Energy Management System

Quick Guide

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EMS

Energy Management System

1 Introduction

EMS

As with Energy Management Systems (EMS) are introduced more and more into the market and the demand of the customers, we like to provide a clean overview of all the ins and outs you need to know to get started on providing Energy Management Systems (EMS) to your customers.

In this document we will cover the basic understanding that you need to get started with Energy Management.

We will discuss the following topics:

- Overall process
- Connection options
- Hardware installation
- Software configuration
- Trouble shooting

2 Overall way of working

The overall way of working can be described as following:

- Design
- Hardware options
- Software options
- Prepare the installation
- Installation PV inc. register and MyAutarco setup
- Installation of the EMS hardware
- Controller configuration
- End-user access setup

By following this general approach, the setup will be the most smoothly. To guide you through these steps and process. The following chapters of the quick guide are based on this principle.

3 Design

While designing Energy Management, it is key to make sure that you understand how the system is envisioned to be used. The goal of the EMS can be different for each customer so it is important to understand this. Based on the goal of the Energy Management System, different components can be selected or used.In some cases, an actual Energy Management System (EMS) controller is not needed, and the same goal can be achieved by the already existing features of the battery, inverter or other devices.

3.1 Device compatibility

The most important check to do is to make sure that the devices you want to connect to the EMS controller are compatible with the EMS controller. While we keep working on adding support for more devices and brands, not everything will be supported.

To check what devices are compatible with the EMS controller,
you can check the online overview at:
Supported devices
Before planning/selling the setup it is important to make sure that the existing or planned devices are compatible with the EMS controller.

4 Hardware installation options

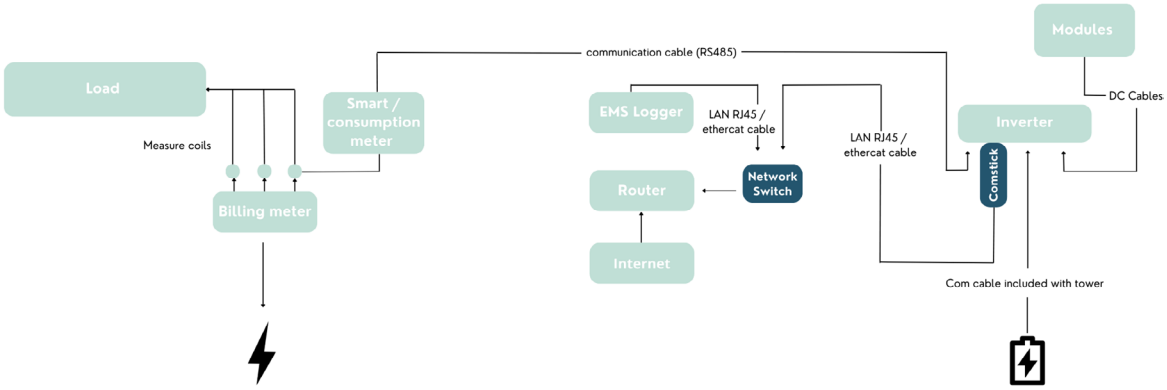
There are many options on how to install the EMS controller to the installation. To help out we have some diagrams per installation type to help out how these should be setup.

Note 1: The key element of the setup is that the EMS controller needs to be in the same network as the devices that you want to connect.

Note 2: When using TCP/IP connection for inverters. Make sure to use the S2.LAN.STICK.D as communication device.

4.1 LAN cable example (recommended)

In the LAN cable example shows a bit more details on where the load is, how cables can be used and the usage of the LAN cable as communication between EMS controller and the inverter.

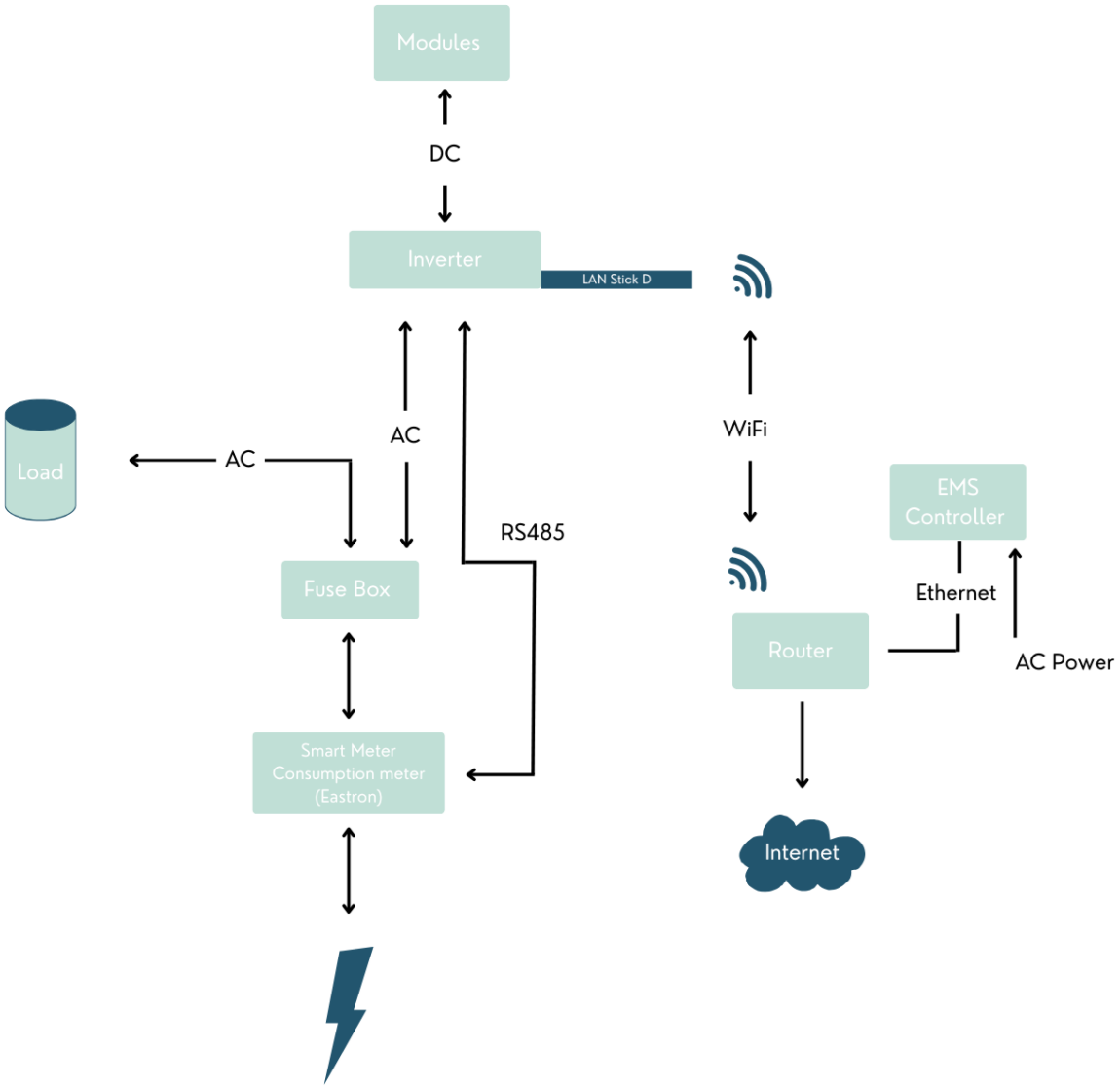


Currently we recommend to use the LAN cable as communication as this provides the stability of a cable over the sometimes unstable WiFi connections. We understand that this will not always be possible and there fore also discuss the other options.

4.2 WiFi setup (WiFi communication for inverter)

With the WiFi option of the LAN-stick you can setup the communication between the inverter and the Router or Access point to use WiFi.

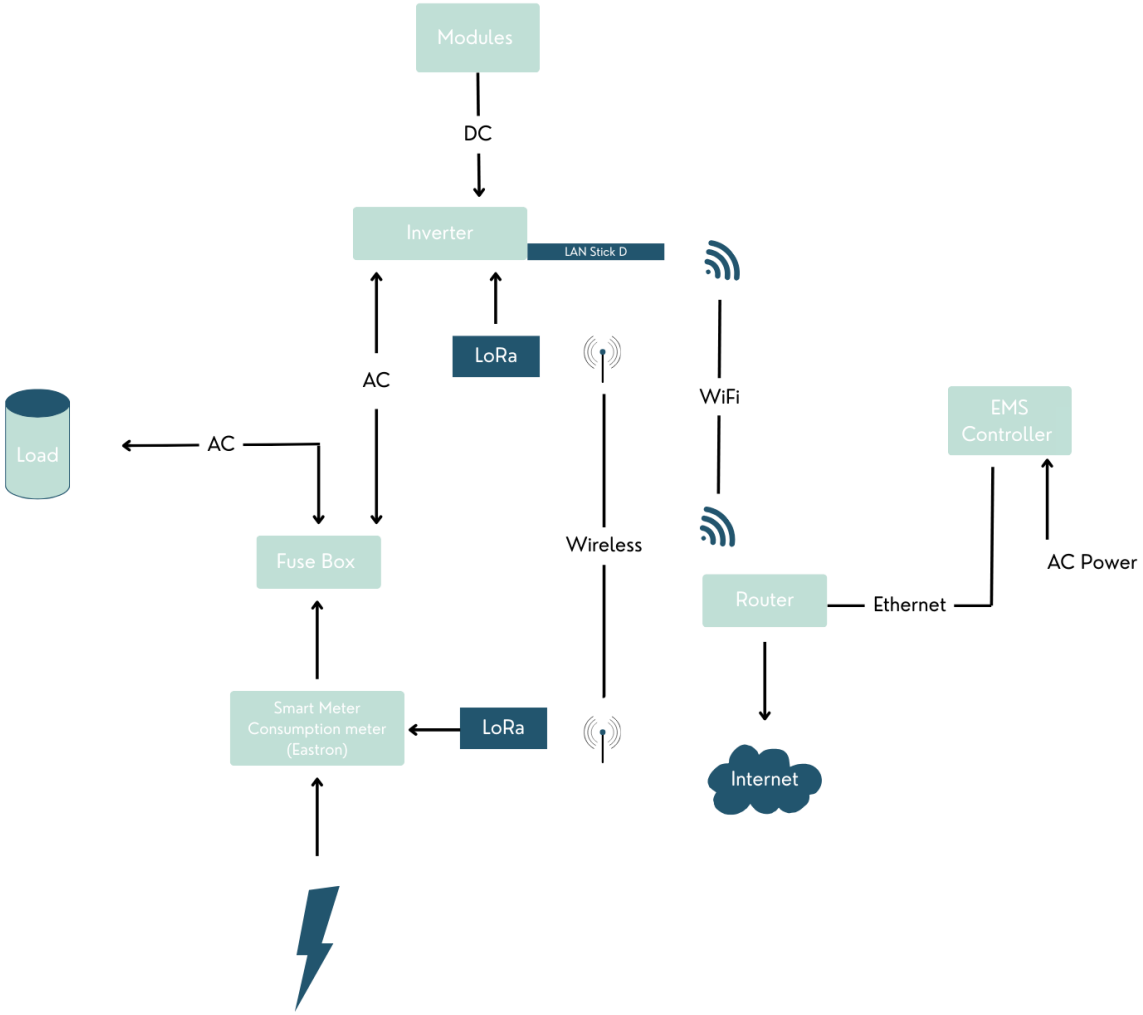
Can be used when only a single cable can be installed, and that cable is used for the RS485 connection between the consumption meter and the inverter.



Note that the EMS connection is only possible on the LAN stick D that supports WiFi as well as LAN. This will not work with the current WiFi stick. WiFi repeaters will also not work as they often create their own network and the devices will not be reachable.

4.3 WiFi + LoRa

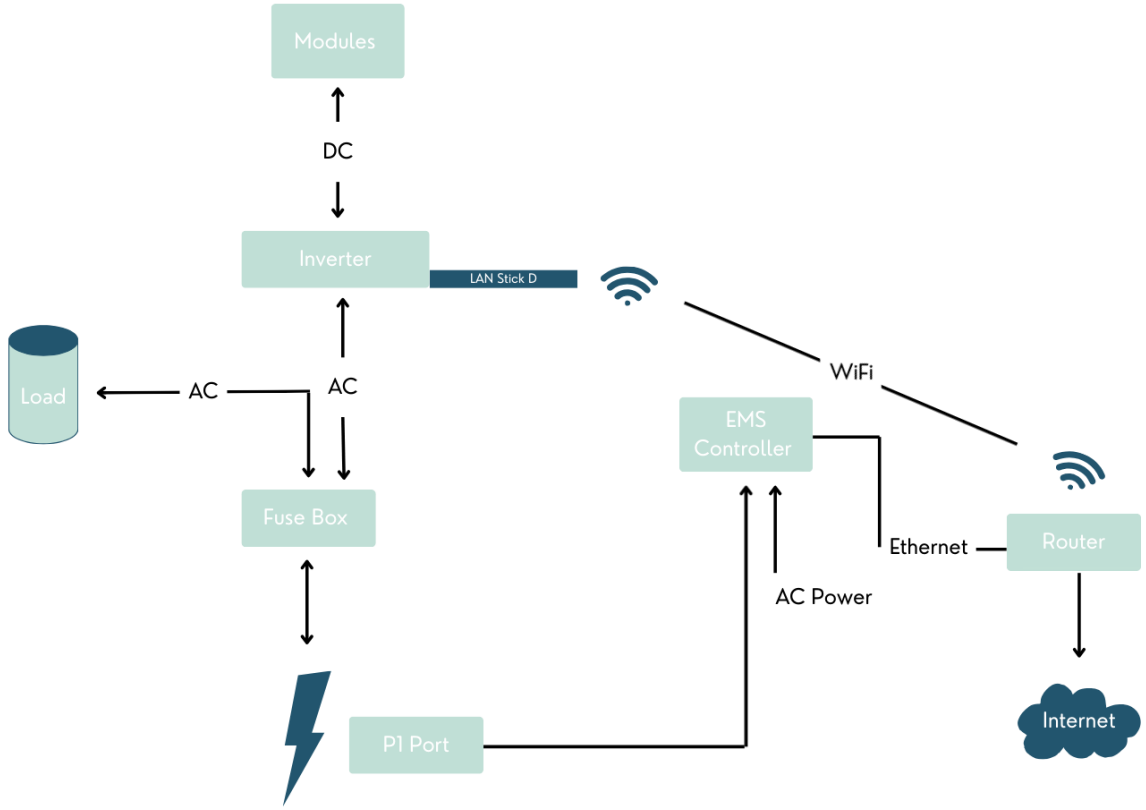
Long Range (LoRa) solutions transmit the signal they have over a long range. This can be used to transmit communication between a consumption meter and an inverter over a wireless connection (Not WiFi). And the communication between the Inverter and the EMS Controller will be handled via WiFi.



4.4 P1 connected

EMS

In some cases, it's not possible to have a consumption meter installed in the fuse box. In these cases, it's still possible to get the EMS Controller to run properly, however it will than need the connection to the P1 port of the billing meter.



In this scenario the meter data will come directly from the P1 port into the EMS Controller. This eliminates the need to install the consumption meter, but comes at a cost, as the inverter will not have access to consumption data.

This results in:

- MyAutarco will not show any consumption related information.
- When the EMS Controller goes down, the inverter can't use the meter data and charging battery for example will not work until the EMS controller is back up online.

4.5 Cabinet connection with EMS Controller

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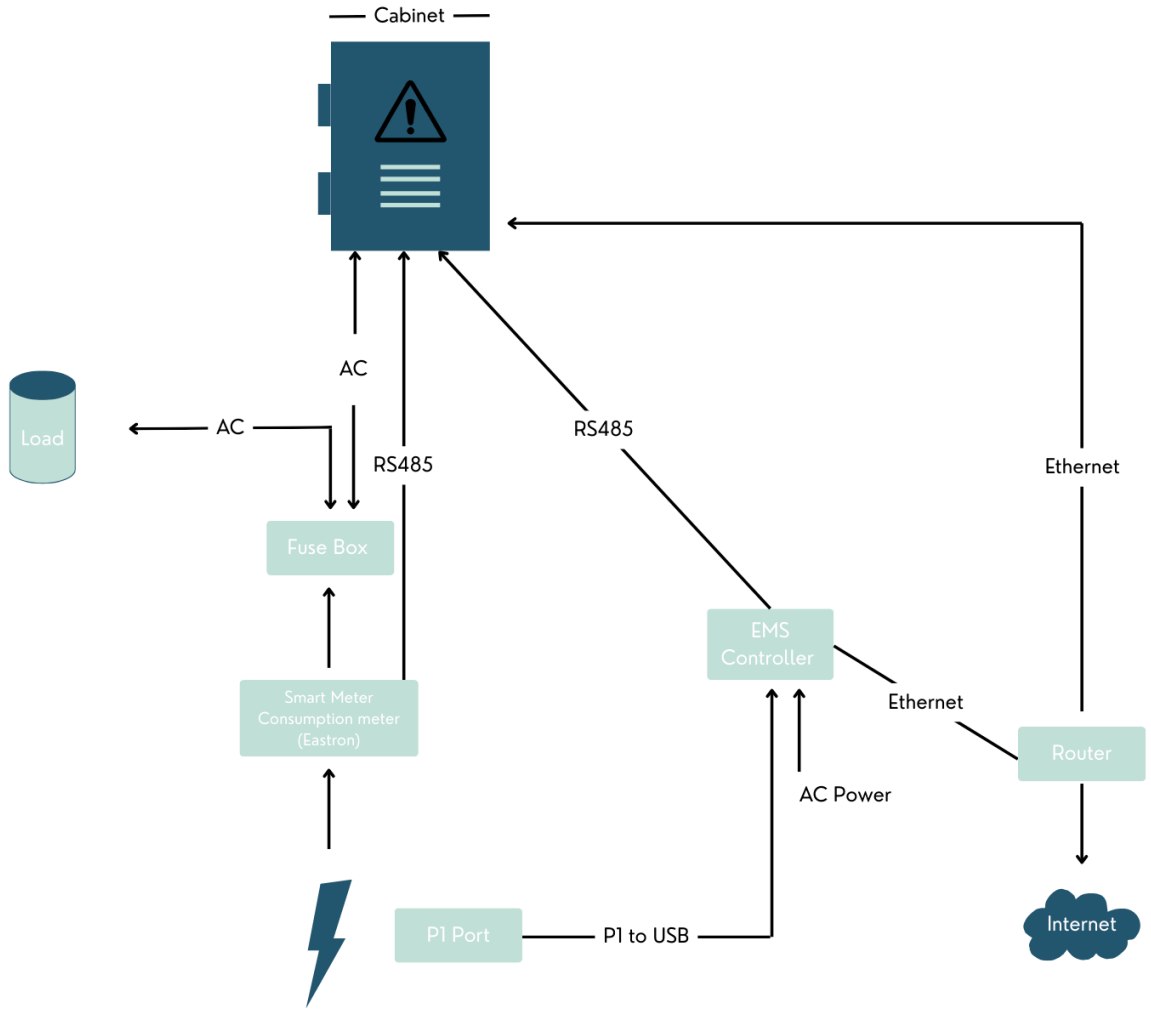
The large cabinet solutions that Autarco offers have multiple connection options, but the following is recommended as it provides the most benefits.
The cabinet uses the following connection options:

- RS485 for EMS Controller
- RS485 for consumption meter
- Ethernet/RJ45 LAN cable for internet

The P1 to EMS controller in the image below is optional



5 Preparation upfront

To make sure the installation goes smooth, there are some preparation steps that you can verify before going to the customer.
The cabinet uses the following connection options:

- Double check the hardware compatibility
- Overview of needed hardware
- Decide on how to setup the connectivity
- Gather required information on the network / connection

5.1 Preparation upfront

After deciding how the EMS should be setup at the customers location, the next step is to make sure that you have the required hardware
The cabinet uses the following connection options:

- LAN stick D communication
- Cables for RS485 (when applicable)
- Ethernet cables
- LoRa (when applicable)
- Mounting material

Power cable for the controller installation is included in the box.

5.2 Gather required information on network / connection

The EMS Controller needs an internet connection and needs to be able to communicate with the other devices that it should be steering. For some networks, the end-customer will have a reserved IP address or other network wishes for the devices. It is important to clarify this before arriving at the installation site.

5.3 Required information

Information required	Note
Grid connection	1phase or 3phase
Allowed current for the connection	
Installation address	To get the right EPEX spot prices and weather forecasts for yield calculation
Allowed expoert limit	
Allowed import limit	

Configuring the controller

Information required	Note
Steering option for PV	
Steering option for storage	
Steering options for charging stations	
Steering options for heat pump and boilers	

5.4 First installation

We strongly advise to practise the installation of the EMS Controller before going to do an installation at an end customer. The main reason for this is that the EMS controller is requiring some IT knowledge and can be a new experience. For to make sure that installations at the customer will be as smooth as possible.

6 Installation

The correct order for the installation would be:

- Install PV and inverter
- Install battery
- Setup communication
- Ensure latest TCP/IP firmware on communication stick
- Install EMS controller
- Configure EMS controller
- link devices to EMS controller
- Set steering modes

6.1 Latest TCP/IP firmware on communication stick

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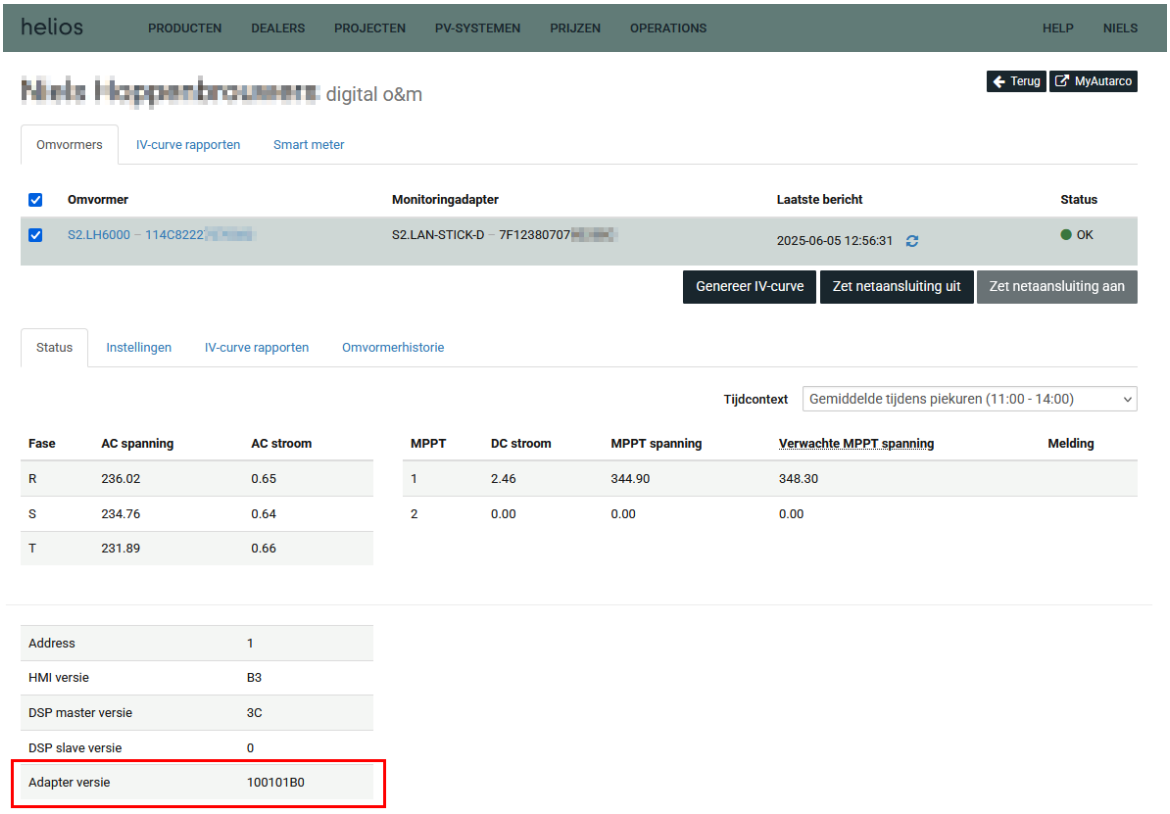
For the communication sticks it is key to have the latest TCP/IP firmware so that the communication sticks can be found by the EMS Controller. Else the device will not respond properly, or it will not find the inverter.

TCP/IP is enabled from firmware version: 100101B0

This can be checked when the system is setup is completed and in Digital O&M



In the future they can be arranged by yourself in Helios, but for now it's easiest to reach out to the support team to request this firmware update to be sure.

The hardware installation should be according to one of the previously setup diagrams to ensure a proper working. There are other options but these are recommended.
The instructions can be found in the EMS controllers' box or here:

English – Safety instructions

- Installed in an electrical cabinet;
- Installed in the vicinity of electric power circuit wiring;
- Connected to any signal wire that does not come from a seperated or safety extra-low voltage (SELV) circuit;
- Not supplied from a class II power supply (power supplies with either a double or reinforced insulation barrier between the input and the output).

I/O Ratings

Power supply	12V, 2, 5A
Digital inputs DIA & DIB	5-50Vdc
12Vout	60 mA
Relay Outputs R1 & R2	5-50Vdc, 1A

Do not surpass the I/O ratings.

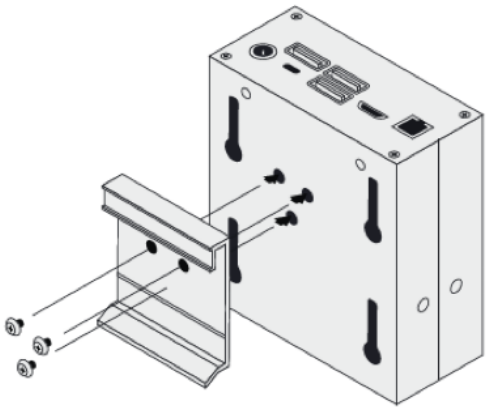
Welcome!

This quick start guide is designed to help you get up and running with our controller in no time.

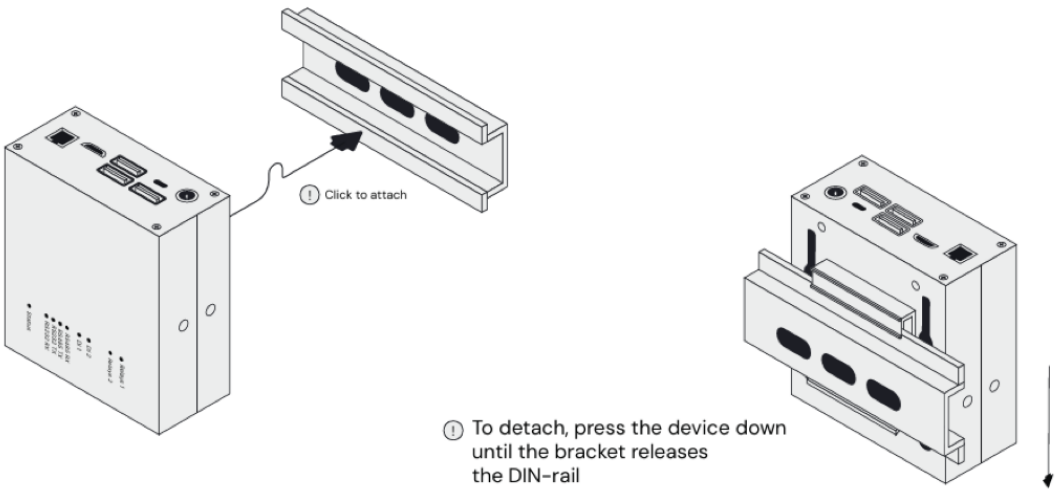
Installation with DIN-rail

Follow this guide to assemble the Smart Grid Controller on a DIN-rail with the mounting plate delivered with your device.

1. **Mounting plate**
   Assemble the mounting plate to the Smart Grid Controller delivered with your device. Use only 3 screws delivered with the product.



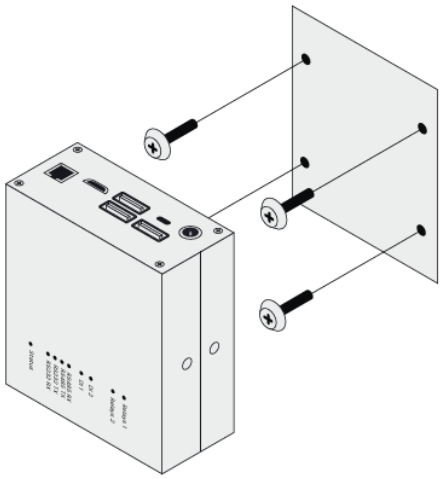
2. **DIN-rail**
   Gently push and click the device on a DIN-rail via the mounting plate.

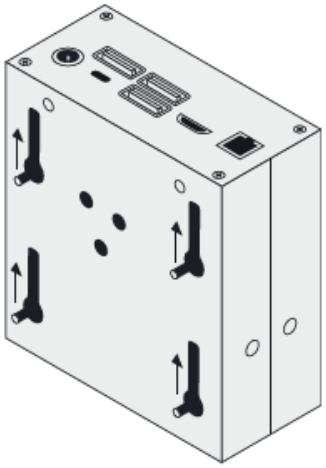


Installation on wall

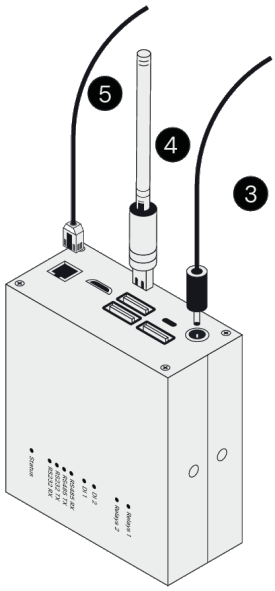
Follow this guide to install the Smart Grid Controller on a wall.

1. **Attach to wall**
   Measure and drill 4 holes into the wall.





2. **Attach screws to device**
   Slide in the screws attached to the wall, in the bottom holes of the device. Gently slide down the device until the screws meet the top each hole.



Finishing the setup
You're almost done with the physical part of the controller. Make sure the main-power is off, then attach the power-supply, the WiFi Service Dongle and ethernet cable to the controller.

3. **Attach the power-supply**
4. **Attach the WiFi Service Dongle for further setup using WiFi**
5. **Attach the Ethernet Cable for further setup using LAN**

6.3 Controller configuration

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The software installation can be done via two paths.

1. Locally with a laptop/computer in the same network as the controller.
2. Via the Remote portal when the EMS Controller has an internet connection (LED's Green)

Locally connecting

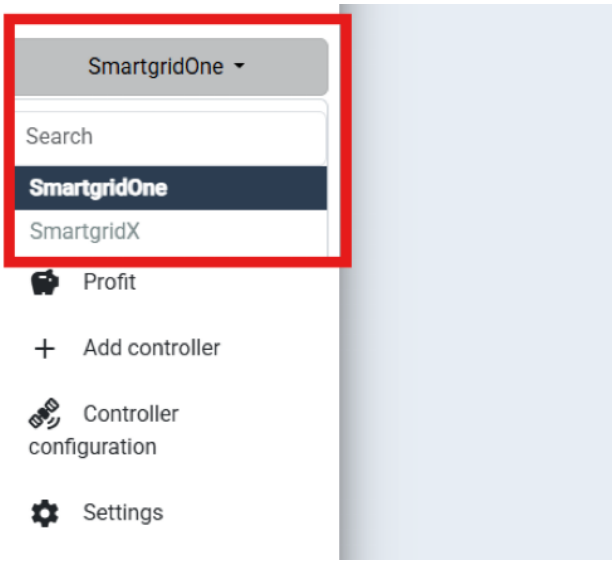
Connecting to the controller via the LAN network

Note that your device and the controller must be connected to the same LAN network, and both must have a working network configuration. The controller is by default configured to receive an IP address via DHCP.
In some rare cases where the network infrastructure does not provide DHCP, it might not receive a valid network configuration. If this is the case, you must use the Wi-Fi service dongle for the initial controller setup.

1. Make sure the controller is connected to the LAN network via ethernet and powered on.
2. Download an IP scanner such as Advanced IP Scanner (Windows) or Fing (Android & IOS).
3. Connect your device to the same LAN network.
4. Scan for the IP address of the controller in the network. You can identify the controller by it's MAC address (see the label of the controller).
5. Open a web browser and surf to the IP address of the controller, e.g. http://192.168.1.123

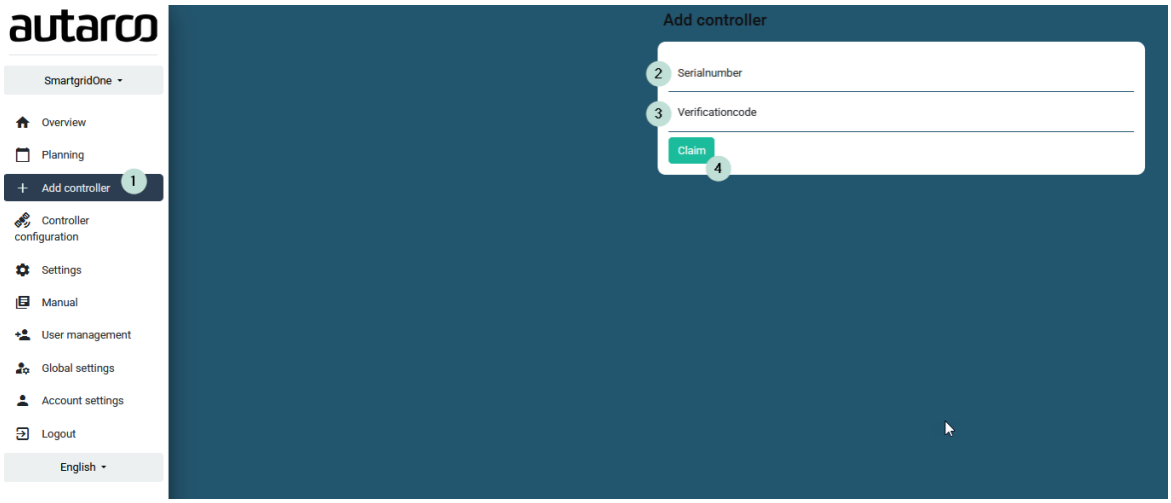
Remote connecting

Log in to the app (smartphone) or Online Controller Portal (computer).
Make sure you are in the SmartgridOne environment



Claim the controller

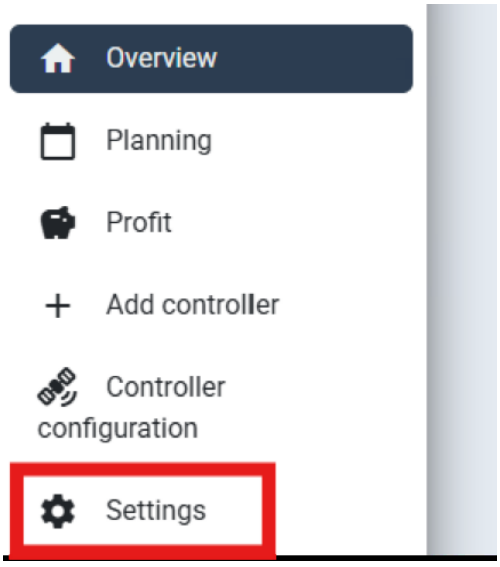
Claiming the controller to your environment is needed to make sure that you have remote access. This can be done via the “add controller” menu



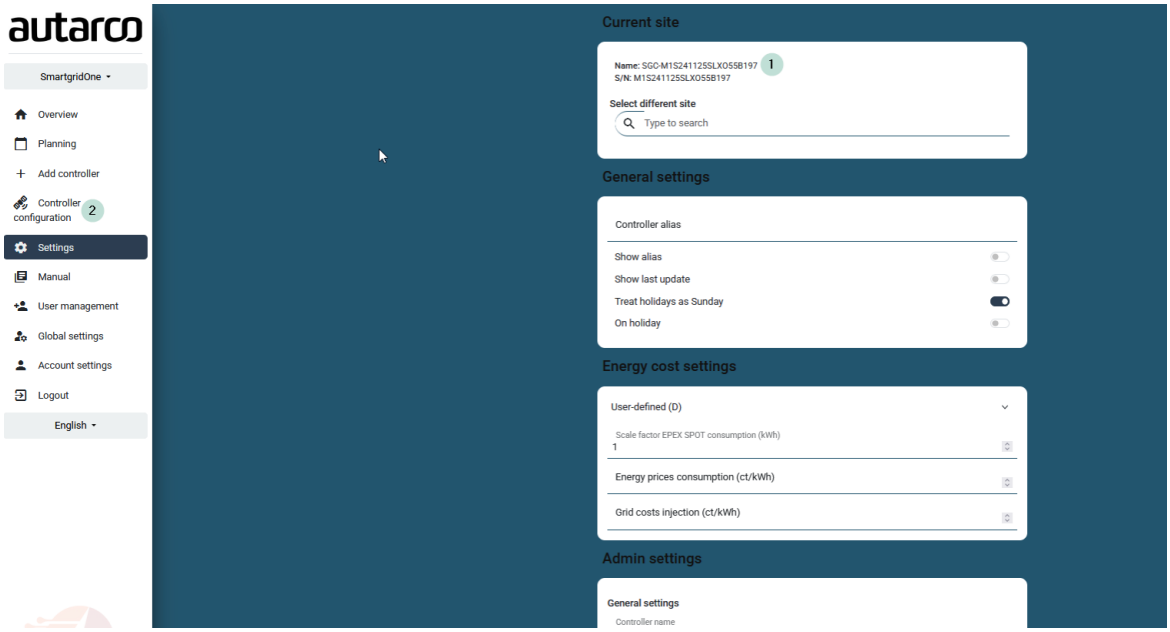
1. Open de Add controller tab
2. Provide the serial number that is given on the device (EMS Controller)
3. Provide the verification code that is given on the device (EMS Controller)
4. Press the claim button
    1. This will give a message that the controller is claimed successfully.

Switch to correct controller

In the settings menu, switch to the SmartgridOne Controller that you want to access.



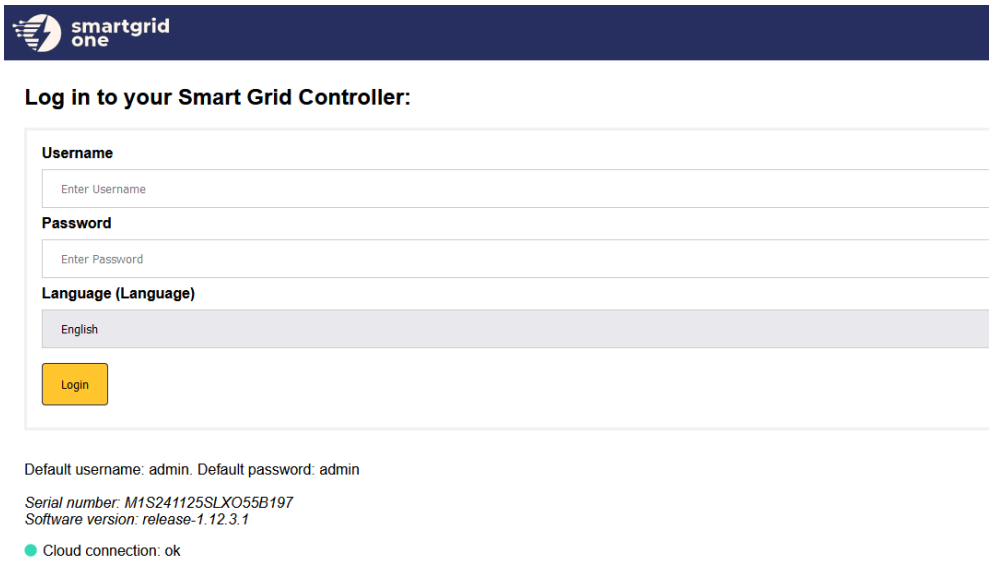
Under Site selection make sure to have the correct controller selected (1).
After the selection you can go into the Controller settings via
“Controller configuration” (2)



Now you will be able to configure the controller remotely

7 Controller configuration

In Chapter 6.3 we’ve discussed how you can get into the controller for configuration.
This chapter will discuss the different steps in the configuration. When connecting to the EMS Controller you see the login screen. Out of safety, its needed to login each time you want to make a change on the controller.



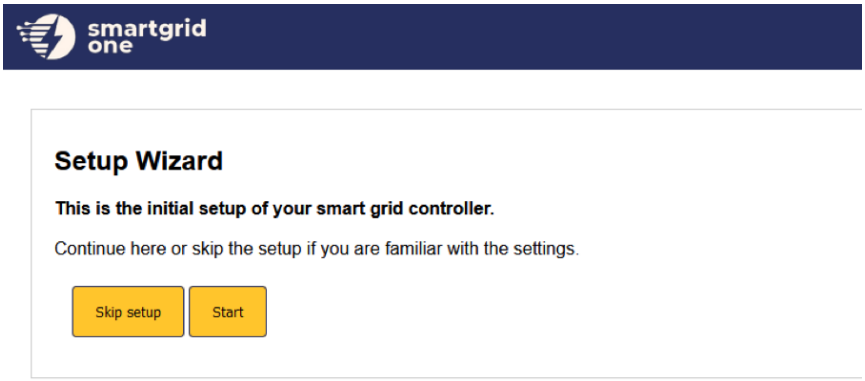
7.1 Initial controller setup

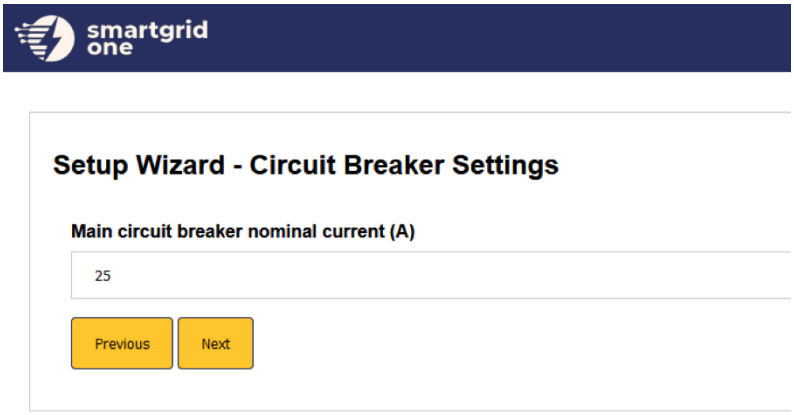
EMS

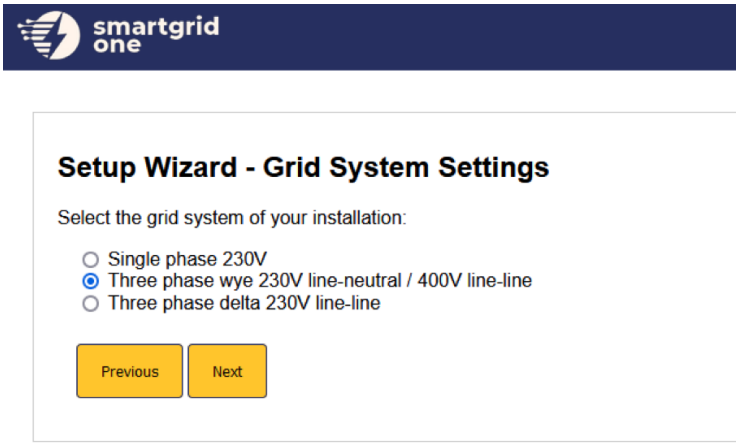
For the EMS Controller to function properly it needs to know some basic information. When a controller is newly installed it will automatically go through the initial setup to gather this information.

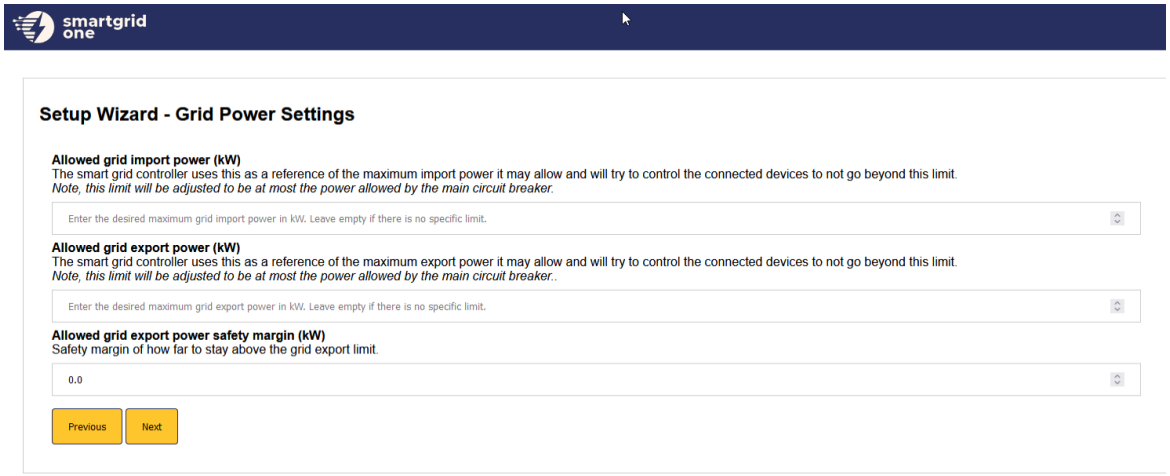
The most important information points are:

- Grid connection (1p or 3p)
- Allowed current
- Adress
- Allows import & export limits

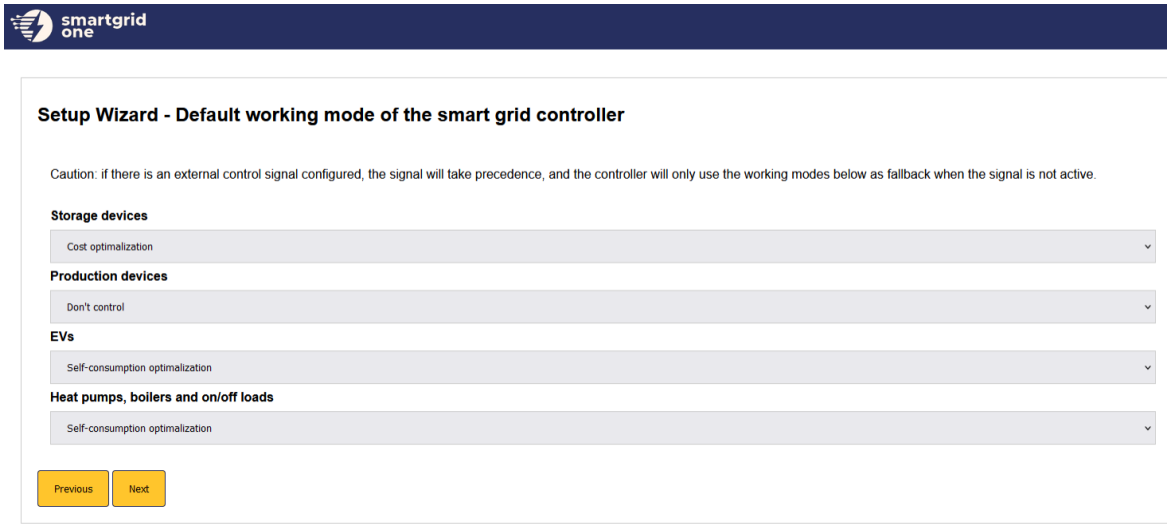


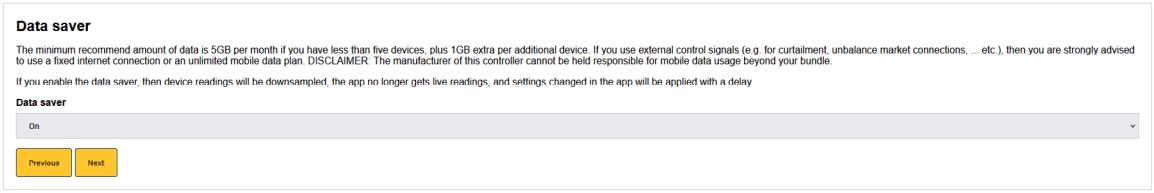




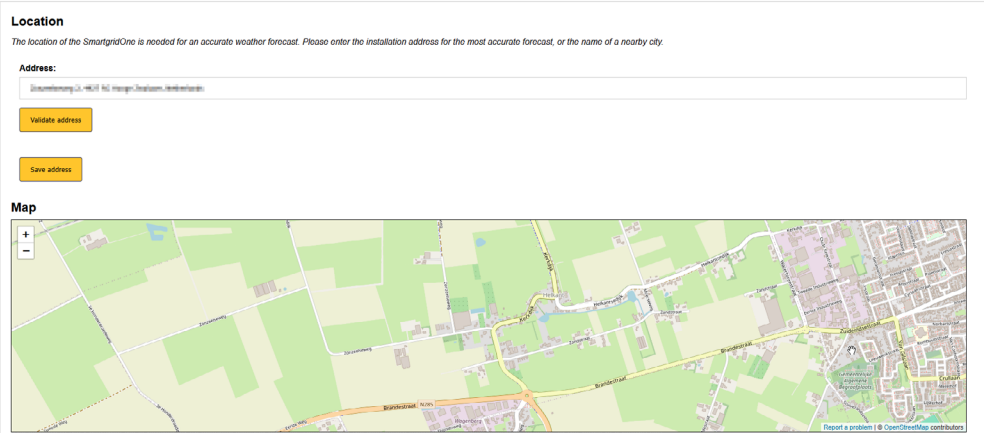


The following settings decide how the EMS is going to work. They can be changed later on but it's good to set them correctly from the start.

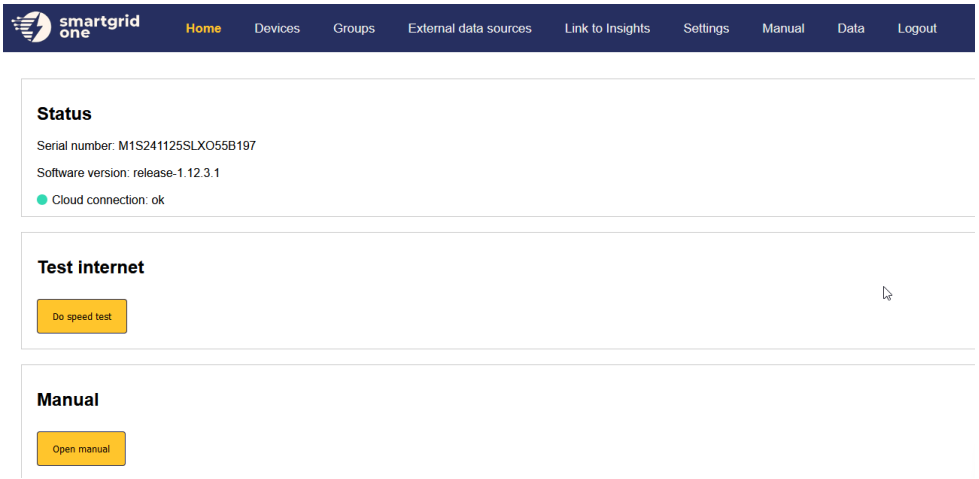




Last but not least it will ask to confirm the address. This is needed to check the EPEX spot prices for example of the negative energy prices but also for Smart Charging.



When everything is done you will be redirected to the overall overview of the EMS Controller.



7.2 Connecting devices

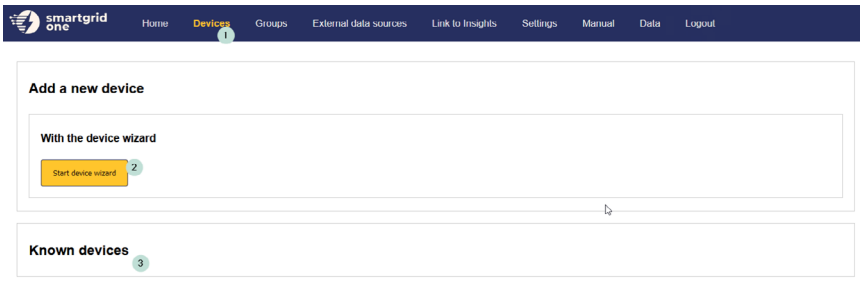
After the initial setup it will be possible to add devices. As there are many devices possible, we will just explain the main products that we provide in our portfolio:

- Inverter
- Cabinet
- Smart meter

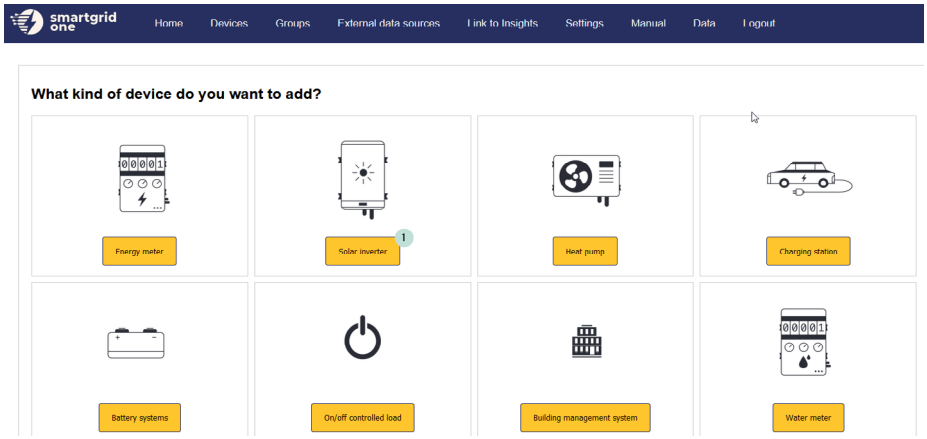
7.2.1 Connecting an Autarco Inverter

To add the inverter, we should add a device

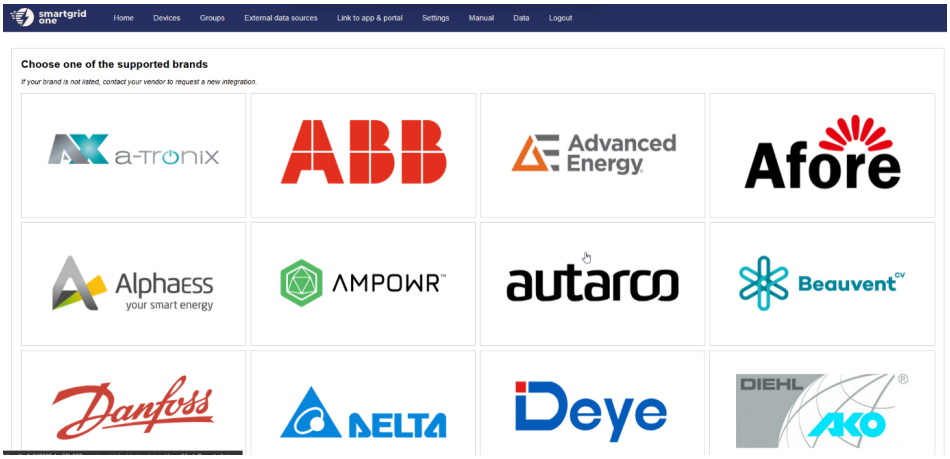
1. Go to the devices TAB
2. You can start adding a new device to the EMS logger
3. Or you can view the current already connected devices to the EMS logger.



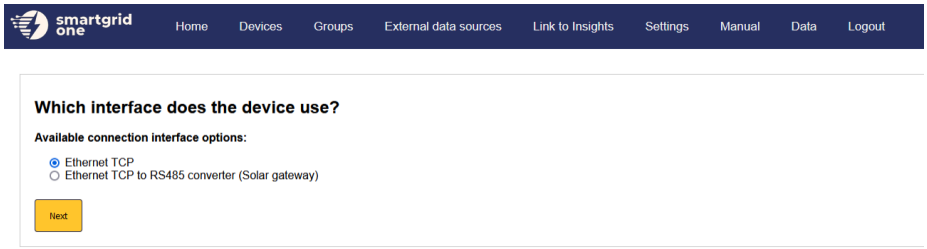
In this example we will add an Autarco inverter with a battery connected to it. For this we need to add the solar inverter.



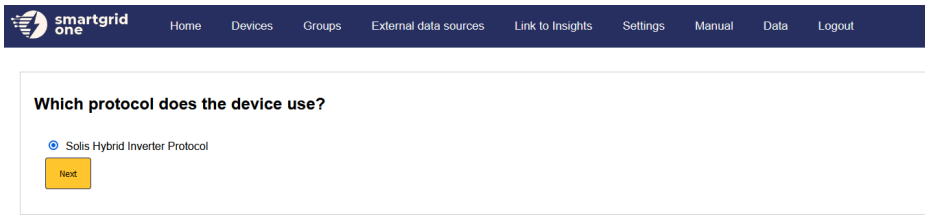
At the brand select Autarco, if Autarco is not showing, make sure your EMS Controller has the latest firmware version.



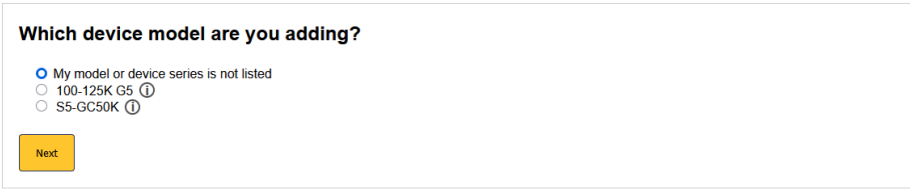
We want to have both the Autarco communication stick and EMS Controller to be active for that, we need to use the Ethernet TCP connection option.



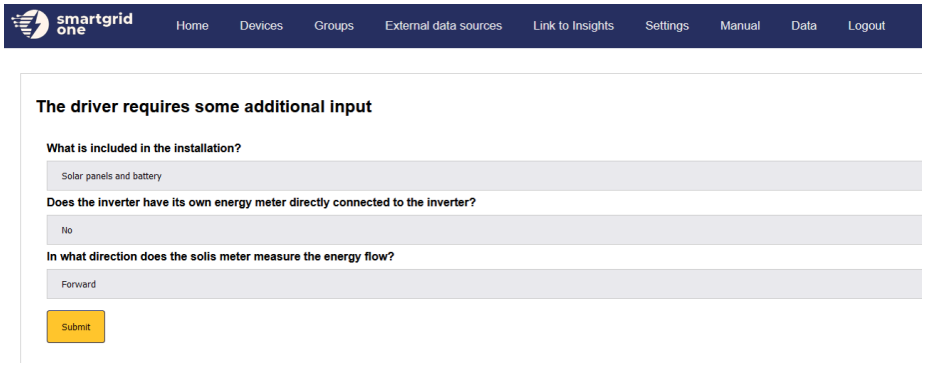
Select the correct protocol based on the inverter type that you have connected.



Only specific models needs to be selected, if your model is not here, it will work perfectly with the default communication protocol. This will be for 99% of the time the correct option.



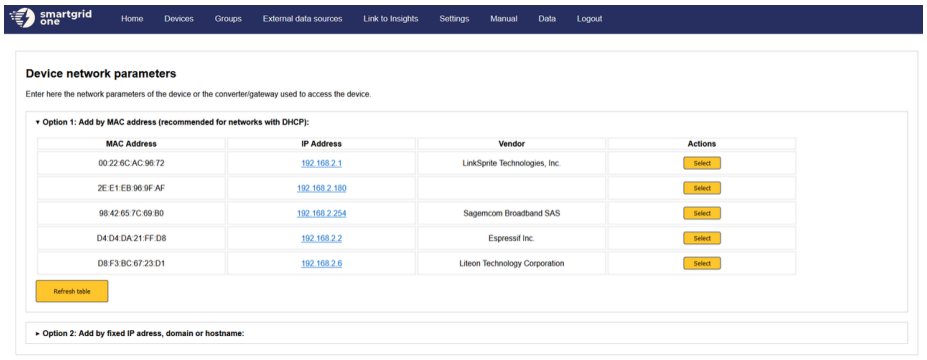
Make sure the select if there is a battery connected to the inverter.



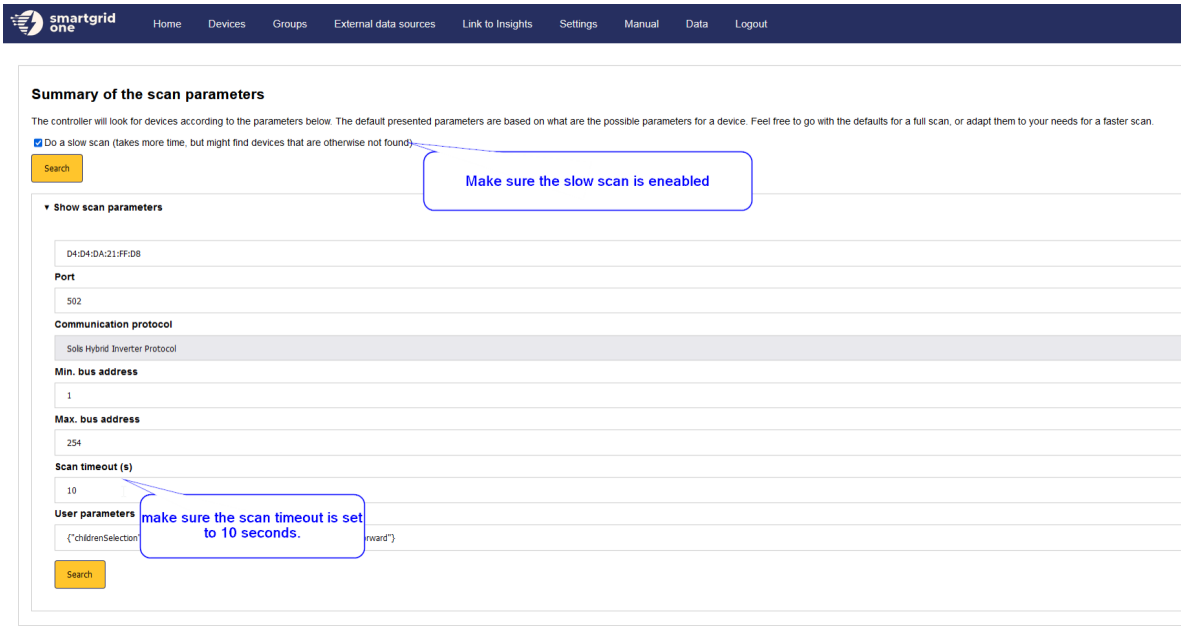
Find the correct device (communication stick) and press select.

Finding the device can be very tricky. In the future the IP will be shown in MyAutarco. But right now the options are:

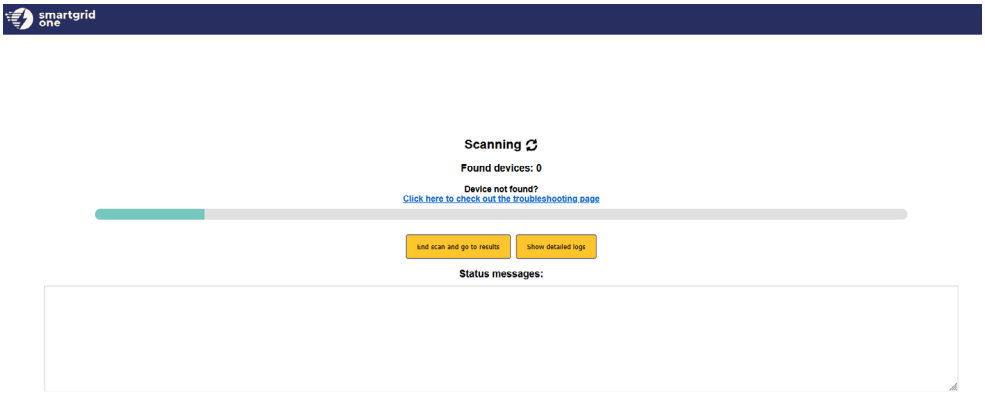
- Search via the DHCP server or via the router which IP address is assigned to the communication stick.
- When online, Autarco support team is able to retrieve the local IP address from the data in MyAutarco. Send an email with the serial number of your inverter to support@autarco.com and request the IP address of the inverter.



- Select do a slow scan
- Set scan time out to 10 seconds.

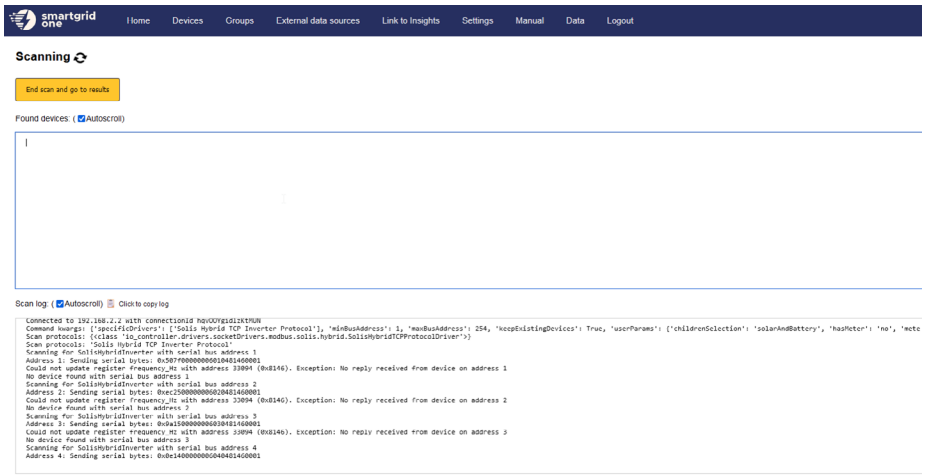


Press the search button. It will than start the scan.



When it finds a device it will show-up in the list.

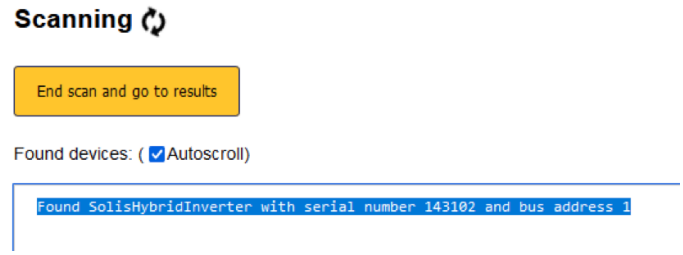
While scanning it will also show the results log below.



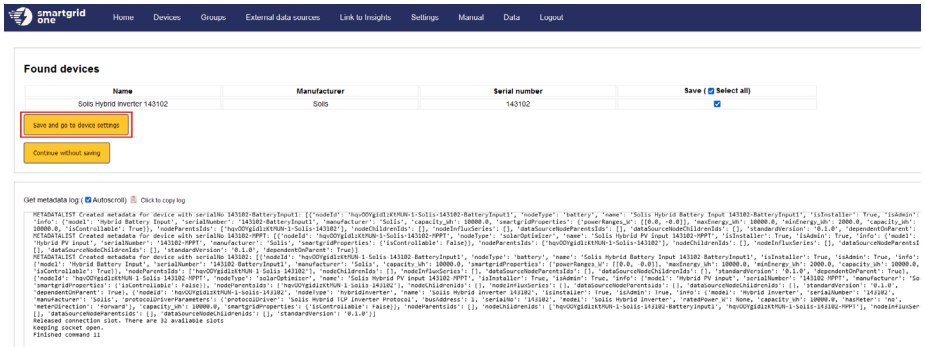
When it actually founds a device it will show in the detailed log like the following example:

```
Testing socket...
Socket test succeeded. Reusing socket
Connected to 192.168.2.2 with connectionId hqvOOYgidlzKtMUN
Command kwargs: {'specificDrivers': ['Solis Hybrid TCP Inverter Protocol'],
Scan protocols: {<class 'io_controller.drivers.socketDrivers.modbus.solis.h
Scan protocols: 'Solis Hybrid TCP Inverter Protocol'
Scanning for SolisHybridInverter with serial bus address 1
Address 1: Sending serial bytes: 0x850d000000006010481460001
Address 1: Received reply bytes: 0x850d000000050104021386
Address 1: Try framebytes: 0x850d000000050104021386
Address 1: Decoding succesful
Frequency: 49.980000000000004
Address 1: Sending serial bytes: 0x6a2800000006010481310001
Address 1: Received reply bytes: 0x6a2800000050104020 8b3
Address 1: Try framebytes: 0x6a280000000501040208b3
Address 1: Decoding succesful
Voltage: 222.70000000000002
Reading device info from Solis inverter
Starting a new block with register serialNo
Address 1: Sending serial bytes: 0xb3a2000000006010480ec0010
```

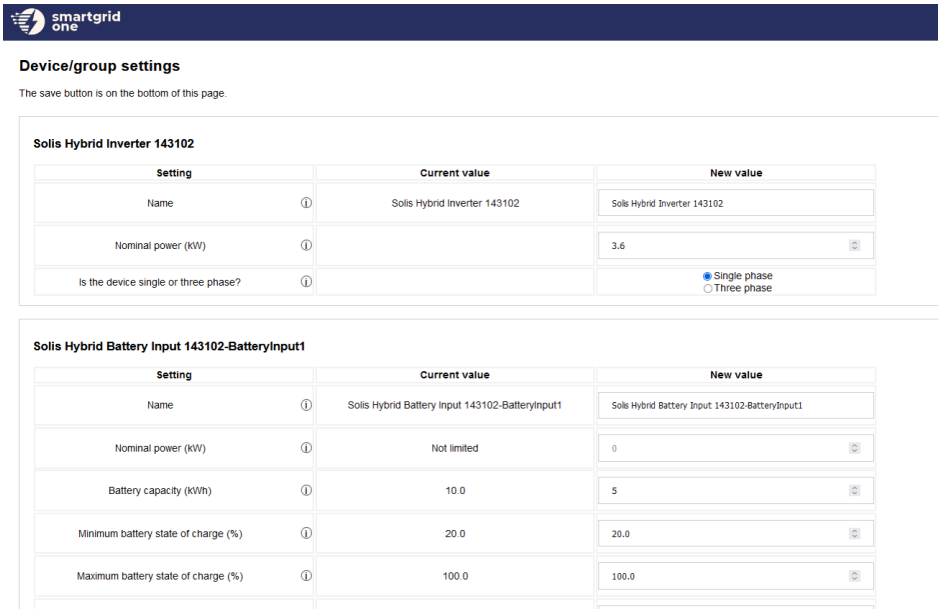
it will show the device up in the found devices overview. You can now press **“End scan and go to results”**



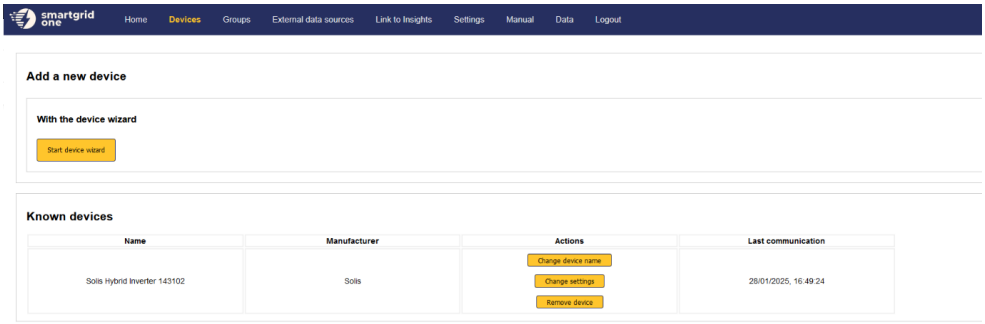
Save and go to device settings. Make sure that the inverter is selected.



At the device settings make sure you set the correct values so the EMS controller knows how to properly steer the connected device.



At the end of the process the new added device will show up at the know devices.

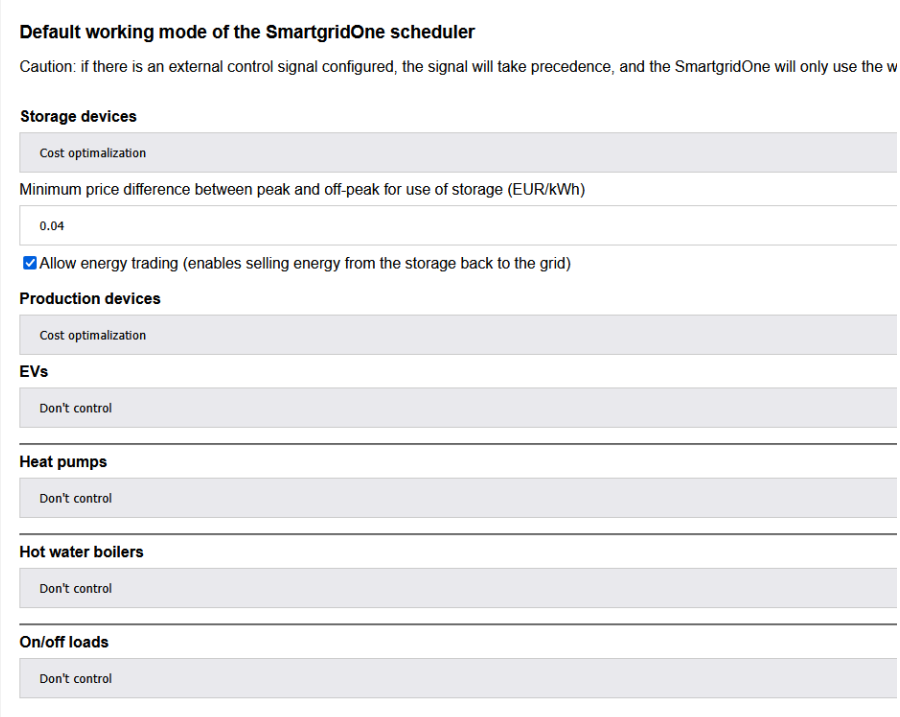


7.3 Steering modes

EMS

When all the important devices are connected, it is time to setup the control modes of the devices. In the top navigation go to settings (1)

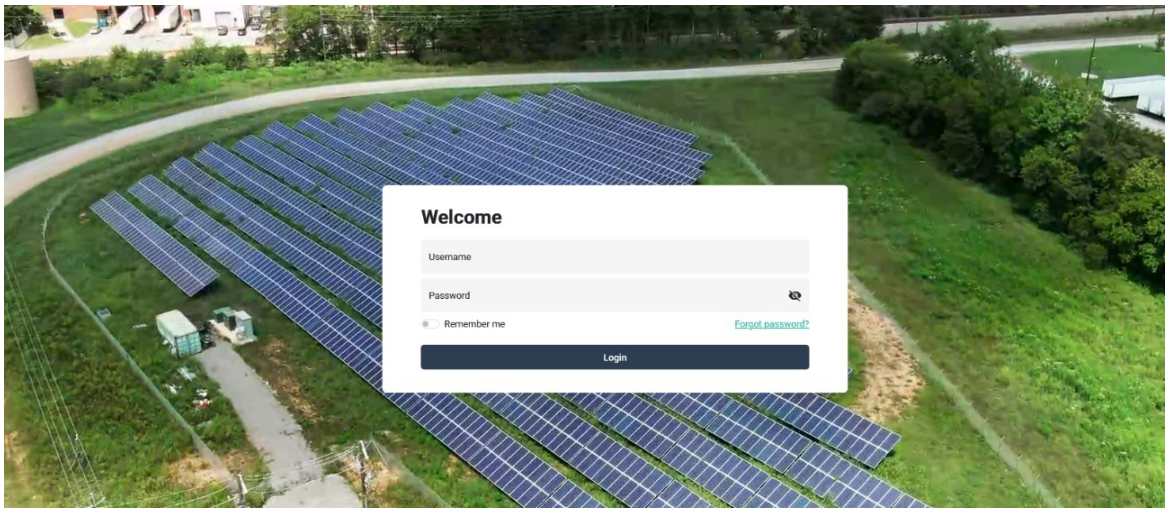
On this page you find the section for Default working modes. This can be used to setup the working modes of the connected devices.



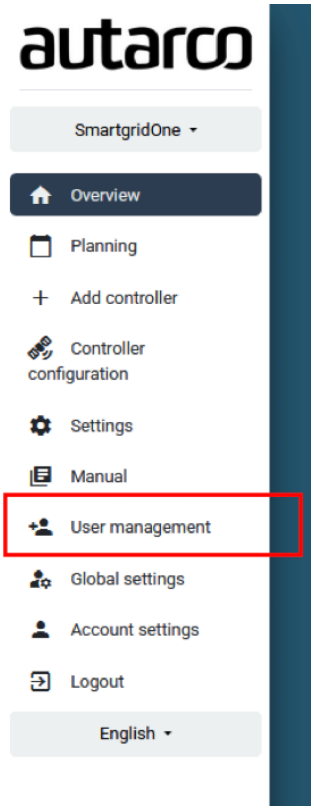
Setup End-user credentials / Login

ften the final step for the EMS setup is to give the users access to the App/web portal so they can view their EMS system.

Make sure you are logged in to the dealers environment on Online Controller Portal

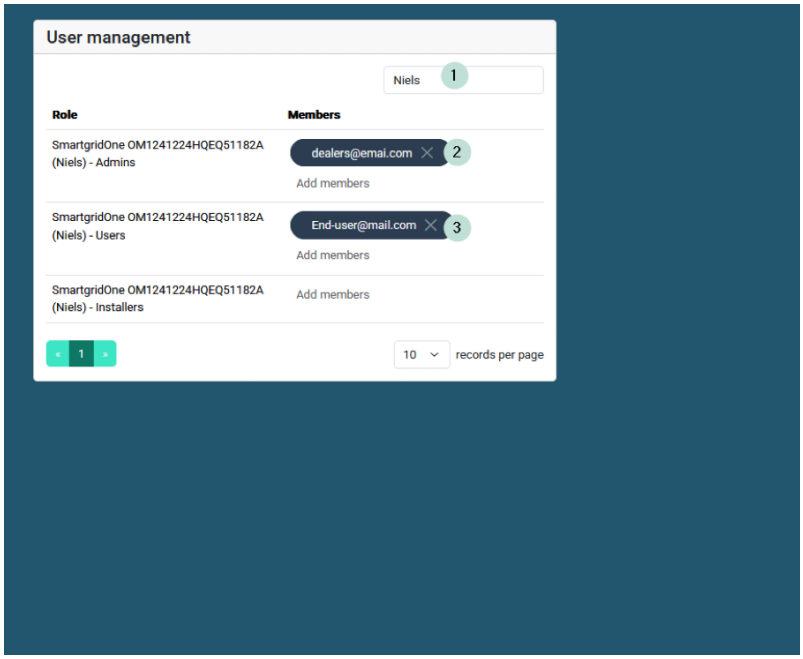


On the menu on the left, open the [User management] page.



On the next page you can see all the connected / available loggers that you've installed so far.

1. Use the search option to find the connected EMS controllers.
2. You will see your own email address shown here. You can add other admins if you want to delegate the managing or maintenance of the EMS controller.
3. Under the [users] option provide the email of the end user that wants to have access to the EMS controllers app.



There will be an automatic email send to the user with a password. After that the user can login to the environment after installing the app.

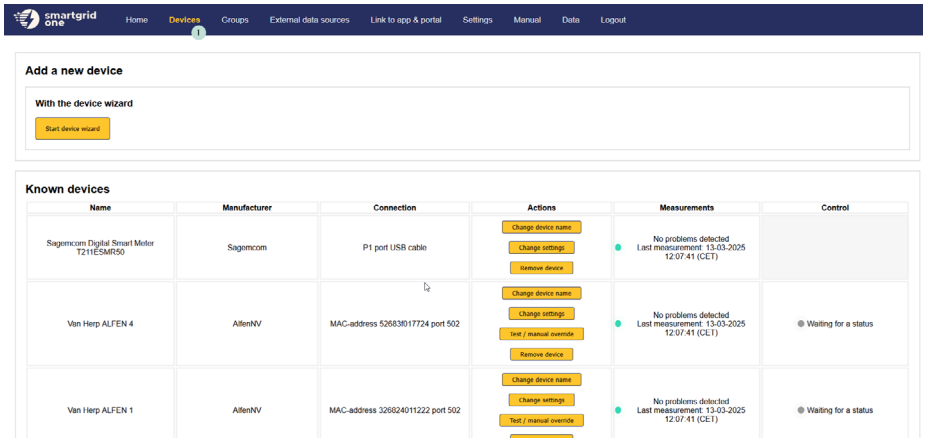
Install via Google Play

Install via Apple Store

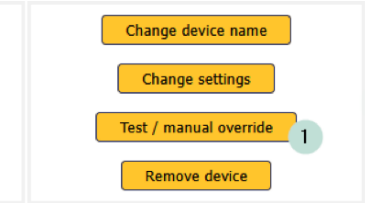
9 Trouble Shooting

9.1 Force charge/discharge battery for testing

Login to the smart grid one controller. Go to devices (1)

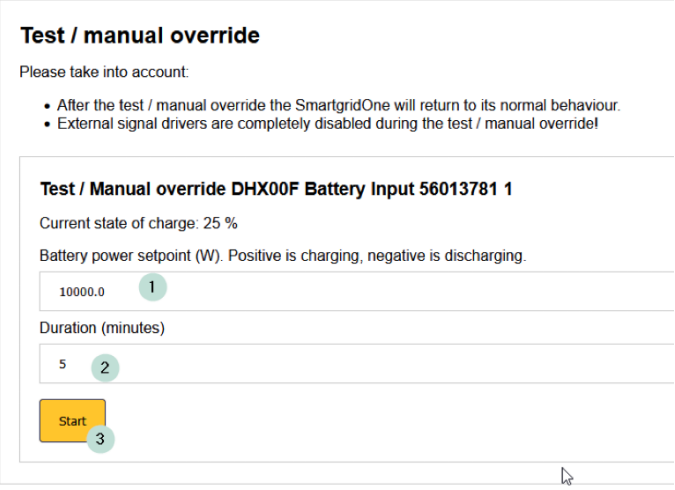


Locate the device you want to test and open the Test/ manual override (1) option



On the test page. There are 2 inputs

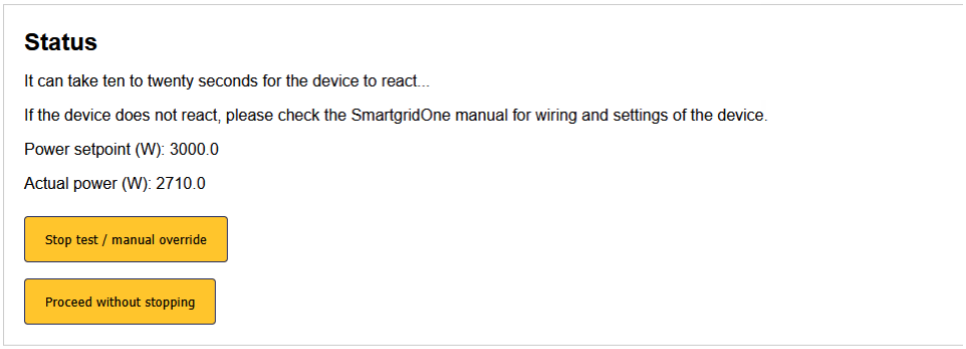
1. The power of the charging or discharging
2. The duration of the test in minutes



3. button to Start the test

After pressing start, it will start the test.

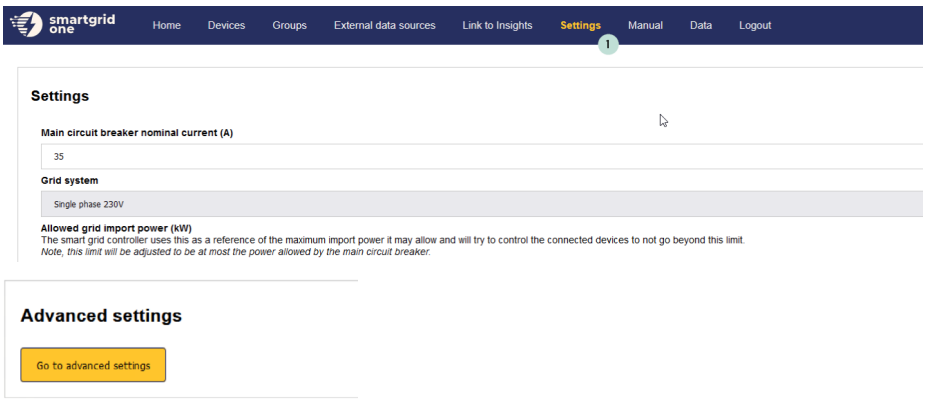
it can take some second before you see something moving. and the actual power is often not 100% correct with the set point. but it should be close! anything else may indicate its off.



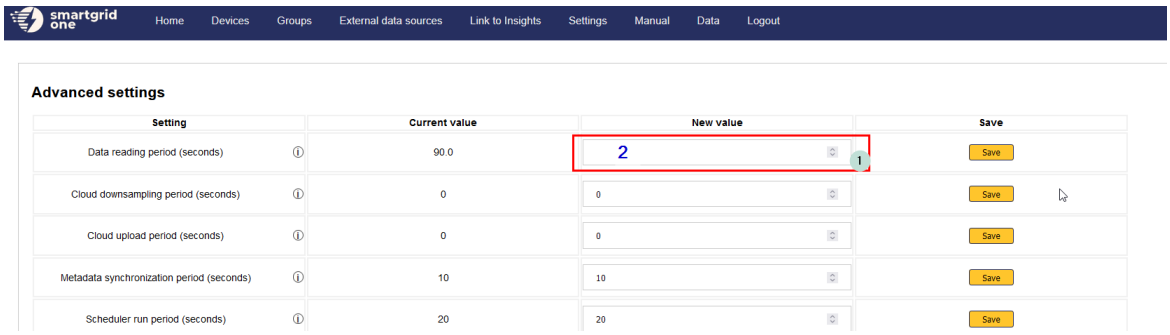
After testing please use the Stop test / manual override button. to prevent multiple tests at the same time.

9.2 Changing data settings on connection issues

When you don't need to do active steering and need to get the data very often it's advised to change the settings of the data polling. Our older sticks are not the best in replying so to not overload the sticks we can adjust the poling settings.



Adjust the Data reading period (seconds) to 5 seconds. This makes sure that we still get proper data into MyAutarco and the EMS Controller can steer for example on smart charging.
make sure to press **"Save"**



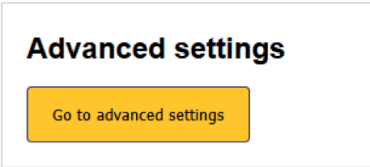
9.3 Oscillations / wrong net injections

EMS

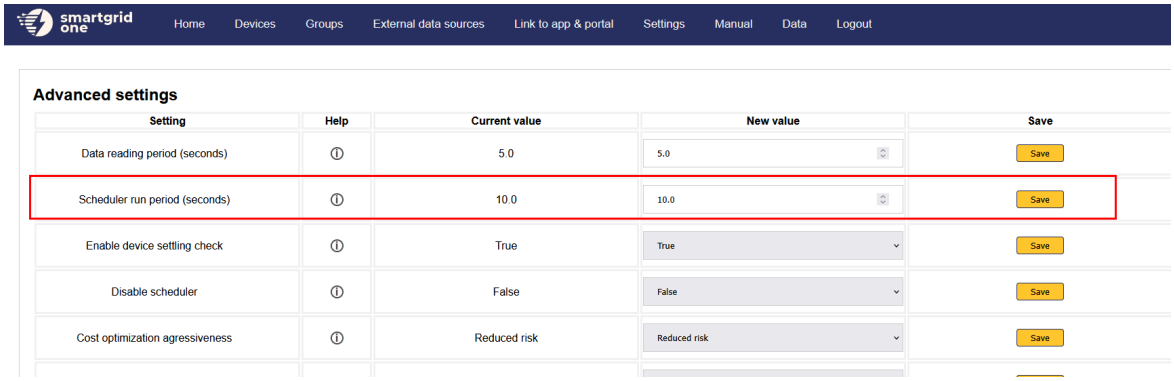
The EMS controller is the big brain of the whole system it needs to retrieve all the data from all the devices and than based on that make decisions on steering and what to do.

The EMS controller is primarily a reactive solution, meaning it operates based on retrieved information. As a result, there is always a delay between the actual event and the controller's response. If certain devices are slow to respond or slow in providing data, this can trigger a chain reaction—where delayed information and sluggish responses cause the EMS controller to oversteer or overreact to the situation. To prevent this happening, you can change the time between the commands send by the EMS Controller.

- Go into the controller.
- Go to settings.
- Go to advanced settings.



Change the highlighted setting "Scheduler run period (seconds)" to a higher number. The EMS will steer slower but will have less oscillations.
NOTE: don't change this to higher in situations where high peak load can cause a broken fuse.



9.4 Controller stuck in booting

EMS

When doing debugging on EMS Controllers the interface is blocked for user input. In that period, it will show that the controller is booting. Or it could be that a software update was not successful. In both cases contact Autarco to get more information on the status. Please make sure to note down the EMS controller Serial number before reaching out.

9.5 Can’t find device

Adding devices to the EMS controller to be steered is the hardest part of the setup. Each device reacts different and each network is also different. This makes it hard to have a one perfect solution described in the manual. Common causes that may cause why the device is not being found by the EMS Controller

General

- Double check if the device is supported in the supported hardware list
- When adding devices the EMS Controller checks if the read values are sensible. If they are not, it will not recognise the device. For this the device should be in fully operational state.
- Double check if the wiring is connected correctly.

TCP/IP

- Device is not TCP/IP communication enabled
- Devices do not have the same IP Address range
- One or more devices are on a WiFi repeater and therefor can not find each other
- The device is responding not fast enough (use the slow scan option with timeout)

RS485

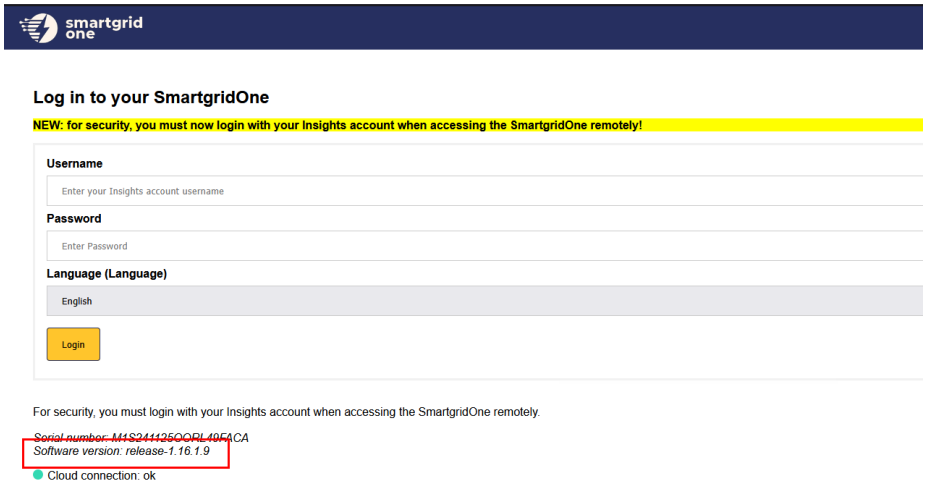
- Some devices may require and end resistor of 120 Ohm when connecting with RS485
- Make sure the correct Modbus address is set and that devices are not on the same address
- Make sure the dipswitches on the EMS Controller are all set to ON.

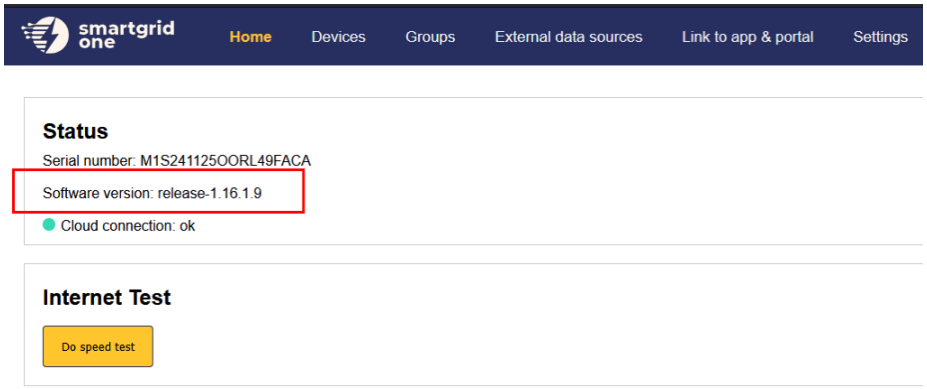
9.6 Errors during adding device

When trying to add a device such as a cabinet. it can happen that the controller runs into an error. We are constantly working on improvements and to give you the best experience we advise to be on the latest Firmware version.

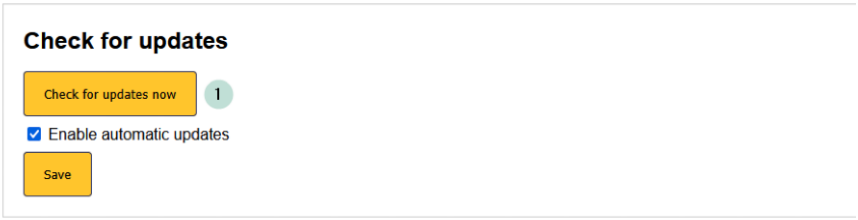
First devices supported from firmware 1.16.X.X If your controller has a lower version than that make sure to update it.

Autarco personnel can manually update controllers to higher version if checking for updates is not working. Feel free to reach out for assistant!





Under settings you can find the button to check for updates.



9.7 Additional documentation online:

EMS

Online trouble shooting guide

10 Setting up imbalance market with Frank Energie

As this may change over time, the online documentation can be found here:
Frank Energie setup