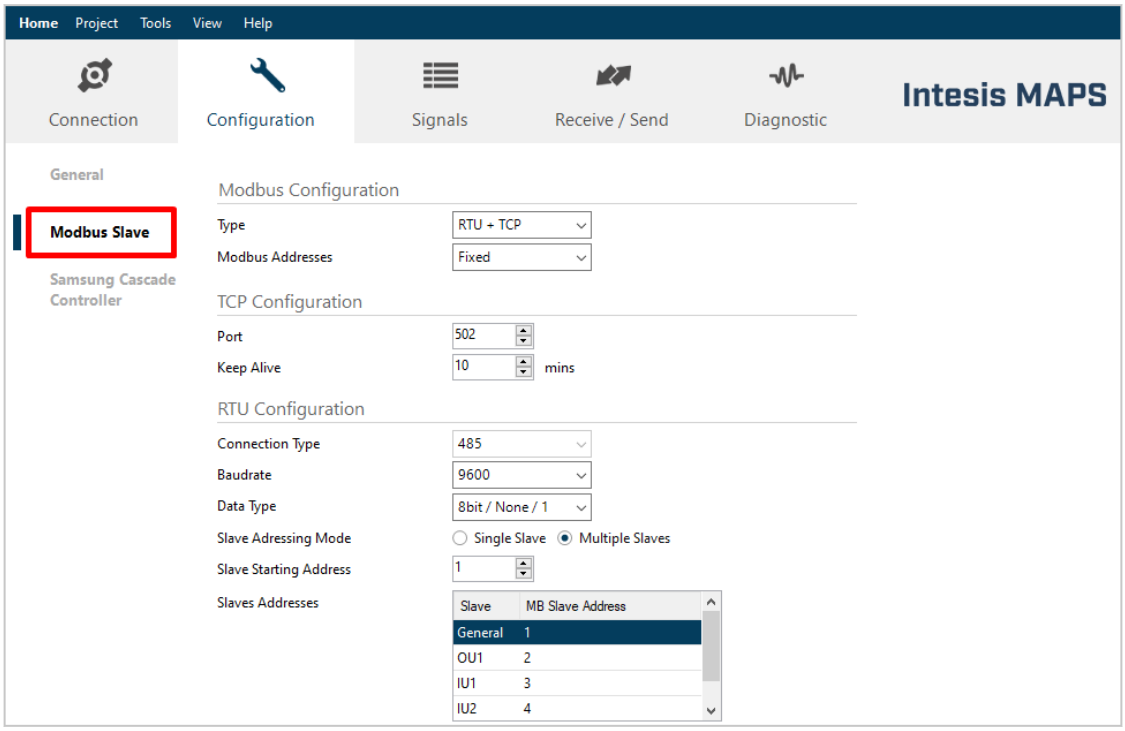
1. **Power Supply** (12-36 VDC / 24 VAC)
2. **Not used**
3. **Analog Inputs**
4. **Modbus TCP & Console**
5. **Relay Output** (DHW 3-way valve)
6. **Samsung** (R1/R2)
7. **Not used**
8. **Console**
9. **Not used**

8.2. Modbus BMS

The Intesis IN780CTR0XSO000 Cascade Controller supports the Modbus TCP communication protocol, allowing the integration of the Samsung EHS or Hydro units installation into a Modbus BMS. The following sections provide all the information needed to configure this protocol on the Cascade Controller properly.

NOTICE
Refer to the User Manual for more information on integration possibilities and available registers.

Figure 9. Modbus configuration parameters



8.2.1. Modbus Configuration

- **Type**: Select the communication type.
  - **RTU**: Serial communication over the EIA-485 bus.

    NOTICE
    Serial communication is currently not supported by the cascade controller.

  - **TCP**: IP communication over Ethernet.
  - **RTU + TCP**: Simultaneous communication: serial over the EIA-485 bus and IP over Ethernet.

    NOTICE
    Since the cascade controller only supports IP communication, use the **TCP** type instead.

- **Modbus Addresses:** Define the type of Modbus register list.
  - **Fixed:** Addresses cannot be modified.
  - **Custom**: The Modbus register list can be freely edited.

8.2.2. TCP Configuration

The following parameters can be customized for the TCP communication type:

- **Port**: Set the port for communication between the cascade controller and the Modbus TCP system (1 .. 65535).

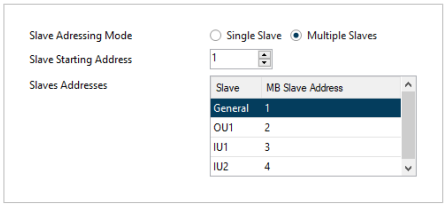
> **NOTE**
> The default port is 502.

- **Keep Alive**: Set the time in minutes before sending a keep-alive message (1 .. 1440. Default value: **10 minutes**).

> **NOTE**
> Set the parameter to 0 to disable this function.

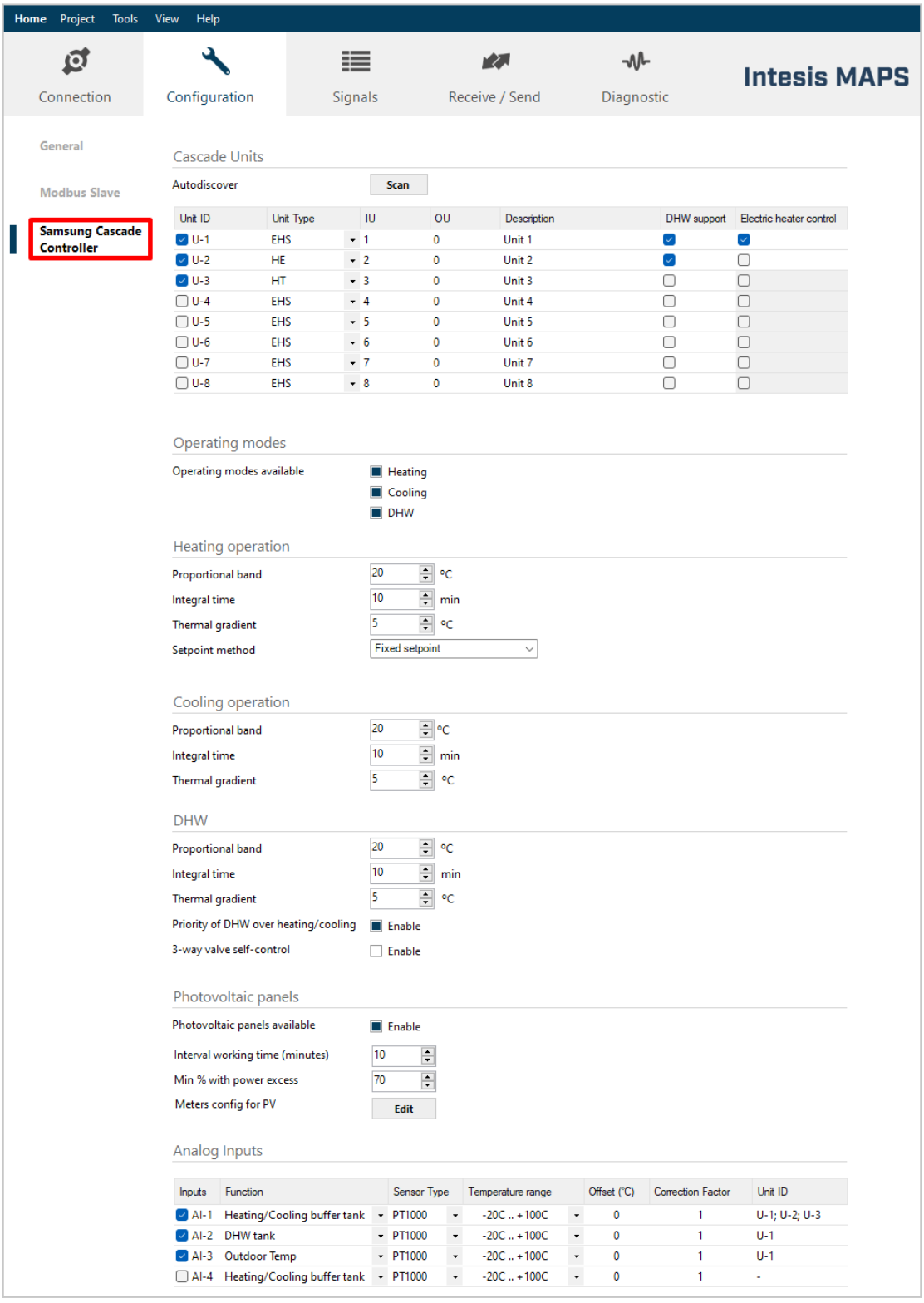
- **Slave Addressing Mode**:
  - Select the **Single Slave** option if you have one single server.
  - If you have multiple servers, select the **Multiple Slaves** option.
- **Slave Starting Address**: Set the server initial address (1 .. 255. Default value: **1**).
- **Slaves Addresses**: if the **Multiple Slaves** option is selected in the **Slave Addressing Mode** section, a table appears here with a **General** address that matches the **Slave Starting Address** value, followed by the supported active units with their assigned Modbus server addresses.

Figure 10. Slave addressing configuration, detail



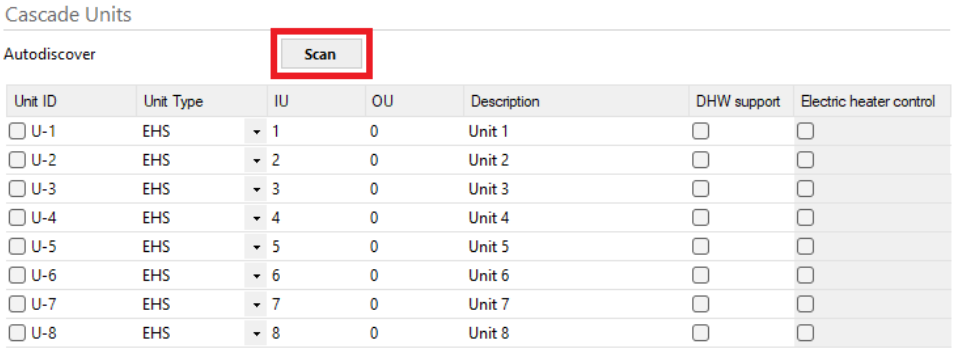
8.3. Samsung Cascade Controller Protocol

Figure 11. Cascade controller parameters inside the Configuration tab



Use this section to select the number of units to control and configure the operating modes, the available sensors (analog inputs), and more. Each section will be discussed in more detail in the following pages.

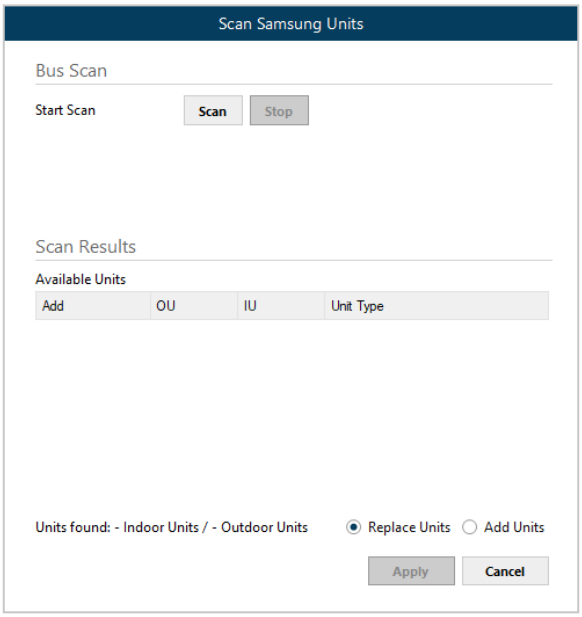
8.3.1. Cascade Units



- **Autodiscover**: Use this function to scan the bus and discover all indoor and outdoor units connected to the installation.

1. Click the **Scan** button to open the **Scan Samsung Units** window:

Figure 12. Bus Scan window



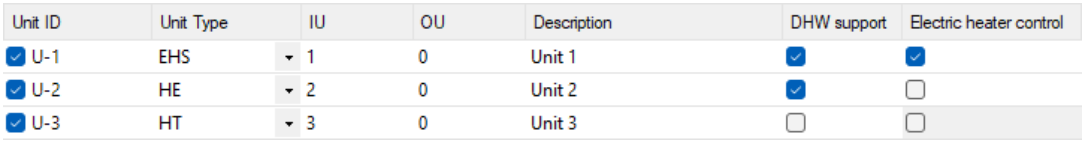
2. Start the bus scanning by clicking the **Scan** button in the **Scan Samsung Units** window. The **Scan Results** table below will populate with the units present on the bus.

IMPORTANT
If a scan has already taken place and the configuration project has been sent to the gateway, you may need to wait for the initialization process to finish before starting a new scan, a process that can take up to one minute. To confirm the completion of the initialization process, look for the **Samsung initialized** message on the **Console Viewer** of the **Diagnostic tab**. For more information, refer to Diagnostic Tab (page 37)

3. Once the scanning has finished, you can select or deselect which units you want to integrate.
   – Check the **Replace Units** option if you want the currently selected units to replace the previously listed units (default).
   – Check the **Add Units** option to add the currently selected units to the previously listed units.
4. Click **Apply** to replace/add the discovered units you have selected to the cascade units table.

- When the units have been added to the cascade units table, they can be configured as needed in the **Cascade Units** table.

Figure 13. Cascade Units table, detail



Unit ID	Unit Type	IU	OU	Description	DHW support	Electric heater control
U-1	EHS	1	0	Unit 1	☑	☑
U-2	HE	2	0	Unit 2	☑	☐
U-3	HT	3	0	Unit 3	☐	☐

The available parameters are:

– **Unit ID**: Use this checkbox to enable or disable the unit.

– **Unit Type**: Currently supported unit types are:
  - **EHS**: Eco Heating System
  - **HE**: DVM with Hydro Unit HE (High Efficiency)
  - **HT**: DVM with Hydro Unit HT (High Temperature)

– **IU**: Indoor unit address (0 .. 63).

– **OU**: Outdoor unit address (0 .. 15).

– **Description**: The default description can be edited to better suit your needs.

– **DHW support**: In some installations, not all units may be dedicated to producing domestic hot water. If this is the case, use this checkbox to specify which units produce domestic hot water. Units with this parameter unchecked will be dedicated exclusively to space heating or cooling, and will not be affected by demand for domestic hot water.

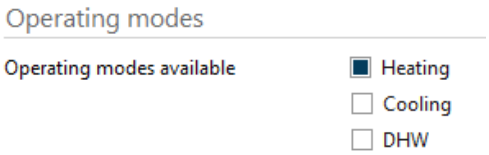
– **Electric heater control**: If an electric heater has been installed in the domestic hot water tank, check the box on the unit to which it is connected. This allows the cascade controller to activate the electric heater through the unit. The electric heater is activated when the system is operating at full capacity, i.e., all outdoor units with domestic hot water support have been running continuously for over ten minutes, and is deactivated when demand decreases and full capacity is no longer required.

NOTICE
In a multi-tank environment, the **Electric heater control** option can be enabled in multiple units, as long as each unit is connected to only one tank. This relationship is defined in the **Function** and **Unit ID** columns of the **Analog Inputs** table. For more information, refer to Analog Inputs (page 30).

IMPORTANT
The **Electric heater control** option can only be selected if the corresponding **DHW support** checkbox for the same unit is also selected.

8.3.2. Operating Modes

Figure 14. Operating modes selection



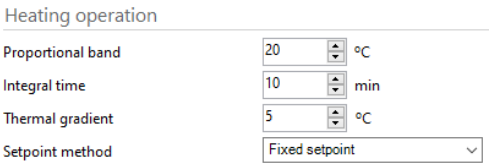
Use this list to select all available modes for the installation. Then, configure them in the specific subsections below.

- **Heating** (Default): The installation provides space heating.
- **Cooling**: The installation provides space cooling.
- **DHW**: The installation provides domestic hot water.

NOTICE
Only the selected modes will be configurable. Unselected modes will not be visible.

8.3.2.1. Heating Operation

Figure 15. Heating operation parameters



In heating mode, the tank temperature can be regulated in two different ways. One method involves continuously comparing the tank's current temperature to a fixed setpoint. The other method computes the setpoint based on an outdoor temperature-dependent heating curve defined by the user, so the tank temperature is adjusted based on outdoor temperature readings.

Regardless of the setpoint method selected, the following parameters are used to help maintain the desired setpoint:

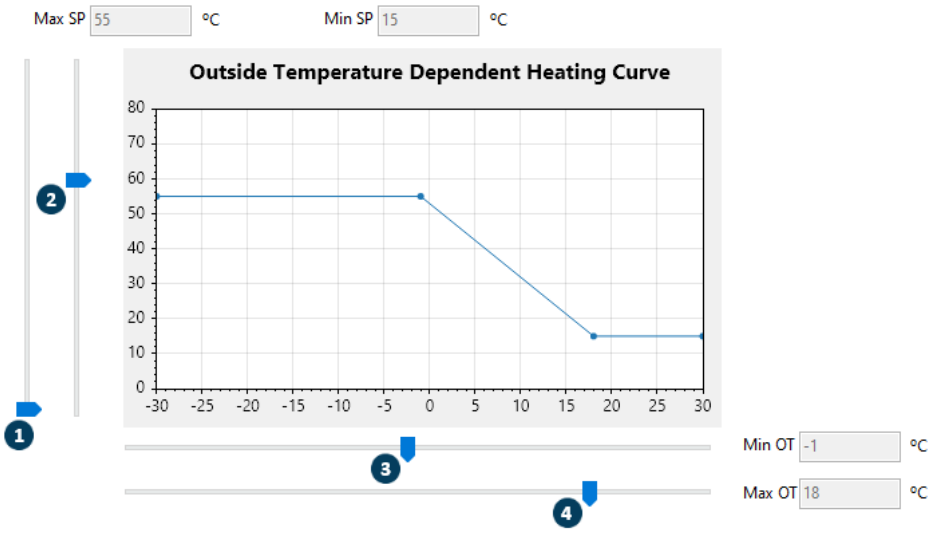
- **Proportional band**: Range of error that allows the controller's output to reach its full capacity, expressed in degrees Celsius. Valid range: 1 .. 60°C. Default value: **20°C**.

NOTICE
In this context, error refers to the difference between the desired setpoint and the measured actual value in the tank. A narrow proportional band is highly sensitive to this difference, while a wide proportional band makes the controller less sensitive to changes.

NOTICE
Example: If the Heating tank setpoint is 40°C and the proportional band is 3°C (7,5%), the proportional control will adjust the output proportionally for errors between 40°C and 37°C, and it will change the output to 100% if the measured actual value drops below 37°C.

- **Integral time**: Determines how quickly the controller corrects accumulated errors over time, expressed in minutes. Valid range: 0 .. 60 minutes. Default value: **10 minutes**.
- **Thermal gradient**: This parameter is used to compensate for the thermal difference between the tank setpoint and the water flow temperature. Valid range: 2 .. 10 °C. Default value: **5°C**.
- **Setpoint method**: Select how the setpoint is set:
  - **Fixed setpoint**: The setpoint is a fixed value, provided from the installation through the **Heating tank setpoint_n (x10) (Heat(15..75°C))** signal.
  - **Dependent heating curve**: With this method, indoor temperature is regulated based on the outdoor temperature. This is defined using a curve based on the building's required heating demand, with the slope of the curve determining how much the temperature should increase or decrease as the outdoor temperature changes. A finely tuned curve helps maintain a consistent and comfortable indoor environment when the outdoor temperature drops, as well as saving energy when the higher outdoor temperature allows it.
    When this option is selected, a graphical representation of the curve with four configurable parameters appears. The horizontal axis covers the outdoor temperature range, and the vertical axis covers the setpoint range.

Figure 16. Outside Temperature Dependent heating curve method



Use the sliding controls to adjust the following parameters:

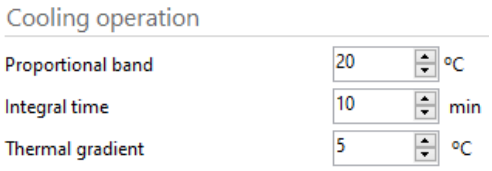
1. **Min SP**: Minimum setpoint temperature for the heating buffer tank.
2. **Max SP**: Maximum setpoint temperature for the heating buffer tank.
3. **Min OT**: Minimum outdoor temperature measured.
4. **Max OT**: Maximum outdoor temperature measured.

NOTICE
The relationship between the outdoor temperature and the required heat load is inverse. The curve always points downward because, when the outdoor temperature rises, the heating system decreases the supply temperature. Conversely, as the outdoor temperature drops, the heating system increases the supply temperature.

NOTICE
Tank temperature is monitored by the **Heating tank actual temperature_n (x10) (°C)** signals, which appear in the **Signals** tab when the corresponding analog inputs have been assigned. The **n** in the register name stands for values between one and four to differentiate the registers in installations with more than one available tank, i.e. when more than one analog input (sensor) is assigned the **Heating buffer tank** function, as each tank will have its own register. For more information, refer to the Analog Inputs (page 30) section.

8.3.2.2. Cooling Operation

Figure 17. Cooling operation parameters



In cooling mode, regulation is achieved by continuously comparing the current temperature of the tank to a fixed setpoint, provided from the installation through the **Cooling tank setpoint_n (x10) (Cool(5..25°C))** signal.

Three different parameters are used to help maintain the desired setpoint:

- **Proportional band**: Range of error that allows the controller's output to reach its full capacity, expressed in degrees Celsius. Valid range: 1 .. 20°C. Default value: **20°C**.

NOTICE
In this context, error refers to the difference between the desired setpoint and the measured actual value in the tank. A narrow proportional band is highly sensitive to this difference, while a wide proportional band makes the controller less sensitive to changes.

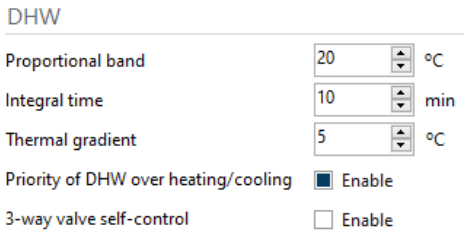
NOTICE
Example: If the cooling tank setpoint is 20°C and the proportional band is 2°C (10%), the proportional control will adjust the output proportionally for errors between 20°C and 22°C, and it will change the output to 100% if the measured actual value exceeds 22°C.

- **Integral time**: Determines how quickly the controller corrects accumulated errors over time, expressed in minutes. Valid range: 0 .. 60 minutes. Default value: **10 minutes**.
- **Thermal gradient**: This parameter is used to compensate for the thermal difference between the tank setpoint and the water flow temperature. Valid range: 2 .. 10 °C. Default value: **5°C**.

NOTICE
The tank temperature is monitored by the **Cooling tank actual temperature_n (x10) (°C)** signals, which appear in the **Signals** tab when the corresponding analog inputs have been assigned. The **n** in the register name differentiates the registers when more than one analog input (sensor) is assigned the **Cooling buffer tank** function in installations with more than one available tank, as each tank will have its own register. For more information, refer to the Analog Inputs (page 30) section.

8.3.2.3. Domestic Hot Water (DHW)

Figure 18. Domestic hot water parameters



Domestic hot water (DHW) production in Samsung EHS or Hydro systems requires a dedicated domestic hot water tank. In EHS mono solutions producing domestic hot water and space heating/cooling, a common 3-way valve is used to divert the flow of heated water from the outdoor units to either the domestic hot water tank or the space heating/cooling tank. The Intesis Cascade Controller monitors the domestic hot water tank temperature via its dedicated sensor (see Analog Inputs (page 30)) and can modify its setpoint as needed.

NOTICE
A 3-way valve is not required for systems used exclusively for producing domestic hot water or for space heating or cooling, since there is no need to divert the flow in those scenarios.

NOTICE
Samsung Hydro HE or Hydro HT units, when combined with a Samsung VRF (DVM) outdoor unit, can provide air-to-water heating, cooling, and domestic hot water (DHW) production, similar in function to a Samsung EHS Monobloc.

In EHS split solutions, each indoor unit is typically connected to a tank, which can be either integrated or external, depending on the configuration. The 3-way valves are also individual, as each indoor unit manages domestic hot water production individually. The role of the Intesis Cascade Controller in this scenario is to manage the shared portion, i.e., the space heating/cooling segment, by activating the heat pumps that are not currently producing domestic hot water when required.

The related parameters for domestic hot water production are:

- **Proportional band**: Range of error that allows the controller's output to reach its full capacity, expressed in degrees Celsius. Valid range: 1 .. 40°C. Default value: **20°C**.

  NOTICE
  In this context, error refers to the difference between the setpoint and the measured actual value. A narrow proportional band is highly sensitive to this difference, while a wide proportional band makes the controller less sensitive to changes.

  NOTICE
  Example: If the domestic hot water tank setpoint is 60°C and the proportional band is 2°C (~3.33%), the proportional control will adjust the output proportionally for errors between 60°C and 58°C and change it to 100% if the measured actual value drops below 58°C.

- **Integral time**: This value determines how quickly the controller corrects accumulated errors over time, expressed in minutes. Valid range: 0 .. 60 minutes. Default value: **10 minutes**.

- **Thermal gradient**: This parameter is used to compensate for the thermal difference between the tank setpoint and the water flow temperature. Valid range: 2 .. 10 °C. Default value: **5°C**.

> **NOTICE**
> The domestic hot water tank temperature is monitored by the **DHW tank actual temperature_n (x10) (°C)** signals, which appear in the **Signals** tab when the corresponding analog inputs have been assigned. The **n** in the register name differentiates the registers when more than one analog input (sensor) is assigned the **DHW tank** function in installations with more than one available domestic hot water tank and a centralized 3-way valve, as each DHW tank will have its own register. For more information, refer to the Analog Inputs (page 30) section.

- **Priority of DHW over heating/cooling** (enabled by default): Determines whether heating or cooling production is paused and switched to domestic hot water production when domestic hot water is required. If not enabled, actions will be handled in the order they are received (first-in, first-out).
- **3-way valve self-control**: As mentioned above, in some scenarios each heat pump can be equipped with its own self-controlled 3-way valve. Check this option if this is the case.

> **NOTICE**
> When that happens, the cascade controller does not control the changes of the 3-way valves.

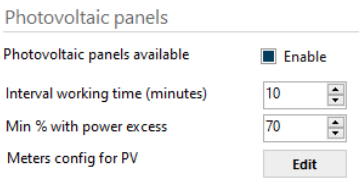
8.3.3. Photovoltaic panels

The Intesis Cascade Controller supports the connection of a photovoltaic system via Modbus TCP and can use its excess power to help reach and raise the domestic hot water setpoint or the buffer tank temperature when the former is reached or when no domestic hot water is being used.

> **NOTICE**
> Refer to the User Manual for more information on connecting the photovoltaic system to the cascade controller.

The following options are available for Photovoltaic panels:

Figure 19. Photovoltaic panel options



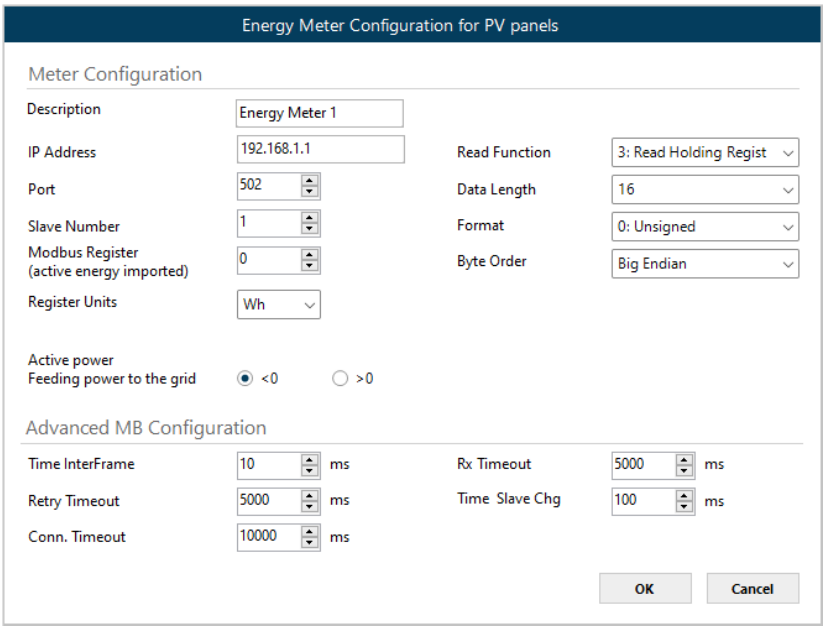
- **Photovoltaic panels available**: Check this option if a photovoltaic system is available in the installation. This enables the configuration of the following parameters, which determine whether the system will remain active to increase the setpoint or not:
  - **Interval working time (minutes)**: This value determines how long, in minutes, the cascade controller will activate the system to increase the setpoint once it detects that the PV system is generating surplus power. The cascade controller will monitor this time period to determine whether to extend it again once it is finished, depending on whether the percentage defined in the following parameter has been reached (range: 10..30 minutes. Default value: **10 minutes**).

– **Min % with power excess**: Establishes the percentage value the cascade controller should use as a threshold to keep the system active for another working time interval. If the threshold is not reached, the system will be powered off for the duration of a working time interval (20..100%. Default value: **70%**).

> **NOTICE**
> When the system has not been powered on for more than four hours, the system will be turned on at any interval point when it detects that electricity is being injected into the grid.

– **Meters config for PV**: Press the **Edit** button to open the **Energy Meter Configuration for PV panels** window.

> **NOTICE**
> Refer to the meter manufacturer's documentation for the meter-specific settings.



Configuration is split into two sections:

- **Meter Configuration**
  - **Description**: Use this text field to give a descriptive name to the meter, such as its model name or location.
  - **IP Address**: IP address of the inverter or energy meter through which the PV system is connected to the cascade controller.
  - **Port**: Port for the Modbus TCP/IP connection (Default value: **502**).
  - **Slave Number**: Inverter or energy meter server Modbus address (1 to 254. Default value: 1).
  - **Modbus Register (active energy imported)**: Address of the Modbus register used to read the active energy imported from the PV system and delivered into the load, usually known as active power (1 .. 65535).
  - **Register Units**: Choose **Wh** or **KWh**.
  - **Read Function**: The register to be read for monitoring can be either a holding register or an input register, depending on the manufacturer. Choose the corresponding function, according to its type, between **3: Read Holding Registers** or **4: Read Input Registers**.
  - **Data Length**: Number of bits for the Modbus register (16, 32, or 64 bits).

- **Format**: Select the data type between **0: Unsigned, 1: Signed (C2), 2: Signed (C1), 3: Float**.
- **Byte Order**: Choose **Big Endian, Little Endian, Word Inv BE, Word Inv LE**.
- **Active power - Feeding power to the grid**:

  NOTICE
  In electrical engineering, power injected into the grid and power drawn from the grid can be represented in two different ways, depending on whether the active sign convention or the passive sign convention is used:

  - **Active sign convention**: Positive values indicate power generation (i.e., feeding power into the grid), and negative values indicate power consumption (i.e., drawing power from the grid).
  - **Passive sign convention**: Positive values indicate power consumption (i.e., drawing power from the grid), and negative values indicate power generation (i.e., feeding power into the grid).

  Since some energy meter manufacturers use the former approach and others use the latter for their active power register, this option allows you to specify which value range should be identified as feeding power into the grid, thus covering both possibilities.

  - **<0**: Use this option if a negative value in the **Active Power** register means that the PV system is feeding power into the grid.
  - **>0**: Use this option if a positive value in the **Active Power** register means that the PV system is feeding power into the grid.

  WARNING
  Selecting the correct value for this parameter is essential to guarantee efficient energy management, so make sure the correct option is selected by double-checking the energy meter documentation. Some manufacturers also publish specific documents covering their Modbus implementation and detailing their interpretation of the active power register, so this information could be located in these specific documents instead.

- **Advanced MB Configuration**:
  You can modify these Modbus parameters to adapt the Modbus communication to every installation.

  IMPORTANT
  These parameters are for advanced users only. As a general rule, keep the default values for proper communication with the meter.

  - **Time InterFrame**: Select the minimum time between received and sent frames (0 to 100000 ms. Default value: **10 ms**).
  - **Retry Timeout**: Select the minimum time between retry frames after no response on the TCP connection (0 to 30000 ms. Default value: **5000 ms**).
  - **Conn. Timeout**: Select the minimum time before launching an error message after no response on the TCP connection (100 to 30000 ms. Default value: **10000 ms**).
  - **RX Timeout**: Select the minimum time before launching an error message when no TCP frames are received but the TCP connection is OK (100 to 30000 ms. Default value: **5000 ms**).
  - **Time Slave Chg**: Select the minimum time of silence when changing from one server device to another one (100 to 10000 ms. Default value: **100 ms**).

8.3.4. Analog Inputs

Figure 20. Available analog inputs

Inputs	Function	Sensor Type	Temperature range	Offset (°C)	Correction Factor	Unit ID
☑ AI-1	Heating/Cooling buffer tank	PT1000	-20C .. +100C	0	1	U-1; U-2; U-3; U-4
☑ AI-2	Outdoor Temp	PT1000	-20C .. +100C	0	1	-
☑ AI-3	DHW tank	PT1000	-20C .. +100C	0	1	U-1; U-2
☐ AI-4	Heating/Cooling buffer tank	PT1000	-20C .. +100C	0	1	-

For the cascade controller to maintain the required water temperature in the buffer tanks, the current temperature of each tank must be monitored. To do so, temperature sensors must be installed in each tank and connected to the cascade controller. Additionally, an outdoor temperature sensor should also be connected when the heating operating mode is enabled and the temperature-dependent heating curve setpoint method is selected.

NOTICE
Refer to the User Manual for more information on connecting the temperature sensors to the cascade controller.

This section is used to activate and assign functions to the installation sensors and to define their characteristics:

- **Inputs**: Use this checkbox to enable a sensor in the corresponding input.
- **Function**: Three possible functions are available:
  - **Heating/cooling buffer tank**: A sensor is installed in the buffer tank for heating and cooling modes.

    NOTICE
    Both heating and cooling are typically managed by the same sensor throughout the year, as the most common scenario involves enabling the heating mode in winter and the cooling mode in summer. For more information about operating modes, refer to Operating Modes (page 23).

  - **Outdoor Temp**: A sensor is installed outside the building to continuously measure the outdoor temperature.
  - **DHW tank**: A sensor is installed in the domestic hot water tank.
- **Sensor Type**: Three sensor types are currently supported:
  - **PT1000**: Platinum-based resistance temperature detectors (RTD) with a nominal resistance of 1,000Ω at 0°C.
  - **NTC_10K**: Negative Temperature Coefficient thermistor with a nominal resistance of 10,000 ohms at 25°C.
  - **NTC_20K**: Negative Temperature Coefficient thermistor with a nominal resistance of 20,000 ohms at 25°C.
- **Temperature range**: This field lists the available temperature ranges for the currently selected sensor type.
- **Offset (°C)**: Value in degrees Celsius to be added to the measured temperature (-3°C..+3°C. Default value: **0**).
- **Correction Factor**: Factor that multiplies the measured temperature (0..2. Default value: **1**).
- **Unit ID**: Press the ... button to select the currently active unit or units to which the analog input is assigned.

NOTICE
Analog inputs with the **DHW tank** function assigned will only display unit IDs with the **DHW support** checkbox selected in the Cascade Units table. See Cascade Units (page 21).

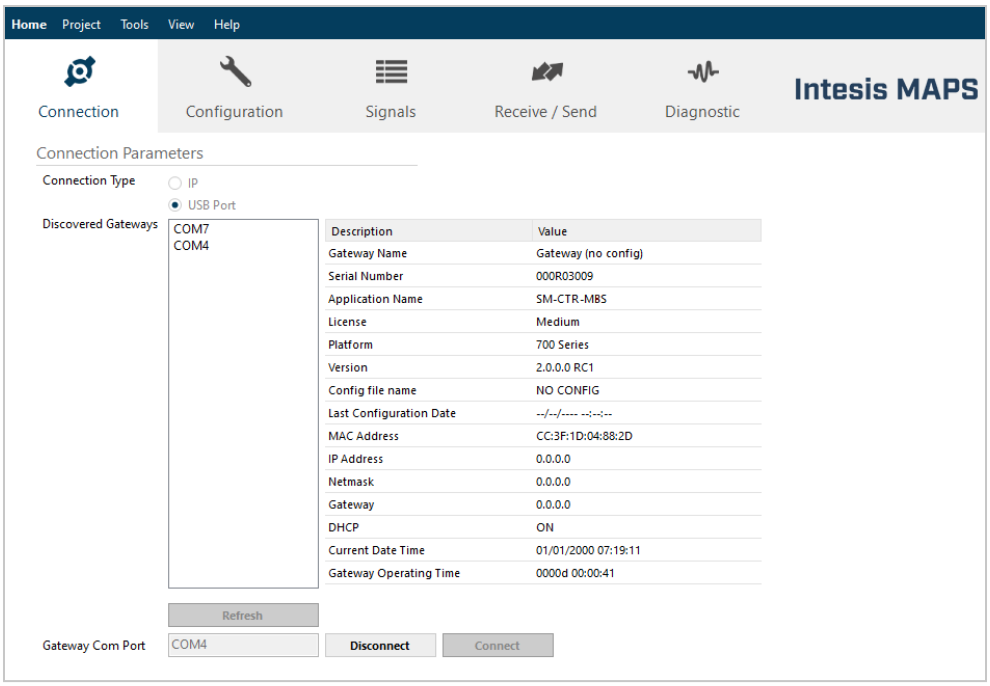
NOTICE

To accommodate installations with multiple tanks, it is possible to assign the same function to more than one analog input. In this case, each tank will have its own signals, identified by the number at the end. If there are, for example, two analog inputs with the **DHW tank** function assigned, the measured values from the first tank will be assigned to the **DHW tank actual temperature_1 (x10) (°C)** and the measured values from the second tank will be assigned to the **DHW tank actual temperature_2 (x10) (°C)** signals, respectively.

This applies regardless of whether the assignment in the analog inputs table is correlative or not, since the determining factor is whether or not the same function has been assigned to a previous analog input.

9. Connection Tab

Figure 21. Connection tab window



1. Connect the cascade controller to your PC. Two possibilities are available:
   - Use the cascade controller's **Ethernet port** and an Ethernet CAT5 or higher cable.
   - Use the **Console** port and a USB Type-C cable.
2. On the **Connection Type** parameter, select the way you connected the cascade controller to your PC:
   - Select **IP** if you are using the **Ethernet port** of the Intesis cascade controller.

     NOTICE
     The default password when connecting via IP is **admin**.

     IMPORTANT
     Make sure you have an internet connection.

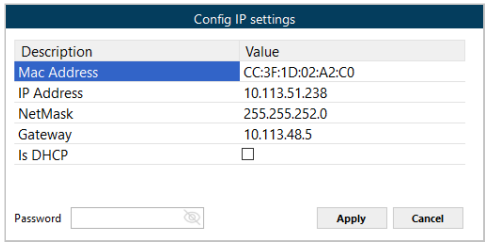
     NOTE
     When using the IP connection, the cascade controller's name appears:
     - **In black**: It is compatible with the selected template.
     - **In red**: It is not compatible with the selected template.
   - Select **USB Port** if you are using the **Console** port of the cascade controller.

     NOTICE
     No password is needed when connecting via USB.
3. Select your cascade controller from the **Discovered Gateways** list on the left.

4. Click **Connect**.

When selecting IP as the connection type, two additional buttons will appear:

- **Identify**: Click the **Identify** button to make the cascade controller's LEDs blink for 10 seconds.
- **Edit**: Click the **Edit** button to open the **Config IP settings** window.



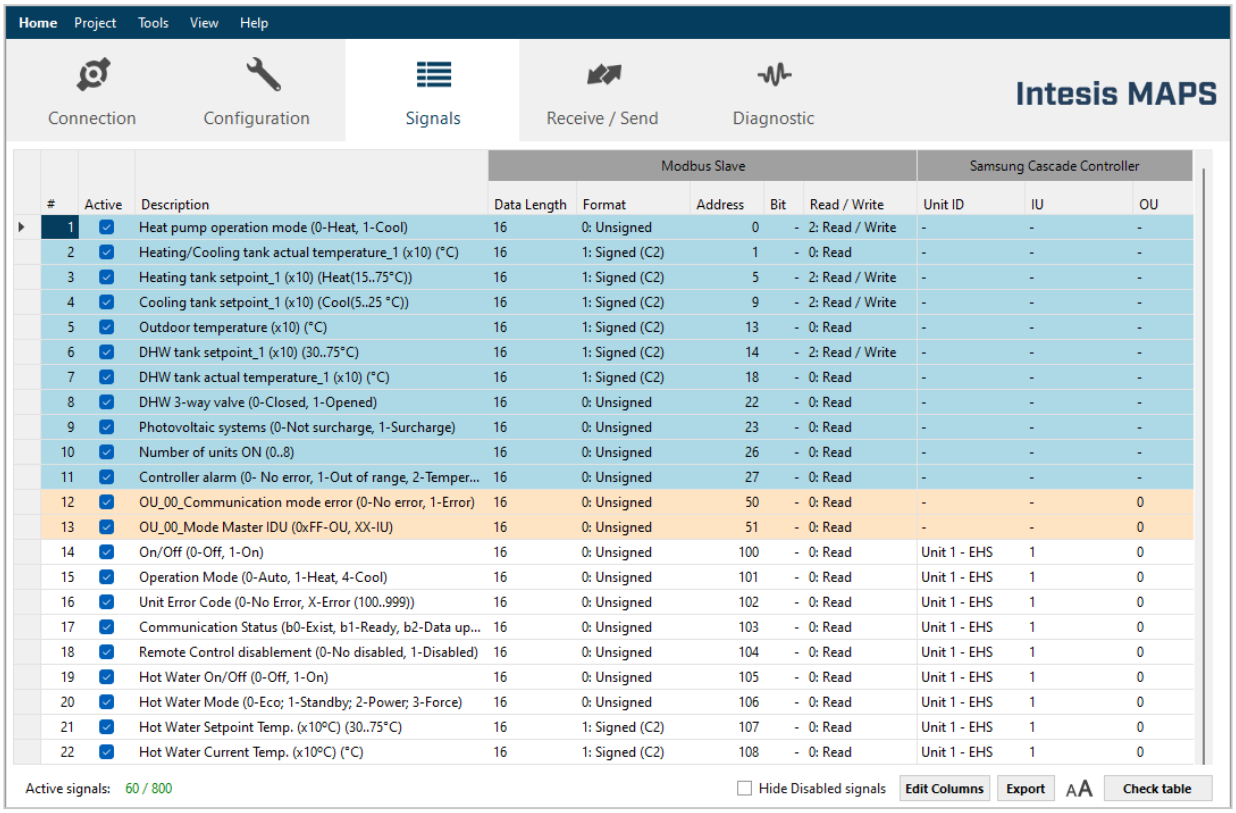
You can edit the **IP Address**, **NetMask**, and **Default Gateway** IP.

NOTE
These parameters can also be edited in the **Configuration** tab. See Connection (page 14).

10. Signals Tab

This menu lists all available signals and their parameters for both the BMS and the cascade controller.

Figure 22. Signals tab



All signals share some common characteristics and parameters:

- **Blue**: General system signals.
- **Orange**: Signals for the outdoor units.
- **White**: Signals specific to EHS/HT/HE units.

Below the list of signals, these options are available:

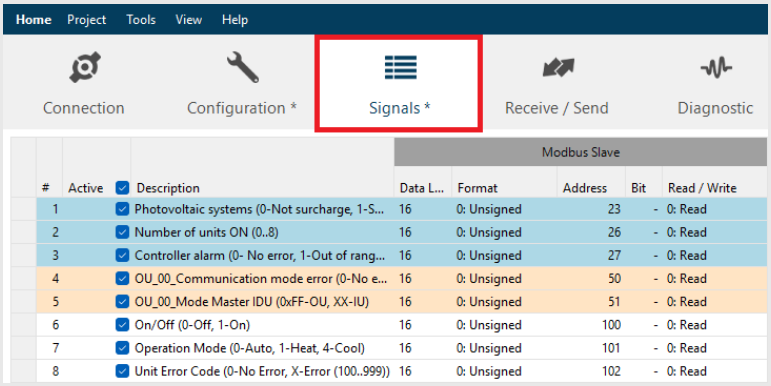
- **Active signals**: Number of active signals / total number of signals.

> **TIP**
> You can use the checkbox at the column header to select or deselect all signals at once.

- **Hide Disabled signals (disabled by default)**: Show/hide all disabled signals from the list.
- **Edit Columns**: Click this button to hide/show any column of the table.
- **Export**: Click this button to export the current signals' configuration to an XLSX file for later import in other systems, helping to reduce commissioning time.
- **AA**: Increases or decreases the font size.
- Click the **Check table** button to review the signals' configuration.

NOTE
If any signal parameter is incorrect, a message will pop up with specific error information.

IMPORTANT
After editing a parameter or enabling or disabling a signal, an asterisk appears on the **Signals** tab icon as a reminder that you have made changes to the project but have not saved them or sent the project to the gateway yet.



To know how to save your project, see Saving, Opening, Importing, and Exporting the Project (page 10).

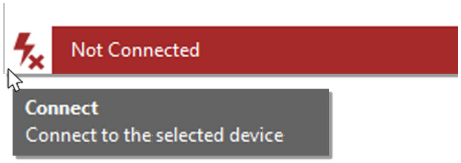
To know how to send your project to the gateway, see Receive/Send Tab (page 36).

11. Receive/Send Tab

Send:

Once you have finished setting the parameters, you have to send the configuration to the cascade controller:

1. Click the **Send** button.
   a. If the cascade controller is still factory-set, you will be prompted to save the project on your PC. Once saved, the configuration is automatically sent to the cascade controller.
   b. If you have already saved the project, the configuration is automatically sent to the cascade controller.
2. Connect again with the cascade controller after sending the file.



NOTICE
The cascade controller reboots automatically once the new configuration is loaded. This process may take a few seconds.

Receive:

Use this function to load the configuration of a cascade controller to Intesis MAPS.

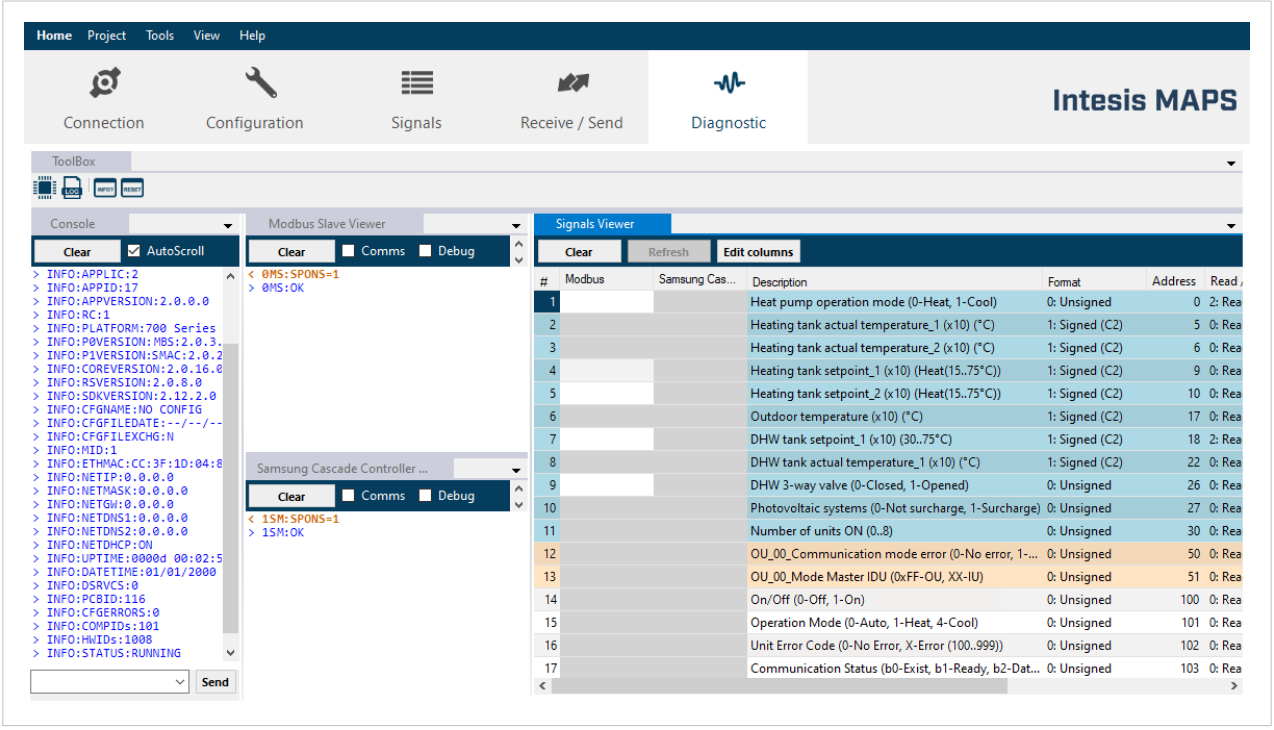
TIP
This function may be helpful when you need to change some parameters of an already configured cascade controller.

Once the configuration is completed and sent, the cascade controller is already operative. Even so, you should review that everything works correctly by entering the **Diagnostic** tab.

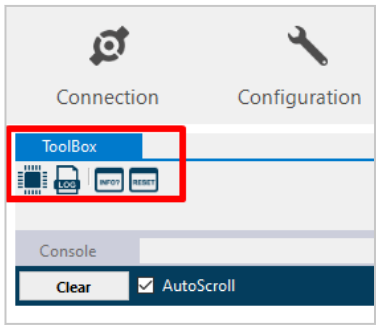
12. Diagnostic Tab

IMPORTANT
Connection with the cascade controller is required to use the diagnostic tools.

Figure 23. Diagnostic tab window. Find the ToolBox between the upper tabs bar and the Console view. Below it, from left to right: Console viewer, Protocol viewers (one above the other), and the Signals viewer



TOOLBOX



From left to right:

- **Microprocessor icon**: Check the current hardware status of the cascade controller.
- **LOG**: Set Intesis MAPS in logging mode to record all the information present in the viewers and save it in a .zip file.
- **INFO?**: Get some cascade controller information.
- **RESET**: Reset the cascade controller.

NOTE
Depending on your screen resolution, the **ToolBox** icons may appear partially hidden behind the **Viewers** window.

VIEWERS

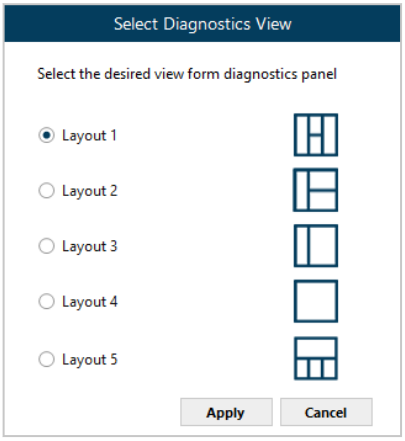
Intesis MAPS provides several viewers:

- A generic console viewer for general information about communications and the cascade controller status.
- A viewer for both protocols to check their current status.
- A signals viewers to simulate the BMS behavior or check the system's current values.

NOTE
Use the refresh button to get updated values on the signals viewer.

The layout of these viewers can be modified:

- Using the **Select Diagnostics View** option from the **View** menu:



NOTE
Layouts 3 and 4 offer two different tabbed options:

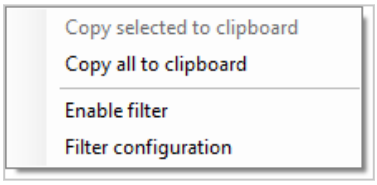
  - Fixed console to the left and tabbed browser for the other viewers
  - Full tabbed browser

- Clicking and dragging the border of a viewer. To do so, place the cursor over the edge of a viewer. On the vertical edges, the cursor changes to ↔ to adjust the width, and on the horizontal edges, the cursor changes to ↕ to adjust the height.

Viewers can also be arranged manually by clicking and dragging them from their title bar, to use them as independent windows or to position them in relation to other viewers.

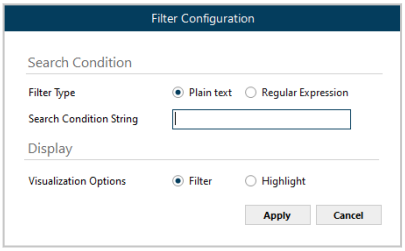
FILTERING

A filtering tool is available for the console and the bus viewers to find the desired information more efficiently. To use this tool, right-click on the viewer.



The options available for this tool are:

- **Copy selected to clipboard**: It copies the selected text into the clipboard. If no text is selected, this option is disabled.
- **Copy all to clipboard**: It copies all the information from the viewer to the clipboard.
- **Enable filter**: This option enables or disables the configured filter. To use this option, a filter must be defined beforehand under Filter configuration.



- **Filter configuration**: The filter itself is defined here, using some additional options:
  - **Search Condition**:
    - **Filter Type**:
      - **Plain text**: It searches all the communication frames that include the text specified in the **Search Condition String** below.
      - **Regular Expression**: It searches all the communication frames that match the regular expression specified in the **Search Condition String** below.

        NOTE
        A regular expression is a sequence of characters that specifies a match pattern in text. If you are not familiar with regular expressions, use the **Plain text** option instead.

  - **Display**:
    - **Visualization Options**:
      - **Filter**: It removes all the communication frames that do not fulfill the filter condition specified in the **Search Condition String**.
      - **Highlight**: It highlights the communication frames that fulfill the filter condition specified in the **Search Condition String**.