

# Quickguide

## eBOX onboard load management

The power  
to move



 COMPLEO

# Inhalt

Introduction .....	4
About this document.....	4
Technical specification.....	4
Overview of graphical user interfaces .....	5
eCONFIG app.....	5
eBOX WebGUI .....	5
Onboard load management WebGUI.....	5
Network configuration.....	6
Access the eBOX WebGUI.....	7
Access the eBOX WebGUI via Ethernet .....	7
Access the eBOX WebGUI via Wifi .....	9
Login .....	11
Firmware-Update .....	12
Option 1: Update via backend .....	13
Option 2: Update via eBOX web interface .....	13
Configure the responders.....	13
Configure the controller.....	14
Access the onboard load management WebGUI .....	15
Set up the cluster .....	15
Add a responder.....	17
Monitoring.....	18
Troubleshooting .....	19

## Introduction

At many sites it is not possible to handle the increased energy demands of electric vehicles. Avoid grid expansion cost, prevent blackouts, and ensure efficient power distribution between electric vehicles with the Compleo eBOX. With onboard load management the eBOX provides a solution that works without additional industrial computers and in use cases in which the upper power limit is known.

Key Features:

- Distribution of power within an eBOX cluster, that takes the demands of each vehicle into account
- Distribution algorithms “First come, First Served”, “Equal Distribution” and “Smart Distribution”
- Calculated or static fallback in case a responder loses its connection to the controller
- Full control through dashboard with event log, allowing for checking the setup success and defining measurements for improving instable connections

### About this document

This document guides you through the process of setting up the eBOXes’ onboard load management. It is one of many documents that focus on different aspects of the operation of eBOXes’. For additional documents please refer to the Document Center.

## Technical specification

Maximum cluster size	15 eBOXes (recommended)
Firmware version	2.2 or higher
Protocol	Modbus TCP/IP
Scaling technique	Controller-Responder (also known as Master-Slave)

## Overview of graphical user interfaces

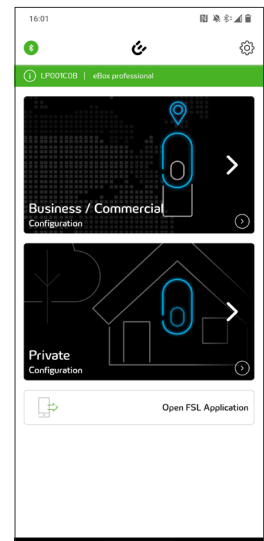
In the process of configuring load management you have to use different graphical user interfaces (GUIs), namely the eCONFIG App, the eBOX WebGUI and the onboard load management WebGUI.

### eCONFIG app

For the initial setup of the eBOX, including electrical settings and backend credentials, we recommend to use the eCONFIG app. Please refer to the eCONFIG manual, which you can find in our Document Center.



In case you can't establish a connection to the WebGUIs via IP-address anymore, the eCONFIG app can serve as a fallback, where you can perform a factory reset.

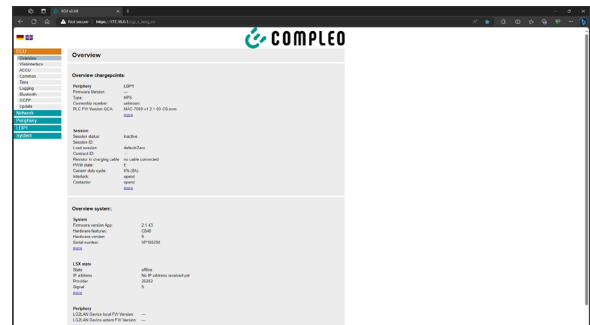


### eBOX WebGUI

Mainly for service purposes but also mandatory for load management settings, the eBOX WebGUI allows you to configure the operationally relevant parameters, one eBOX at a time

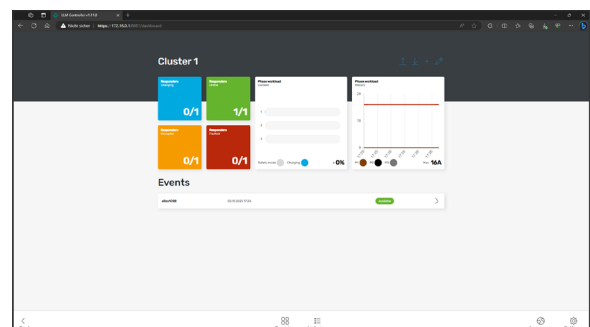


If you are experienced with the eBOX, you can perform the individual configuration of each eBOX inside the WebGUI and use the eCONFIG app as a fallback only.



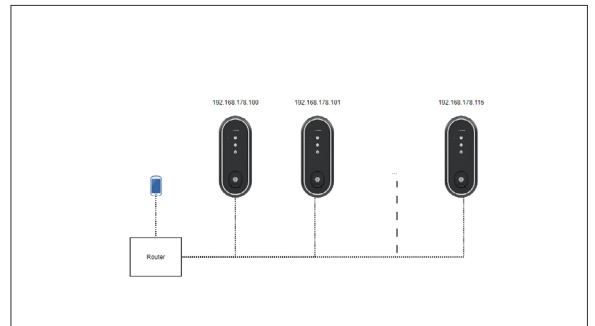
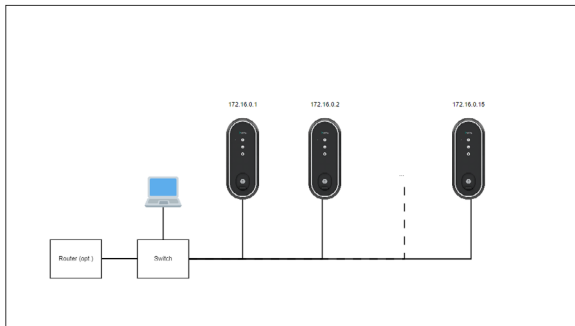
### Onboard load management WebGUI

The onboard load management WebGUI runs only on the controller of each cluster and is used to setup and monitor the corresponding cluster. It is accessible as soon as you activate it in the eBOX WebGUI.



## Network configuration

All eBOXes of one cluster must be within the same subnet. The eBOXes can communicate via LAN or Wifi. To enable communication between eBOXes you must assign a locally unique static IPv4 address to each eBOX. See examples in the diagrams below. To configure IP addresses, you need to connect to each eBOX. Access to the WebGUI is described in the next section.



To help your decision on which setup to use, the following table shows pros and cons of a wired setup and a wireless setup respectively.

	Wired setup	Wireless setup
<b>Pros</b>	<ul style="list-style-type: none"> <li>robust network stability</li> <li>physical barrier to network ports</li> </ul>	<ul style="list-style-type: none"> <li>no need for wiring</li> <li>easier reconfiguration of existing clusters</li> <li>configuration on smartphone possible</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>expensive wiring</li> <li>adjustment of existing installation</li> </ul>	<ul style="list-style-type: none"> <li>network stability impaired by moving vehicles</li> <li>no physical barrier to network</li> <li>jamming possible (jamming disrupts wireless signals by transmitting interference on the same frequency)</li> <li>due to impaired stability the safety mode is activated more often and affects the efficiency of load management</li> </ul>

## Access the eBOX WebGUI

### Prerequisites:

- Correctly mounted and wired eBOX
- Laptop with rights to change IPv4 address
- LAN cable and/or if applicable, access to the existing LAN/WiFi (the use of existing LAN/WiFi requires the eBOX to be configured previously via eCONFIG app or WebGUI)
- PUK of eBOX (find the PUK on the back of the eBOX manual)

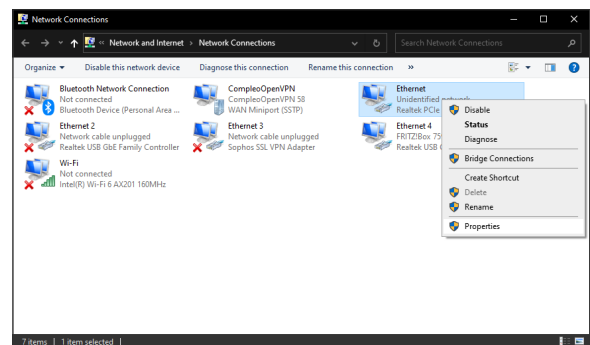
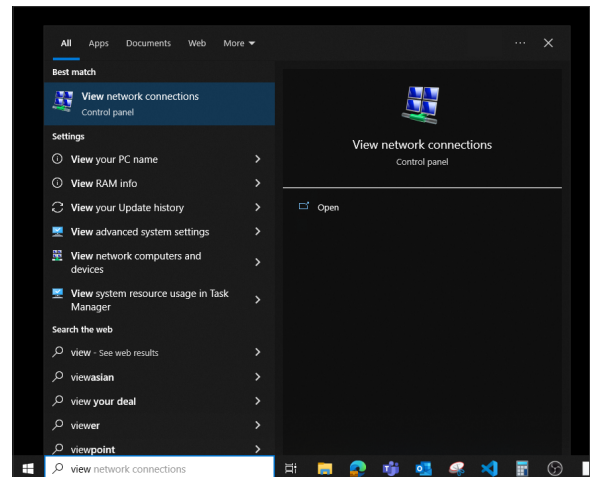


In context with eBOX WebGUI, only the mandatory steps for configuring onboard load management are described in the following. For more detailed information please refer to the QuickGuide WebConfig inside the Document Center.

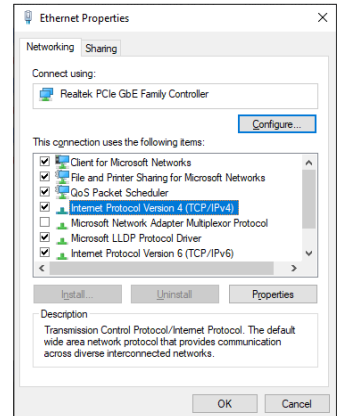
Connect your laptop to the eBOX via Ethernet or Wifi. Find instructions for accessing via Ethernet in the following section „Access the eBOX WebGUI via Ethernet“. If you are using Wifi, please jump to section „Access the eBOX WebGUI via Wifi“.

### Access the eBOX WebGUI via Ethernet

1. In the Windows search bar, search “View network connections” and open.
2. Right click the used Ethernet port and go to properties (admin rights required)



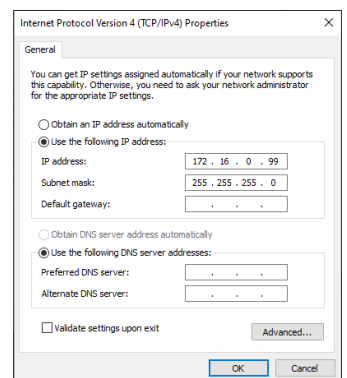
3. Double click „Internet Protocol Version 4 (TCP/IPv4)“.



4. Assign IP address in the address range 172.16.0.x as shown in the screenshot. Everything except .

1 is OK, because the charging station has this address. We recommend 172.16.0.99.

Also enter subnet mask 255.255.255.0. Then click on „OK“ in both previously opened windows.



5. Open a common browser and enter <https://172.16.0.1/>, then jump to section „Login“.



If firmware version < 1.3.38 is installed you might need to use "http://" to reach the WebGUI.

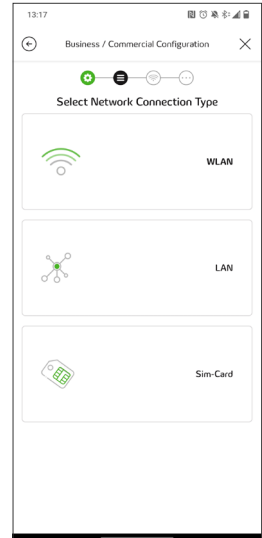
If you use a switch to conveniently set up multiple charging stations, make sure that only exactly one charging station with the above address is connected to it or supplied with power at a time. Otherwise, IP address conflicts will occur. As soon as you have given the charging stations individual IP addresses, you can access the WebGUI of various eBOXes simultaneously in different tabs.



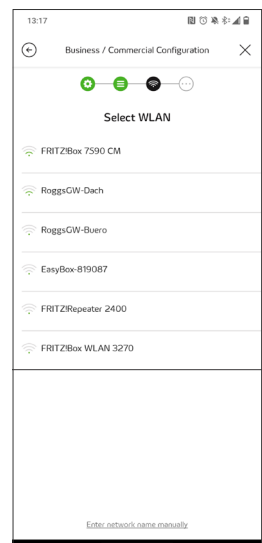
**Access the eBOX WebGUI via Wifi**

Use the eCONFIG app to establish a connection to a WiFi. For more details, please refer to the eCONFIG manual, which you can find in our Document Center. During the configuration workflow

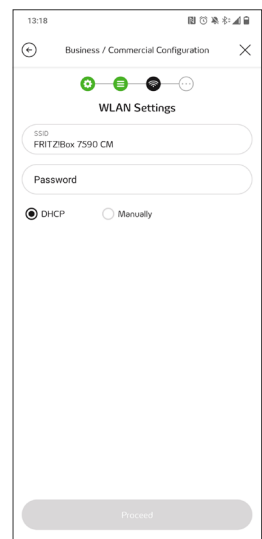
1. Select WLAN as Network Connection Type.



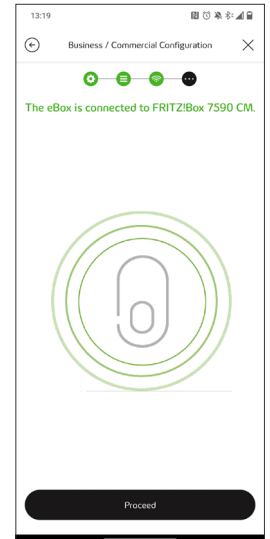
2. Select WLAN




3. Choose DHCP and enter the password.

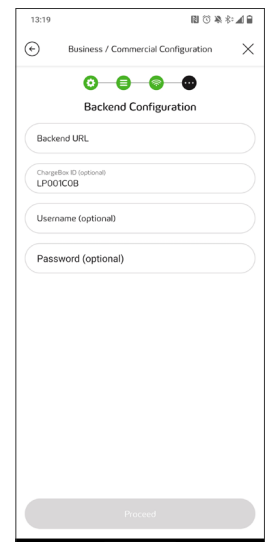


4. Check for success of connection.




5. Enter backend credentials and proceed (optional) or quit the process.

 In case you want onboard load management and backend connection be run through different interfaces, e.g. onboard load management via Wifi and backend connection via SIM-card, you can adjust the backend connection interface in the eBOX WebGUI later without affecting the Wifi connection.



6. Log into your router's interface and go to the list of Wifi devices. The example on the right shows the list of Wifi devices inside a common router.

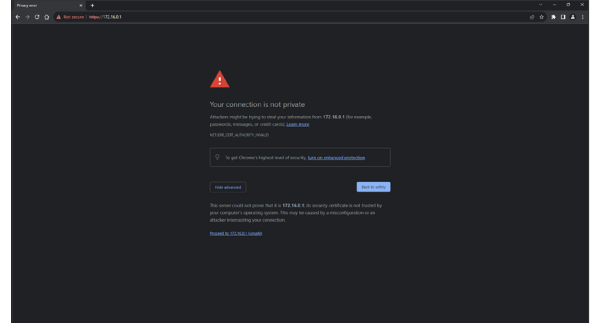
Signal	Name	IP Address	Band	Throughput (Mbps)	Properties
	Android	192.168.178.95	5-GHz	1866 / 7780	Wi-Fi 5, 80 MHz, WPA...
	Samsung	192.168.178.25	2.4-GHz	300 / 111	Wi-Fi 4, 40 MHz, WPA...
	eboxLP001C0B	192.168.178.142	2.4-GHz	120 / 11	Wi-Fi 4, 40 MHz, WPA...

 If the Wifi IP address of the eBOX changes during operation, controller and responder lose their connection. Therefore it is strongly recommended to activate the option inside the router's interface, to always assign the same IP address to the device.


7. Click on the devices hostname to be redirected to the eBOX WebGUI.

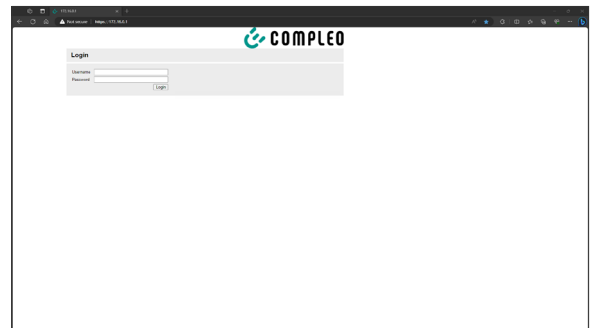
## Login

If necessary, skip the security warning by clicking “Advanced” and “Proceed to 172.16.0.1 (unsafe)”.



Login with username “admin” and password [PUK].

 The [PUK] can be found on the backside of the user manual.



## Firmware-Update

Firmware 2.2 or higher is required for using onboard load management. There are several ways to identify the current firmware version. Identify the current firmware version on your eBOX and update along the path, starting with the next highest version.

### OCPP BootNotification

```
{„chargeBoxSerialNumber“:“*“,„chargePointModel“:“*“,„chargePointVendor“:“*“,„firmwareVersion“:“1.3.38“,„iccid“:“*“,„imsi“:“*“,„meterSerialNumber“:“*“,„meterType“:“*“}
```

### eBOX WebGUI

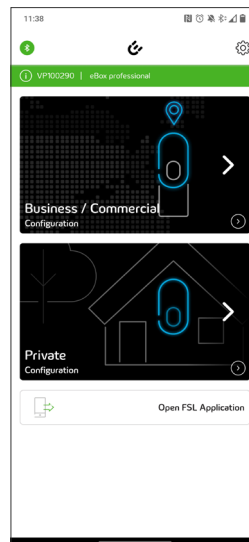
Go to “System > System data” and check “ACCU firmware version”

System data	
ACCU firmware version:	2.1.0
Firmware version App:	2.1.43
Firmware version router:	5.4
Firmware version UI-Board:	0.1.17
Firmware version HPS-Board:	APP-2.3.1-EU-S
Hardware features:	C848
Build date:	2022-09-05 14:12:02
Git-Hash:	71d69184b3d6e630af64401ed300dc4b3c7b742c
MAC0:	9C:30:66:06:63:33
MAC1:	9c:30:66:06:63:34
Hardware version:	9
Serial number:	VP100290
Production date:	202309051530
Production number:	D2
Commissioning state:	ready for commissioning

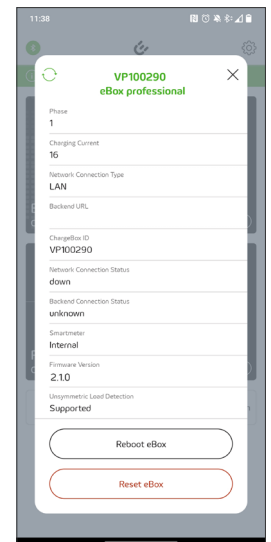
Refresh

### eCONFIG-App

1. Click on „info“
2. Check „Firmware-Version“



to 1.



to 2.

If an update is required and the eBOXes are connected to a backend that supports mass updates, jump to section „Option 1: Update via backend“ for highest comfort. If that is not possible, jump to section „Option 2: Update via eBOX web interface“.

**Option 1: Update via backend**

To avoid having to log into the web interface of each eBOX, please contact the operator of the charging station and ask them to check the currently installed firmware and perform an update for each eBOX at your location, if possible and necessary. If not, move on to the next section.

**Option 2: Update via eBOX web interface**

1. Access each eBOX through the local network as described in section „Access the eBOX WebGUI“ and “Login“.
2. Go to “ECU > Update”
3. Choose a file
4. Click “Upload FW”
5. Confirm
6. Install

The eBOX will be rebooted. The update may take up to 4 minutes and in case of updating to 1.3.38 even up to 15 minutes.

The screenshot shows the 'Update' page in the eBOX web interface. It has a header 'Update' and a section 'Update over local sources' with the text 'upload can last several minutes'. Below this is a dropdown menu for file selection and an 'Upload FW' button. A 'Status' section below shows 'no update packet available' and a 'Refresh' button.

The screenshot shows the 'Update' page after a file upload. It has a header 'Update' and a section 'Uploaded File:' with the text 'File was uploaded successfully' and 'MD5 checksum: d98b38717381b001a5ea39ea07a67'. Below this is a confirmation dialog: 'Shall the file really be uploaded? This may take some time.' with 'yes' and 'no' buttons.

## Configure the responders

As mentioned in the section „Technical specification“, one of the eBOXes within a cluster must take the role of controller while all eBOXes within a cluster are responders, including the controller, which controls itself. Any of the eBOXes can be a controller.



In case you are using a SIM-card and an APN for backend connection, it is recommended to make the eBOX with the strongest cellular network reception available the controller, so that you can access its web interface remotely with reliability, whenever needed.

To configure the responders, repeat steps 1. - 6. for each responder:


1. Access the eBOX WebGUI of the desired responder
2. If you are using a wired connection, go to “Network > Interfaces“, else jump to 5.

3. Under Network 1 Settings, assign a locally unique IP address and save settings at the bottom of the page.
4. Access the eBOX WebGUI again by entering the newly assigned IP address in the search bar of the browser and login.
5. Go to “LDP1 > Loadmanagement”
6. Under “Settings responder”, change the load management type to “modbus\_tcp”.
7. Choose Modbus interface, either net1 or wlan1, depending on whether you use a wired or wireless connection.
8. Press “OK” to save settings.

You are now done with the configuration of the responders.

## Configure the controller

For the controller, in addition to performing the steps from the previous section, check the box “Controller active”, and press “OK” to save settings.



Keep in mind that the controller is also a responder which controls itself.

**Ethernet**

Network 1 Settings

Network active

Start DHCP client

Static IP active

Static IP address

Netmask

Start DHCP server

Network 2 Settings

Network active

Start DHCP client

Static IP active

Static IP address

Netmask

Start DHCP server

**Loadmanagement**

**Settings controller**

Controller active

**Settings responder**

Load management type:

Save settings

**Loadmanagement**

**Settings controller**

Controller active

**Settings responder**

Load management type:

**Modbus TCP**

Interface:

Port:

Save settings

**Loadmanagement**

**Settings controller**

Controller active

**Settings responder**

Load management type:

**Modbus TCP**

Interface:

Port:

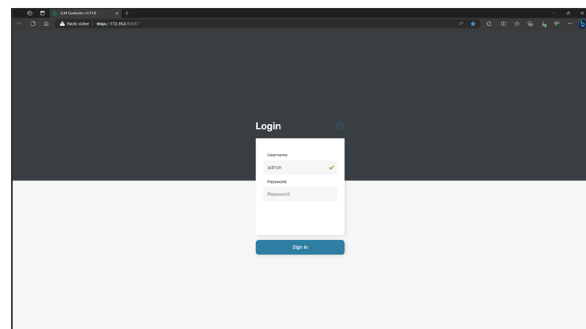
Save settings

Access the onboard load management WebGUI

1. To access the load management web interface click "Open controller" which shows as soon as you press "OK" to save settings after checking the box "Controller active".


Alternatively you can manually add the port ":8087" to the IPv4 address of the charging station in the browser, e.g.: <https://176.16.0.1:8087>

2. You have to login again with the same credentials you used for the eBOX web interface: admin:[PUK].

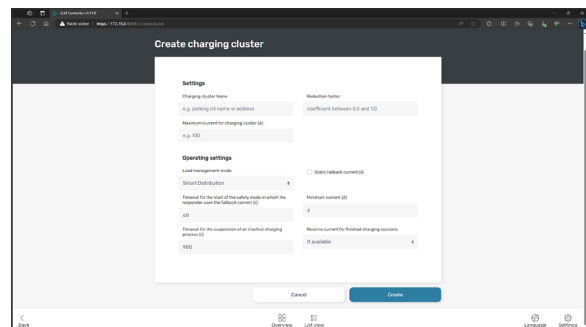


### Set up the cluster

After login you are immediately presented with the cluster configuration.



All electrical settings must be performed by a qualified electrician.



1. Choose a name for the charging cluster, which should help you identify it, when accessing remotely.
2. Set the maximum current for the charging cluster (A)
3. Set the reduction factor. The reduction factor will be multiplied with the maximum current. This for example allows you to add a 10 % buffer to the maximum current at the mains connection to lower the risk of tripping the RCD, by setting a reduction factor "0.9". However, this makes the load management less efficient.

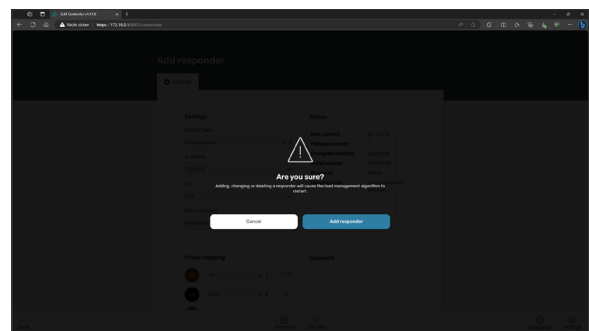
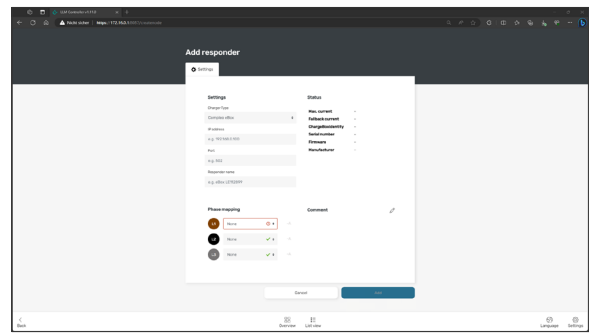
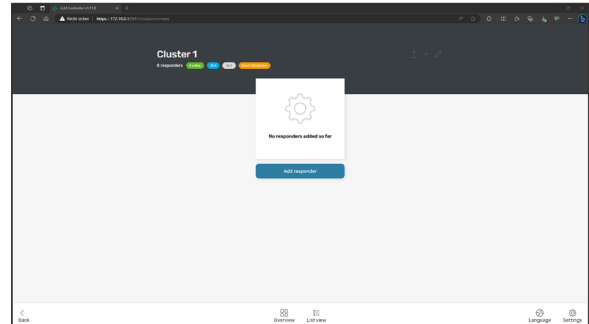
For the following parameters it is recommended to use the defaults.

4. Choose a load management mode. The options are
  - a. None - this makes load management inactive but still enables the monitoring features for a cluster
  - b. Equal Distribution - The available current is equally distributed among active charging sessions
  - c. First Come First Serve - The active charging sessions receive the max. possible current according to their starting time
  - d. Smart Distribution (default) - In contrast to equal distribution this mode takes into account responder-specific max. currents, currents as requested by the EVs, and phase load
5. Set the timeout (s) for the start of the safety mode in which the responder uses the fallback current. The default value is 60 s.
6. Set the timeout for the suspension of an inactive charging process (s). The default value is 900 s (15 min). The charging station cannot detect whether a charging process is paused or finished. Therefore it is possible to configure this timeout.
7. Decide whether to use a static fallback current (A). The fallback current will be reserved by the controller side and used by the responder in safety mode, if needed. By default, the fallback current is calculated by rounding off the maximum current for the charging cluster divided by the number of responders, e.g. 6 A for a charging cluster with 100 A and 16 eBOXes. One eBOX more would reduce this value slightly below 6 A, which is out of norm and therefore results in a fallback of 0 A. In this case a qualified electrician might consider manually assigning a static fallback current of 6 A to this cluster.
8. Set the minimum current (A). The norm allows 6 A at minimum. Consider using 10 A in public settings to be compatible with a wider range of vehicles, but reevaluate the fallback current then.
9. Decide, when to reserve current for finished charging sessions. As set in step 6, it is possible for the controller to interpret whether a charging session is finished. However, if a pause gets misinterpreted as the end of the session, it is not possible for the EV to wake the eBOX back up again. Therefore the following options should be evaluated:
  - a. Never - Suspended charging sessions will be limited to 0 A.
  - b. If available - The current that is not in use will be reserved for suspended charging sessions.
  - c. Always - The minimum current will be reserved for suspended charging sessions.
10. Click "Create" to finish.



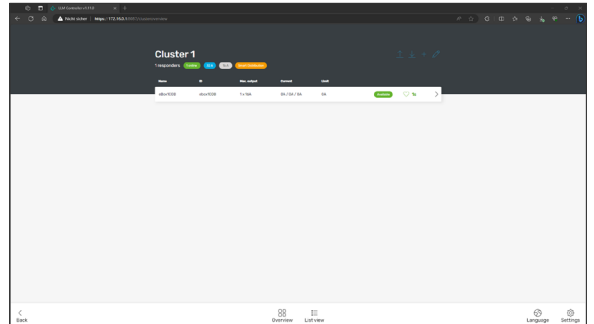
### Add a responder

1. Add a responder by clicking the button of the same name for the first responder, or by clicking the “+” in the top right corner for all further responders.
  
2. Enter the IP address of a responder. In wired setup, use the IP addresses you assigned. In wireless setup, use the IP addresses the Wifi router assigned, which you can find in the list of Wifi devices inside the WebGUI of the router.
  
3. Enter the Modbus port (default: 502)
  
4. Choose a name for the responder
  
5. Adjust the phase mapping if applicable.
  
6. Make a comment if necessary.
  
7. Click “Add”.
  
8. Confirm.
  
9. Repeat for each responder.



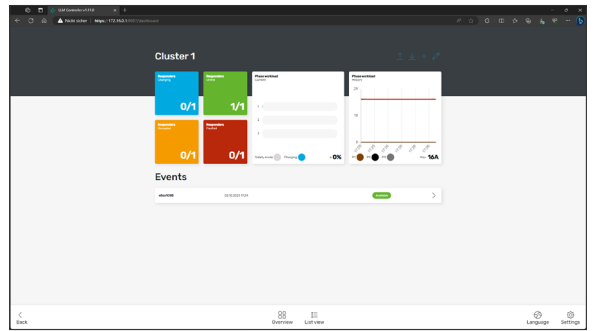
### Monitoring

After adding a responder, you will be presented with the list view. At the bottom of the page, change to overview for more detailed monitoring.



The dashboard shows you the status of each responder, the current workload per phase, and a graph of the workload per phase of the past hour. It also shows you a list of the most recent events.

You can use the overview to check whether the configuration meets your expectations, if so, congratulations, you're done!



## Troubleshooting

Problem	Proposed solution
eCONFIG app does not connect to the eBOX	<ol style="list-style-type: none"> <li>1. Open eCONFIG app</li> <li>2. Go to Bluetooth settings of your smartphone</li> <li>3. Decouple the eBOX from your smartphone</li> <li>4. Restart Bluetooth scan on the eBOX by holding the Bluetooth button until it turns blue</li> <li>5. Refresh search for Bluetooth devices on smartphone</li> <li>6. Couple again</li> <li>7. Go back to eCONFIG app and wait for the eBOX to appear at the bottom of the screen</li> </ol>
I cannot access the eBOX WebGUI	<ul style="list-style-type: none"> <li>• Check the URL</li> <li>• Make sure your laptop or smartphone is within the same local network</li> <li>• Else, reset the eBOX via eCONFIG app. Setup progression will be lost.</li> </ul>
I cannot access the onboard load management WebGUI.	<ul style="list-style-type: none"> <li>• Make sure that the controller is activated</li> <li>• Check the URL</li> </ul>



The power to move



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