# EV NET
# EV CHARGER

# INSTALLATION GUIDE

Model EVNET-7KW-S/T2-1PH: 32A

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# 1. Overview

List of abbreviations:

**EV**: Electric Vehicle
**PHEV**: Plug-in Hybrid Electric Vehicle
**EVSE**: Electric Vehicle Supply Equipment
**OCPP:** Open Charge Point Protocol, a control protocol used for communication between chargers and servers
**AC**: in reference to Alternating Current
**DC**: in reference to Direct Current
**PE**: Protective Earth
**Tethered**: in reference to an EVSE with integral charging cable of fixed length
**Socketed**: in reference to an EVSE possessing a socket that accepts Mode 3 charging cables
**RCD (AC/DC)**: Residual Current Device, a safety device, designed to interrupt power in the event that a fault leakage current to ground occurs
**CB/MCB:** in reference to Circuit Breaker or Main Circuit Breaker
**CT (also CT clamp):** Current Transformer, an electrical device for non-contact measurement of current in a conductor

## 1.1. Product description and features

### 1.1.1. Description

The EVNET-7KW-S/T2-1P:32A, EVNET for short, is a single-phase electric vehicle charging station, available in socketed and tethered models. With a compact design, advanced smart charging and safety features, and a maximum current of 32A (7.4 kW supplied power), the EVNET is ideally suited for home and public charging of EVs and PHEVs. This smart charger supports remote monitoring and configuration via a mobile app, which allows the user to control how and when their vehicle is being charged.

### 1.1.2. What's in the box?

The EVNET comes packaged in a carton containing the main charger unit, access RFID card, and neoprene screw cover pads (x4). The tethered model is packaged with a 5 meter charging cord with Type 2 connector and appropriate cable gland for mounting to the main body.

### 1.1.2.1. Illustrated Dimensions

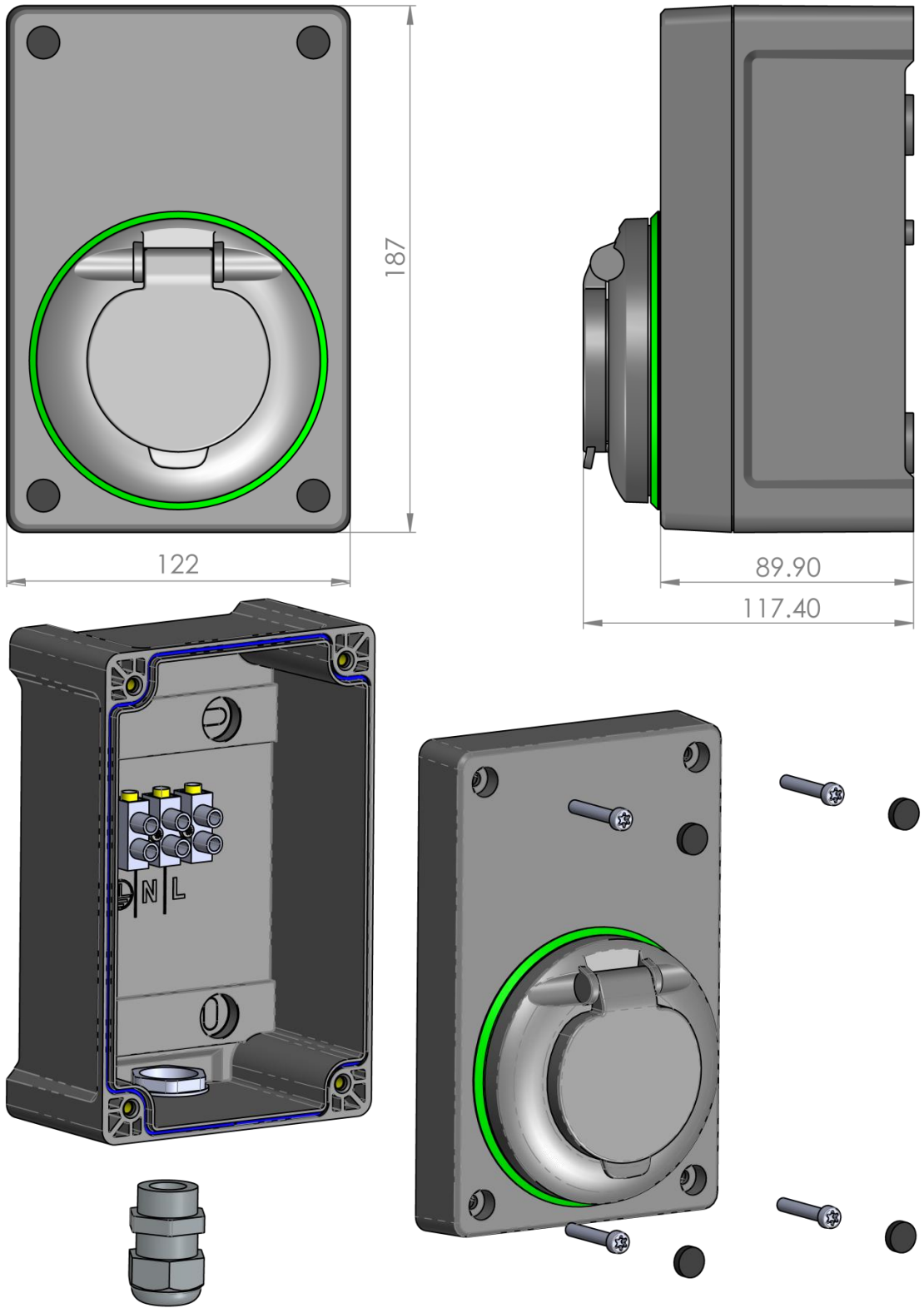



***Fig 1*** *Dimensions and disassembled view of socketed EVNET*

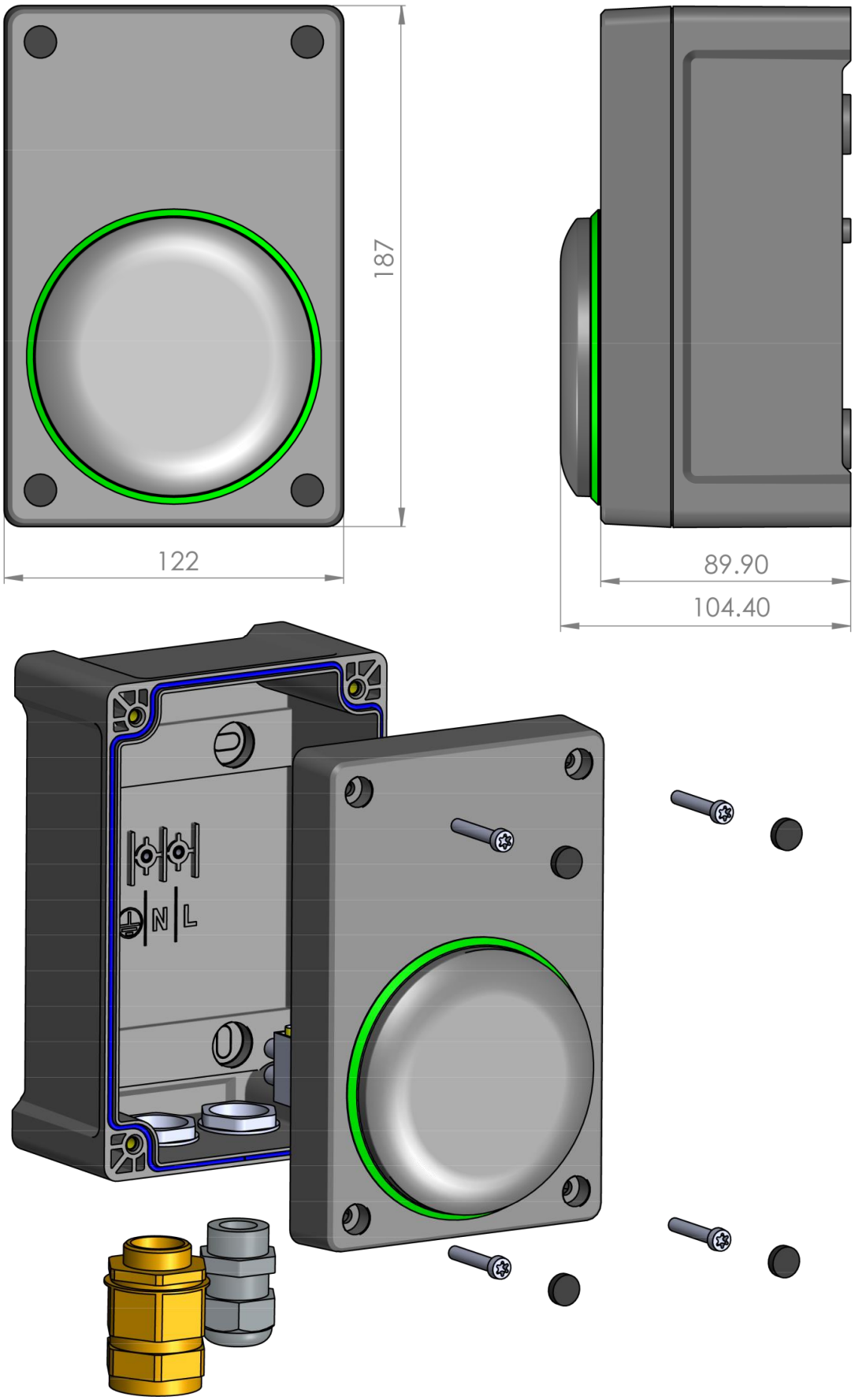



***Fig 2*** *Dimensions and disassembled view of tethered EVNET*

## 1.2. Features

### *Smart and efficient charging*

The EVNET belongs to a class of EVSE called smart chargers, because its entire functionality can be controlled remotely and automatically. This is enabled by the OCPP 1.6J protocol support embedded in the charger. This is a universally accepted control protocol for charging stations, meaning that any OCPP-based server can talk to, control, and remotely update the EVNET, independent of service provider and other factors.

The main benefits of smart charging are the ease of use and flexibility it offers, because it enables the user to control the time, duration, and amount of charging that is delivered to their EVs. In locations where electricity rates are variable throughout the day, this translates into substantial energy bills savings, as the charger can be configured to take advantage of lower energy prices during off-peak periods. Additionally, the EVNET has been designed to function with home solar installations. Thus, it can be set to provide charging only when excess energy is being generated, providing a very efficient utilization of energy resources. Smart charging also enables multiple chargers in a location to communicate with each other, and best utilize the available power to optimally charge several EVs.

The EVNET requires an internet connection to execute its smart functions. It can be configured to support a primary and secondary network interface. For example, it can maintain a wireless network connection, but fall back to GSM or wired Ethernet in case of poor connectivity or router failure. If no network connection can be established, the EVNET is capable of operating in a configurable "offline plug-in charge" mode, whereby it works as a simple EVSE, providing the maximum permissible charging power when an EV is connected.

### *Access control*

As the EVNET is intended for both residential and public applications, it has a number of access control functionalities, such as RFID ("smart card") authorization, mobile app authorization, and full control by the OCPP server backend. Thus, a user can configure the access to their charger(s) from basic unrestricted, to higher levels of control, based on their application.

### *Rugged compact design*

The EVNET is designed to have a small footprint and to be easily installed in various locations, both indoors and outdoors. Despite its miniature size, it is a fully-fledged single-phase charger and can deliver the maximum permissible power. Models are available as either socket- or tethered-type, giving clients flexibility in designing their EV charging experience.

### *Built with safety and security in mind*

The EVNET is designed with multiple safety interlocks in order to prevent the hazards associated with high-current, high-power devices, such as electrical shocks, fires, and equipment damage. It monitors the state of the electrical network, and using a CT clamp, can monitor total installation consumption. The EVNET has a built-in AC/DC RCD, and will prevent leakage currents from causing damage to people and devices.

Additionally, EVNET socketed chargers feature an electromechanical lock, which secures the Type 2 connector while the socket is energized and prevents the plug from being accidentally disconnected under power. A tamper sensor, embedded in the device, is used to detect unauthorized disassembly. The charger utilizes both sound and light signaling to report its state and possible faults, enabling the quick and safe detection of problems.

## 1.3. Device specifications

| Model | EVNET-7KW-S-1PH: 32A | EVNET-7KW-T2-1PH: 32A |
|---|---|---|
| Power | 7360 W | |
| Nominal voltage $V_n$<br>Working voltage range<br>Power consumption (max.) | 230 VAC, 1-phase<br>± 20 % deviation from $V_n$<br>5.2 W, 8.2 VA | |
| Maximum charging current $I_{max}$ | 32A | |
| Protection features | · RCD Type A + DC sense (6mA)<br>· Neutral voltage (70 $V_{rms}$)<br>· Overcurrent (Overcurrent protection trip when $I_L > 1.2 \times I_{max}$)<br>· Temperature (limiting 72°C -78°C, fault at 79°C)<br>· Undervoltage (shutdown at 115$V_{rms}$±10 $V_{rms}$)<br>· Overvoltage(shutdown at 300$V_{rms}$±10 $V_{rms}$)<br><br>· Reverse phase or phase-to-phase: the hardware can safely handle mains misconnection<br><br>·Tamper sensor: the hardware can detect unauthorized opening of the charger body | |
| LED Indication | · RGB LED light ring around the type II connector or tethered cap | |
| Vehicle connection | Tethered cord, terminated by EV plug Type II (5m length) | Type II EU Socket with cover and electromechanical actuator lock |
| Backend Connectivity | **WLAN:** 802.11 b/g/n/e/i (2.4GHz)<br>**Ethernet:** via internal RJ45 port<br>**GSM:** 2G (optional: 3G, LTE CAT M1, CAT NB1) | |
| Backend protocol and smart charging capabilities | OCPP 1.6J<br>- Power profiles supported:Default, TxProfile, MaxProfile | |
| Auxiliary connectivity | **Bluetooth (BLE 4.0)**: for configuration and diagnostics only | |
| Wireless capabilities | **Access Point:** integrated web server for settings and diagnostics (web client) | |
| | **Station:** for backend connectivity | |
| | **Note:** Supports simultaneous Access point and Station functionality | |
| RFID | NFC ("smart card") protocol | |
| Earth disconnection (PEN conductor) | Neutral-to-Earth fault: $V_{N\text{-}PE} > 70V_{rms}$<br>Line to Neutral 207V up to 253V | |
| Measurements | RMS Voltage, RMS current, Active power, Active energy | |

| Model | EVNET-7KW-S-1PH: 32A | EVNET-7KW-T2-1PH: 32A |
|---|---|---|
| Dimensions (**H**x**W**x**D**) | 187 x 122 x 118 mm<br>7.4 x 4.8 x 4.6 in | 187 x 122 x 104 mm<br>7.4 x 4.8 x 4.1 in |
| Weight | 0.9 kg / 2 lb (without cord) | 1.1 kg / 2.4 lb |
| IP Rating | IP54 | |
| Temperature | Operational Limiting Range: -40°C - +70°C | |
| | Transportation Limiting Range: -40°C - +85°C | |
| | Storage Limiting Range: -40°C - +85°C | |
| Humidity | Annual: <95% non-condensing | |
| Mechanical Class | M1 | |
| Electromagnetic Class | E2 | |
| Environmental Class | 3K7 | |

### 1.3.1. EMI compliance and other standards

The EVNET is compliant to the following standards and directives:

- **General:** IEC 61851-1:2017 Part 1, BS 7671:2018, **RCD:** IEC/EN 61008-1
- **EMC:** IEC 61851-21-2:2018 Part 21-2 (Emissions Class B, Immunity – Residential Environments); Class B for EN 55032:2015, EN 61000-3-2: 2014, EN 61000-3-3: 2013, EN 61000-4-2: 2009, EN 61000-4-4: 2004, EN 61000-4-5:2014;EN 61000-4-8: 2009, EN 61000-4-11: 2004
- **Radio equipment:** Radio Equipment Directive 2014/53/EU, EN 62311:2008; **GSM module** - EN 60950-1:2006 &A11:2009&A1:2010&A12:2011&A2:2013 , ETSI EN 301 489-1 V2.2.0, EN 301 511 V12.5.1 (2017-03); **WiFi module** - EN 301 489-1 V2.2.0 (2017-03), EN 301 489-17 V3.2.0 (2017-03), EN 60950-1: 2006 & A11: 2009 & A1: 2010 & A12: 2011 & A2: 2013, EN 300 328 V2.1.1 (2016-11)

## 1.4. Safety and precautions

**Intended use:** This product is solely designed and approved for use as an Electric Vehicle Supply Equipment (EVSE), used to supply charging current to EVs and PHEVs that do not require ventilation. It is intended to be used within specifications and only with the appropriate auxiliary equipment and adequate wiring. It is not intended to be repurposed or reconfigured for any application or use not within its specification. Failure to operate the device as intended may result in severe damage to equipment and personnel and poses a fire and explosion hazard. It is designed for **permanent connection to the grid** (Mode 3, case B – socket type and case C – tethered type).


**The usage of an additional extension cords or conversion adapters is not allowed!**

**Risk of electric shock**: This device utilizes voltages that pose an immediate threat to life. It shall be installed only by a licensed or experienced electrician as per all regional and national electric regulations in effect. The device and auxiliary equipment shall be carefully inspected for signs of damage (cracked case, frayed or exposed conductors, and compromised insulation) before installation or use. Any installation or servicing activities shall be executed only after the mains supply has been disconnected from the main breaker or by physically disconnecting the supply conductors at the main distribution board.

This device is intended to be connected to a centrally grounded system. The PE conductor shall be adequately sized and grounded to earth at the service equipment. The EVSE has a built-in RCD, which protects the downstream conductors from earth leakage events. In order to protect upstream conductors, a RCD can be used at the supply equipment, subject to regional and national regulations that apply.

**Risk of fire or explosion**: This device handles high voltages and currents. Use of improperly rated conductors can result in excessive heating, leading to a risk of fire and damage to the mechanical integrity of the system. AC grid connection shall be made in accordance with the device technical requirements to ensure that the installation is sufficient to supply the rated maximum current and power. The product uses relays, which can cause arcs during switching. The device shall be installed in a location free from flammable gases and liquids to avoid an explosion hazard.

**Mechanical**: The product is intended for wall or panel mounting. It shall not be installed on ceilings, floors, or inclined walls. To avoid mechanical damage, the product shall be mounted as described in the installation guide, and using the specified tools and materials. Proper Personal Protective Equipment is recommended, including but not limited to: eye protection, shock protection, gloves and other appropriate protection.

# 2. Installation guide

## 2.1. Pre-requisites

### 2.1.1. Tools and materials

#### *2.1.1.1. Tools*

- A set of Torx, Phillips, and Flathead screwdrivers with insulated handles
- Torque-limited drill or cordless screwdriver, drill bits for large diameters (step cone up to 28mm)
- Hammer drill and bits
- Electrician kit, including pliers, strippers, ferrule and RJ-45/22 crimping tools

#### *2.1.1.2. Materials*

- Conductors (insulated single-core or stranded), conduit, cable tie-downs, cable clamps
- Signal cables (UTP5 and 2x2 twisted pair cable)
- Connectors (RJ-45/22) and ferrules
- Insulation materials
- Wall anchors (e.g. with 4x17 screw or similar) for mounting the EVNET body

### 2.1.2. Site survey and selection

The EVNET can draw up to 32A at 230VAC and shall be installed on a dedicated circuit. The entire building electrical installation must be adequately sized to accept this load under peak loading conditions. Ensure that all elements of the electrical installation, from the utility connection, through to the dedicated EVNET circuit are adequate for the rated power.

Ensure that the distribution panel has a position for a dedicated circuit breaker. Details are provided in section 2.1.3 regarding its rating and possibilities to derate.

The EVNET is designed for indoor and outdoor installation. To ensure a long service life, select a location that is not exposed to harsh elements, such as direct sunlight and rainfall, has proper ventilation and normal humidity.

Consideration about connectivity must also be made. For example, if the EVNET is to be connected online via Wi-Fi, select a site within range of the wireless network to ensure a steady connection. Alternatively, select a site with easy access to a wired network connection or mobile network coverage. Consider that the CT clamp, which is installed at the main distribution panel, needs a wired connection to the charger.

## 2.1.3. Electrical wiring and breaker requirements

### 2.1.3.1. Calculating circuit voltage drop and sizing circuit wiring and breaker

In order for the EVNET to provide full charging power, it must be supplied through a dedicated circuit capable of handling the full 32A of current with less that 10 VAC voltage drop. The circuit's nominal rating should be no less than 40A. The circuit can be implemented with solid or stranded copper wire, or copper-clad aluminum wire. Stranded conductors shall be connected to the device only after a ferrule is installed.

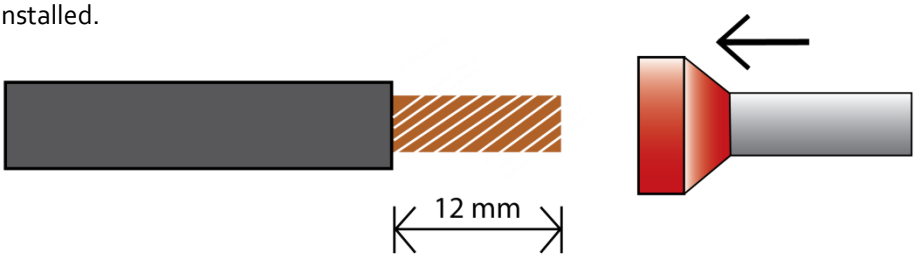



***Fig 3*** *Ferrule installation for stranded power conductors*

| Derating guideline for single-phase EVNET | | |
|---|---|---|
| Circuit Capacity*, A | Max Charging Current, A | Max Delivered Power, kW |
| 40 | 32 | 7.4 |
| 32 | 25 | 5.8 |
| 25 | 20 | 4.6 |
| 20 | 16 | 3.7 |
| 16 | 13 | 3.0 |
| *C-curve rating of circuit breaker | | |

***Table 1*** *Derating guideline for existing or under-powered installations*

**Note:** The manufacturer recommends installing the EVNET on a dedicated electrical circuit to ensure the proper and complete functionality of the charging station. Since the device has built-in RCD Type A (30 mA AC + 6 mA DC) protection, an additional RCD/RCCB upstream is **not required nor recommended,** as it can result in spurious tripping. If the electrical installation features a system RCD, the dedicated circuit **may** be taken downstream of it.

Although the device has built-in overcurrent protection, it is **mandatory** that a circuit breaker of the correct rating **is installed upstream of the device and upstream SPD**!

Table 2 can be used to determine the approximate voltage drop at peak currents. **The installed length is the running distance from the source panel to the EVCP** (the table takes into account resistance in both legs of the circuit).

| Installed length, m | Voltage drop in copper conductor at 40A, VAC | | | |
|---|---|---|---|---|
| | Area, $mm^2$ | | | |
| | 4* | 6** | 10 | 16 |
| 5 | 1.7 | 1.2 | 0.7 | 0.4 |
| 10 | 3.4 | 2.3 | 1.4 | 0.9 |
| 15 | 5.2 | 3.5 | 2.0 | 1.3 |
| 20 | 6.9 | 4.6 | 2.7 | 1.8 |
| 25 | 8.6 | 5.8 | 3.4 | 2.2 |
| 30 | 10.3 | 7.0 | 4.1 | 2.6 |
| 35 | 12.0 | 8.1 | 4.8 | 3.1 |

**Note**: Shaded areas indicate excessive voltage drop
*recommended minimal conductor area for 16A charging
** recommended minimal conductor area for 32A charging

| Installed length, m | Voltage drop in aluminum conductor at 40A, VAC | | | |
|---|---|---|---|---|
| | Area, $mm^2$ | | | |
| | 4 | 6* | 10** | 16 |
| 5 | 2.6 | 1.8 | 1.1 | 0.7 |
| 10 | 5.3 | 3.5 | 2.2 | 1.4 |
| 15 | 7.9 | 5.3 | 3.2 | 2.0 |
| 20 | 10.6 | 7.0 | 4.3 | 2.7 |
| 25 | 13.2 | 8.8 | 5.4 | 3.4 |
| 30 | 15.8 | 10.6 | 6.5 | 4.1 |
| 35 | 18.5 | 12.3 | 7.6 | 4.8 |

**Note**: Shaded areas indicate excessive voltage drop
*recommended minimal conductor area for 16A charging
** recommended minimal conductor area for 32A charging

***Table 2*** *Calculated voltage drop at consumer for Imax = 40A, based on installation length (per leg), conductor material and cross-sectional area*

The circuit voltage drop at peak load can also be determined using a test load $R_L$ of lower power rating. The voltage drop is calculated from the difference between the open-circuit and loaded voltage at the circuit load side: **Voltage drop = $V_{open\text{-}circuit}$ - $V_{Load}$**

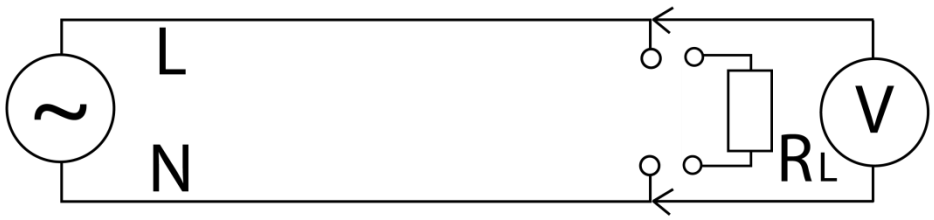



***Fig 4****Experimental determination of voltage drop using a test load $R_L$-measurement*

The nomograph below can be used to calculate the circuit voltage losses at peak current. For a given test load, a line can be drawn from the origin to the corresponding value on the upper horizontal axis. Then, the measured voltage drop can be matched to the corresponding peak current drop by reading out the left vertical axis. The nomograph includes sample plots for 1-4 kW test loads and assumes nominal 230V at which the test load is specified.

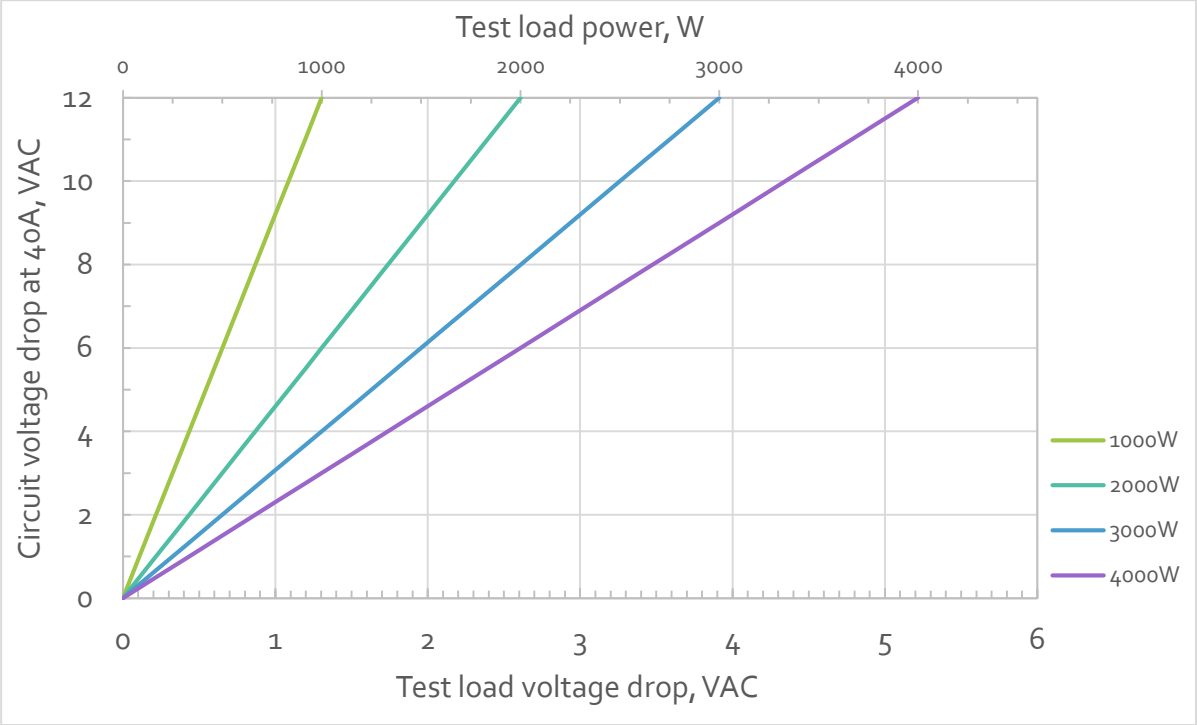


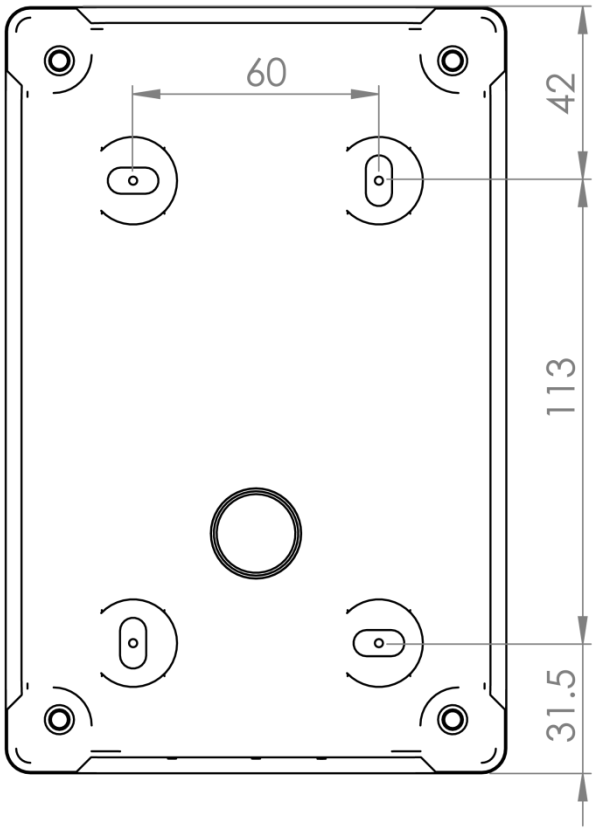

***Fig 5****Calculation of voltage drop at 40A based on test load of known power*

In circumstances where the supply installation is inadequate for the full charging output of the EVNET, refer to the derating guideline presented in Table 1 and set the maximum output current accordingly when comissioning the EVNET as per section 2.5.2.

2.1.3.2. Grounding considerations

In the installed supply circuit, the grounding conductor must be rated to carry the full return current in the event of a fault and must be adequately sized (matching the capacity of the L and N conductors).

## 2.2. Installation: Mechanical




The main screws fastening the main body of the EVNET are located in the four corners of the charger body, and may be directly accessed (the felt protecting pads may have to be removed).

The EVNET is intended for wall-mounting via four holes in the enclosure lower body, as seen in Fig 6. The holes may be drilled to fit standard wall anchor bolts or screws. Note the location and spacing of the mounting hole centers. Do not drill holes outside the external perimeter of the mounting holes (as indicated in the figure.

Prior to mounting the body, drill the holes to accept the respective cable glands for supply and signal wiring, and with tethered models, the charging cord (Fig 7). Some EVNET cases have drilling centers indented in the plastic body, which can serve as guides for drilling the gland openings. **The gland holes should be accurately drilled out to prevent interference of the gland hardware and the charging assembly!**

*tern*

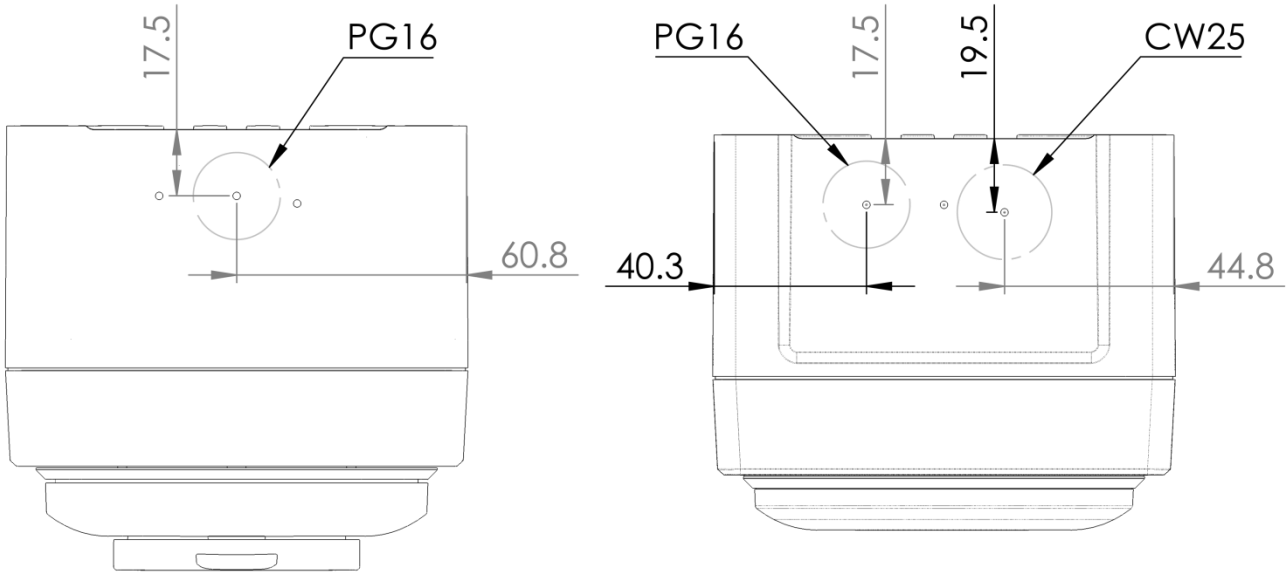



***Fig 7*** *Main body cable gland hole locations (**Left**: Socket; **Right**: Tethered)*

### 2.2.1. SIM card and GSM antenna location

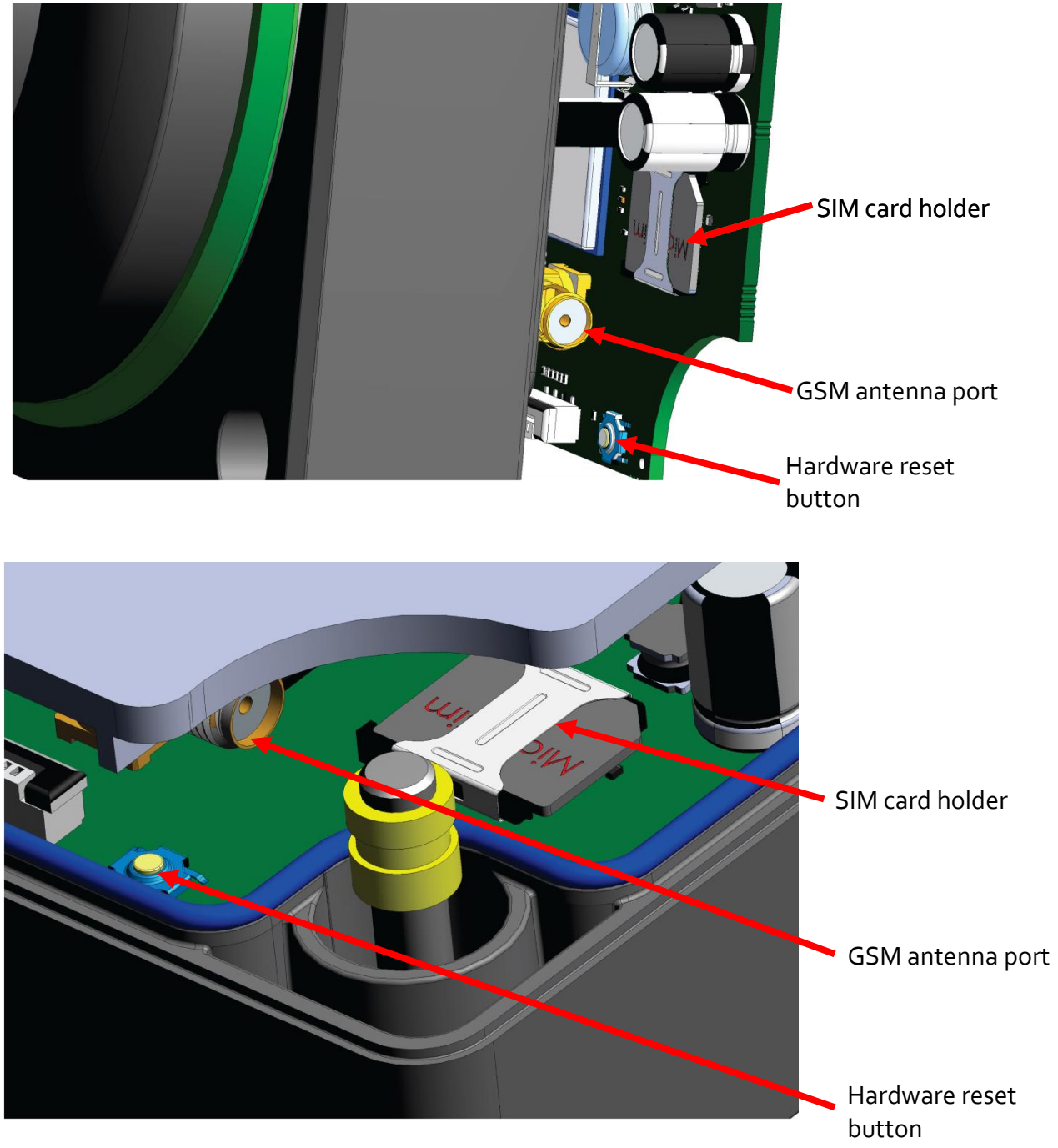



***Fig 8*** *Location of EVNET important components (**Top**: Socket; **Bottom**: Tethered)*

## 2.3. Installation: Electrical

### 2.3.1. Overall system wiring diagram

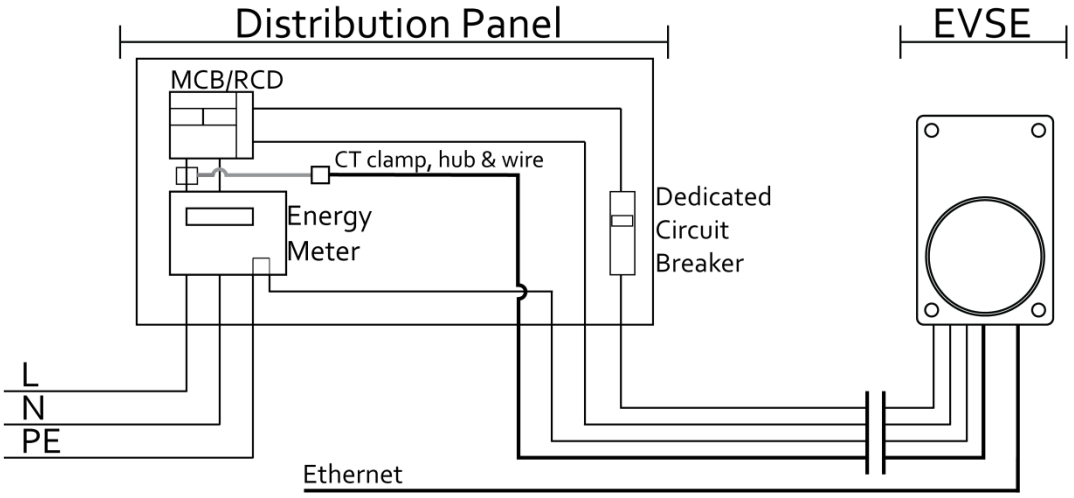



***Fig 9*** *EVNET installation diagram, overall*

**Hint:** Due to the universal availability of CAT5 UTP cable, it is advisable to use it as a combined cable for the Ethernet and CT clamp connections, avoiding a second run of signal wires. Two twisted pairs are used for the CT clamp connection and two for the Ethernet Tx and Rx lines. The following table summarizes a suggested connection scheme, consistent with RJ-45B wiring scheme.

| CT Clamp connection (RJ-22) | | | Ethernet connection (RJ-45-B) | | |
|---|---|---|---|---|---|
| Pin # | Wire Color | Designation | Pin # * | Wire Color | Designation |
| 1 | brown-white | VCC | 1 | orange-white | Tx+ |
| 2 | blue | A | 2 | orange | Tx- |
| 3 | blue-white | B | 3 | green-white | Rx+ |
| 4 | brown | GND | 6 | green | Rx- |
| * Pins 4,5,7,8 are not connected! | | | | | |

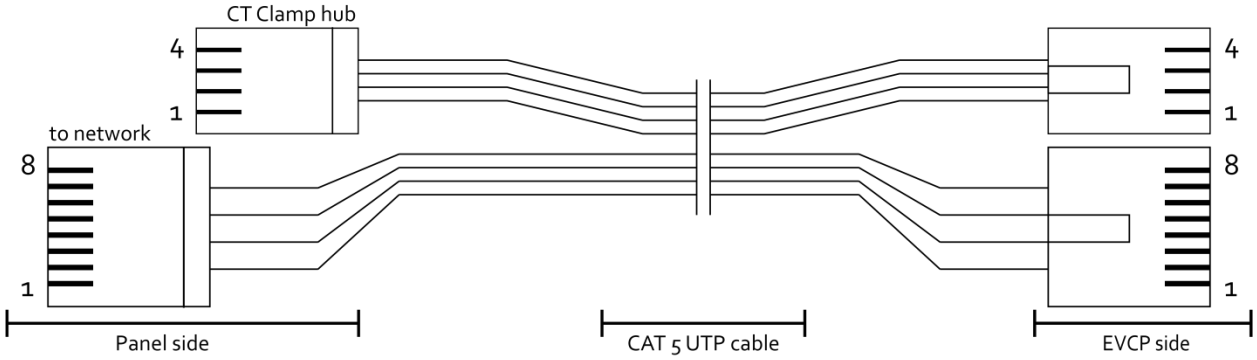


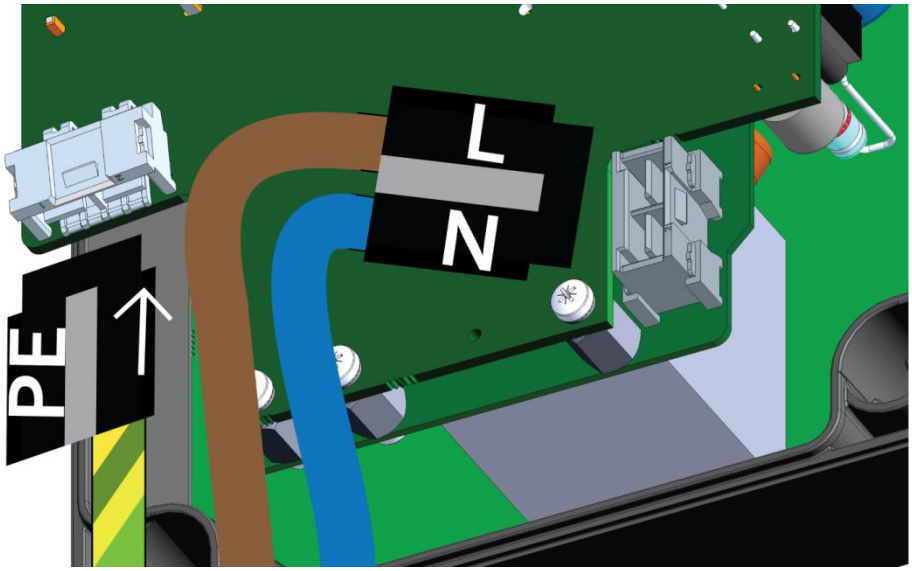

***Fig 10*** *Combining CT clamp and Ethernet signal wiring into one UPT cable*

### 2.3.2. EVNET wiring diagram

The power and signal conductors can be connected to the device after the EVNET body has been mounted to the wall and the cable glands have been installed. The conductors are pulled through the gland with enough slack to make the connections without strain. The terminals are intended to be fastened with a flathead screwdriver at 1.5Nm torque.

**Safety note:** before working with bare conductors, ensure that the power is disconnected and the circuit is not live!

2.3.2.1. Socketed model




The connection terminal is located on the EVNET body. One side is connected to the EVNET board via short conductors that have been prepared at the factory. If the connecting cables are detached from the main assembly, the following diagram illustrates their connection.
The body has markings in the plastic that denote the proper position of the incoming conductors. See Fig 11-12.

Ethernet and CT clamp connections are made to the main board of the device via RJ-45 and RJ-22 sockets, respectively. No other connections have to be made.

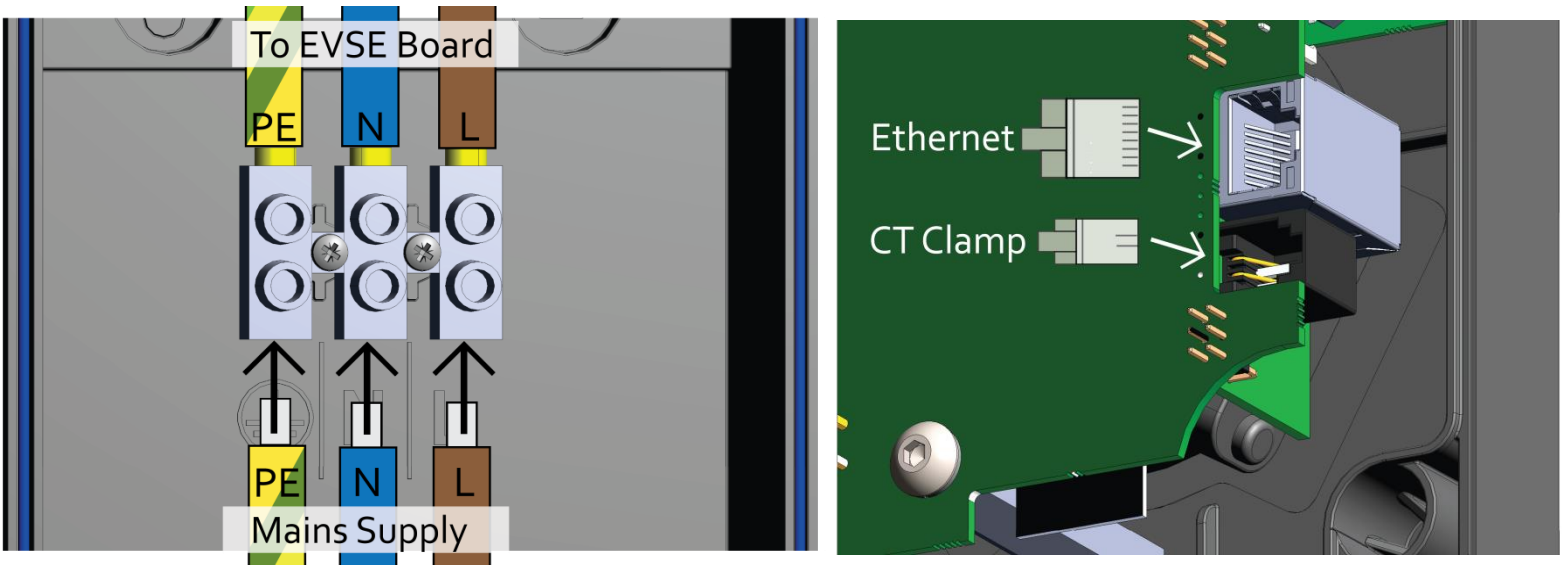



***Fig 12*** *Socket: terminal block and signal connections*

2.3.2.2. Tethered model

On the tethered model, the terminal block is located on the back side of the main board. It is used for making the connections between the charger and the incoming supply, as well as between the charger and the supplied charging cord. This also requires that the control pilot (CP) signal wire from the charging cord is connected to the EVNET as illustrated in Fig 13.
Ethernet and CT clamp connections are made to the main board of the device via RJ-45 and RJ-22 sockets, respectively. No other connections have to be made.

**Note: The power conductors between the EVNET main assembly and the terminal block have been pre-installed in the proper orientation and location. To ensure proper functionality, do not attempt to disconnect or rewire them!**

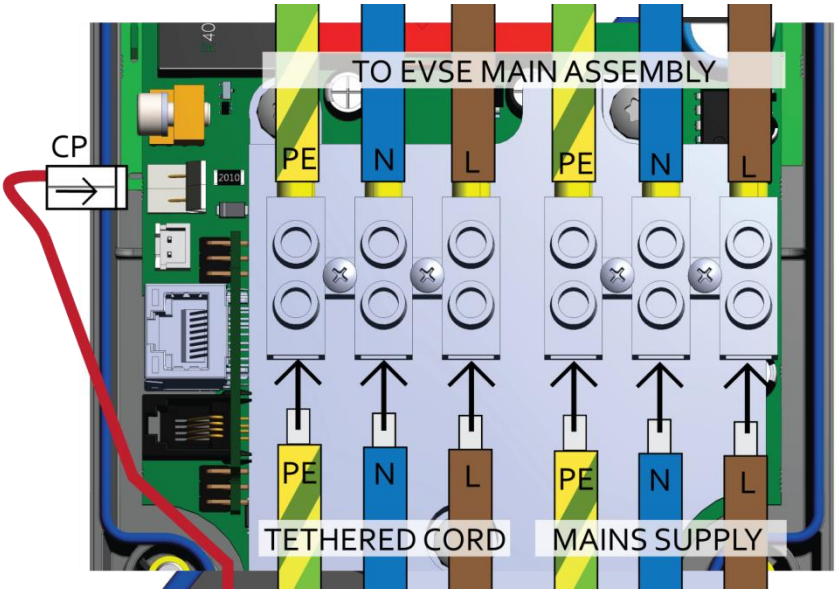



***Fig 13*** *Tethered: terminal block and signal connections*

## 2.4. Installation: CT clamp

The CT clamp is intended to be installed upstream of the MCB. It monitors the total system current draw and relays the values to the EVNET, which can then regulate its output power to prevent the MCB from tripping.

Once installed, the CT clamp can be configured in the web client, as described in section 2.5.1

## 2.5. Installation: Commissioning

Only commission the EVNET after all electrical and mechanical prerequisites have been fulfilled.

Before switching on the power to the EVNET circuit, ensure that all electrical connections have been made securely and that no conductors remain exposed or touching.

Ensure that the two sections of the device have been firmly secured with the mounting bolts.

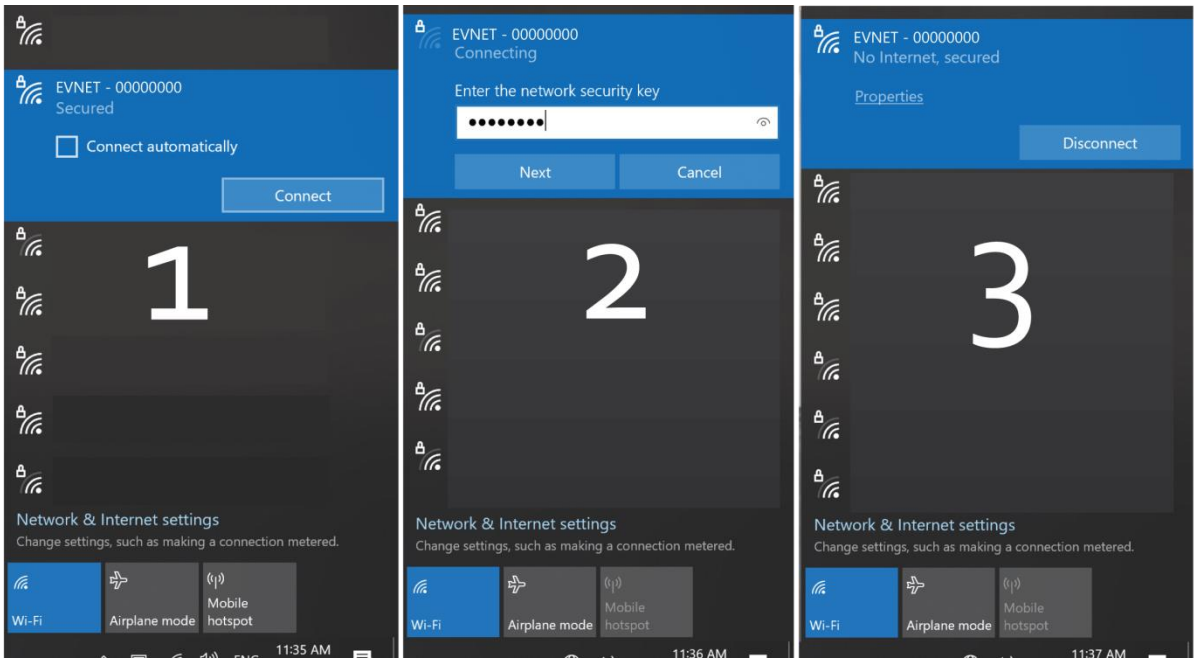
On power-up the EVNET will provide visual and sound indication. It will beep briefly and the RGB light ring will light in yellow. The device can then be configured via the web client. Until it is configured, it will remain in the same state, indicated by a constant yellow light. If the product has been preconfigured to connect to a backend server and has an accessible internet network, it will connect and indicate an available status by a constant blue light.

## 2.5.1. Accessing the web client and configuration

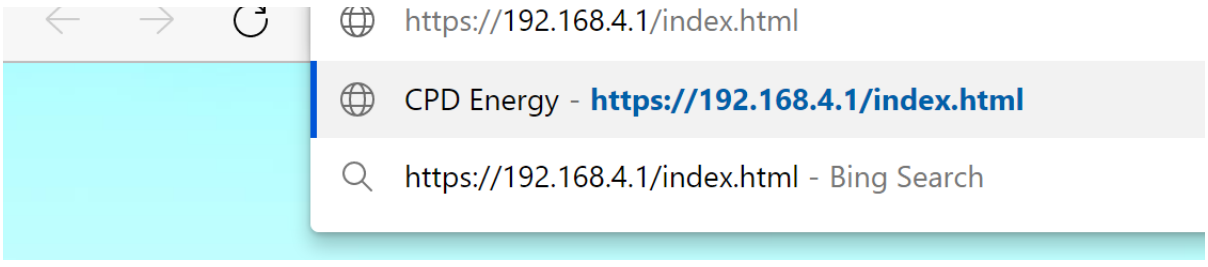
The EVNET has a backend that is accessible via a web interface. The web client can be accessed from any HTML browser on a Wi-Fi enabled device, such as a smartphone, tablet, or laptop.

On startup, the EVNET broadcasts its name and serial number as a Wi-Fi network. After entering the network pass code, the device will be connected.

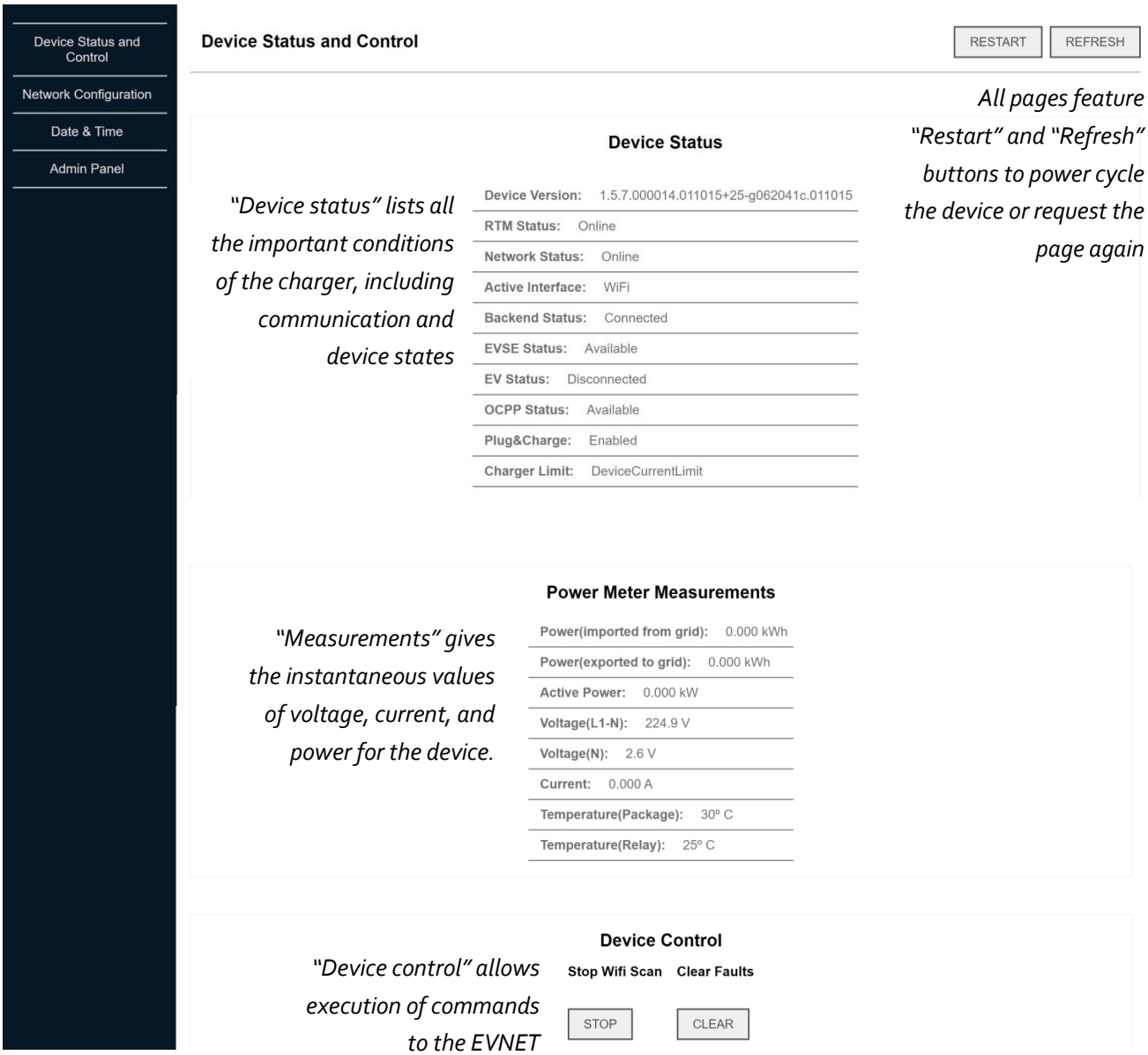
**Note: some mobile devices may notify that they are connected to a network but have no internet access. Such warnings should be waived and the device allowed to go through with the connection.**



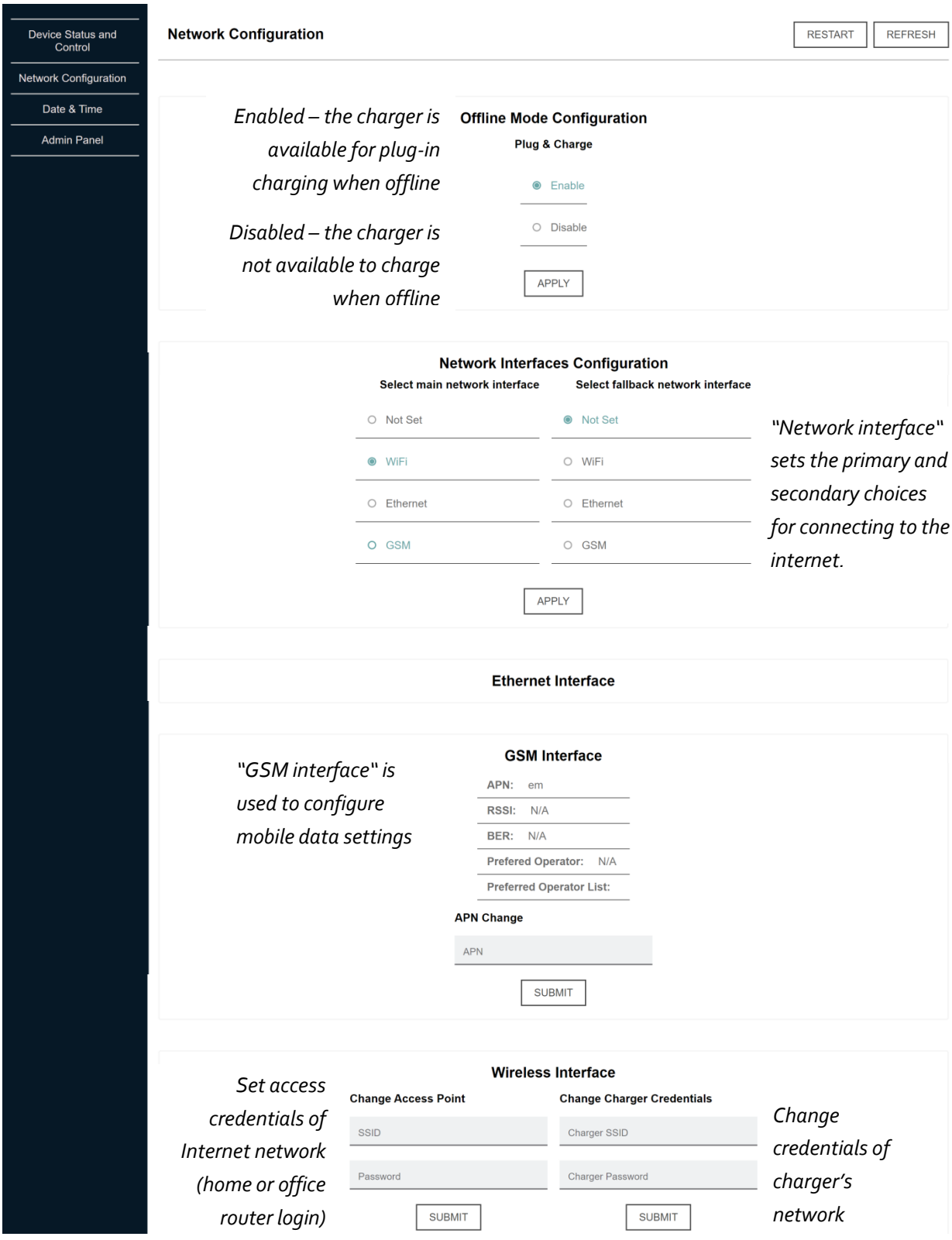

In a web browser, enter the index IP address (https://192.168.4.1/index.html). Ignore certificate warnings if any arise; if certificate validation warnings persist, switch to a different browser (recommended – Firefox, Edge, Chrome, Safari):



This will afford the main page of the EVNET web client - Device Status and Control – and a navigation bar on the left:



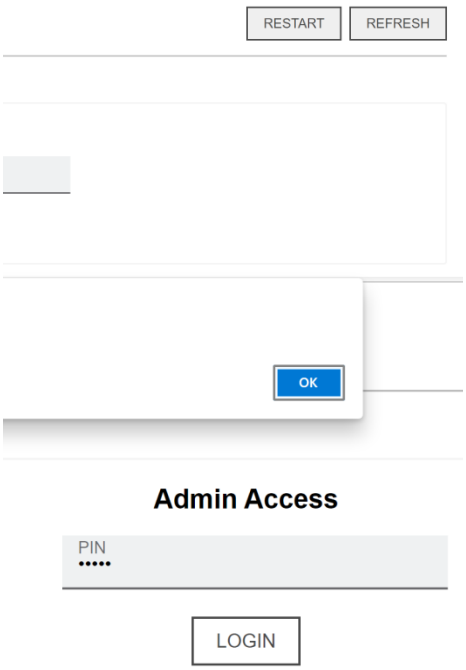
Network Configuration has important settings that are to be configured when deploying the EVNET, such as the internet network interface and possible fallback (secondary) interfaces:



Once the admin credentials have been entered and the login verified, the navigation bar shows additional items, as shown on the left.

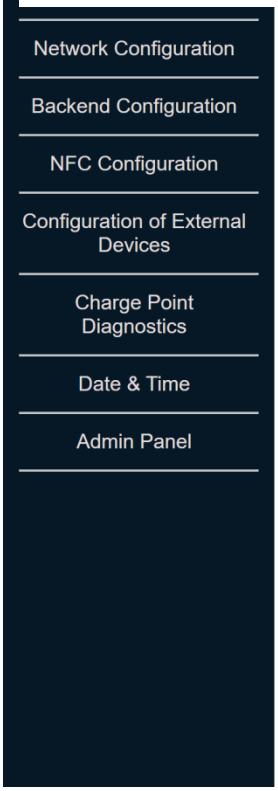
When configuring the EVNET for the first time, the following settings must be made:

- Setting the virtual fuse (based of CT clamp input)
- Configuration of RFID access cards
- Configuration of the backend interface for smart charging and app access features, such as scheduled and flexible charging, and DLM networks.
- (Optional) Updating the firmware to the most recent compatible version.

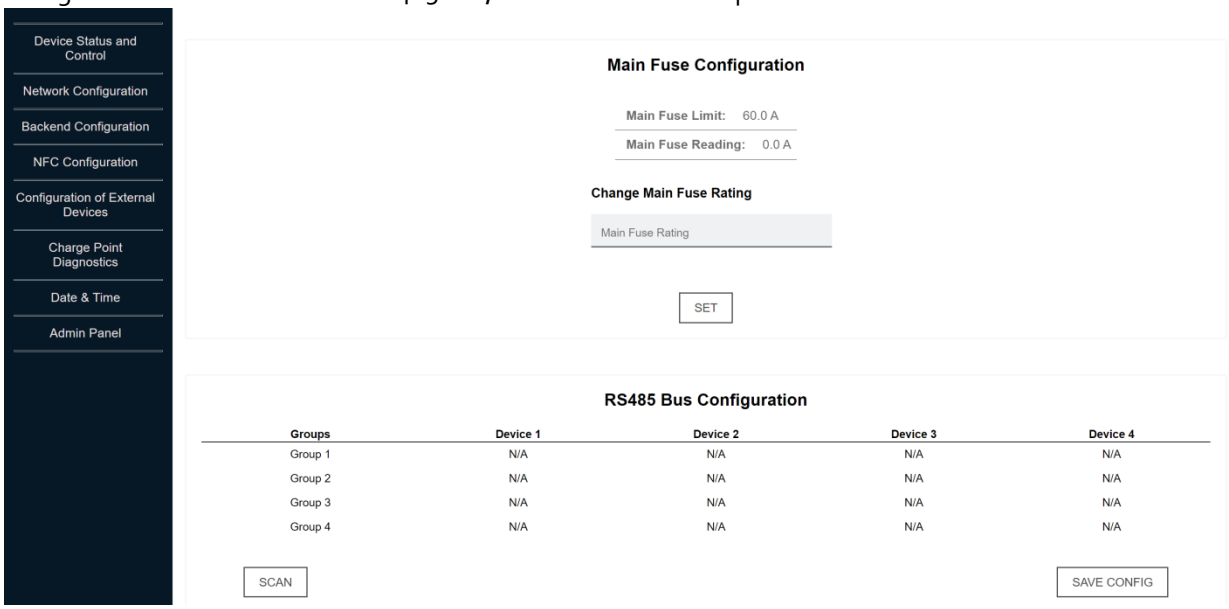




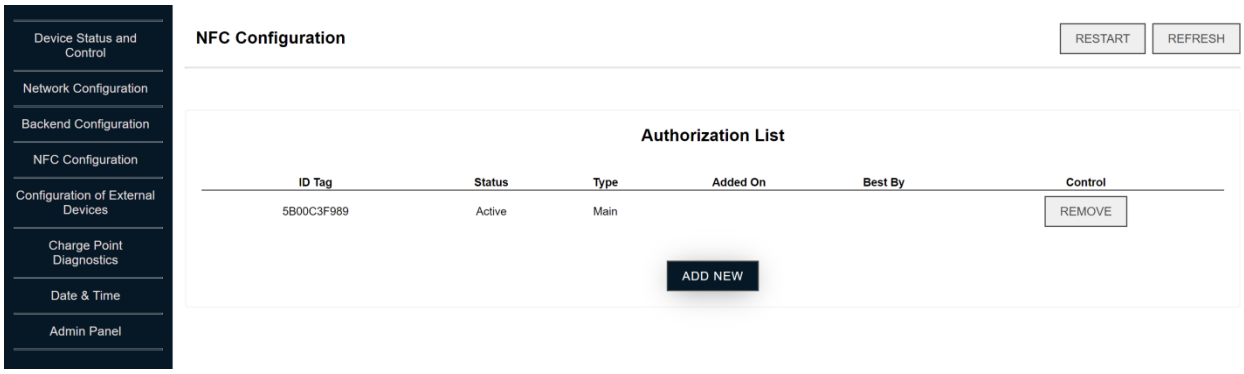


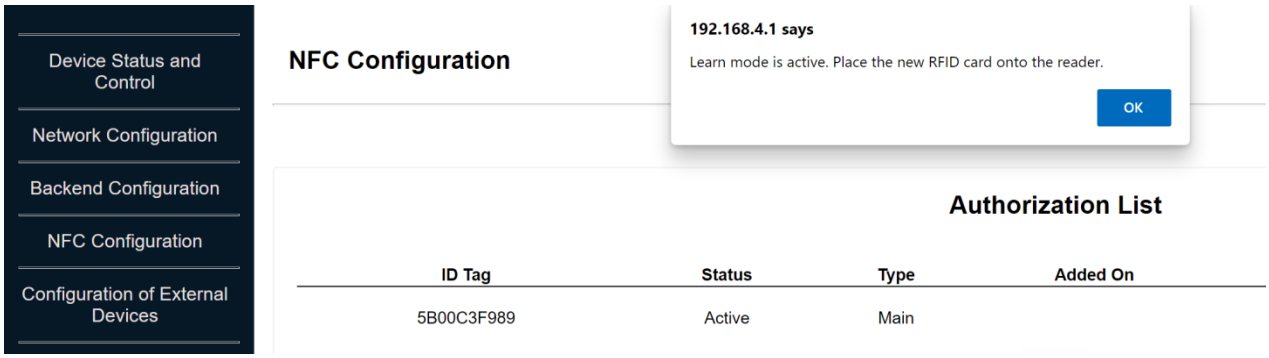


Setting the virtual fuse limit is done in the "Configuration of External Devices" tab, which can also be used to configure other devices on the RS-485 bus, used for the CT clamp communication.

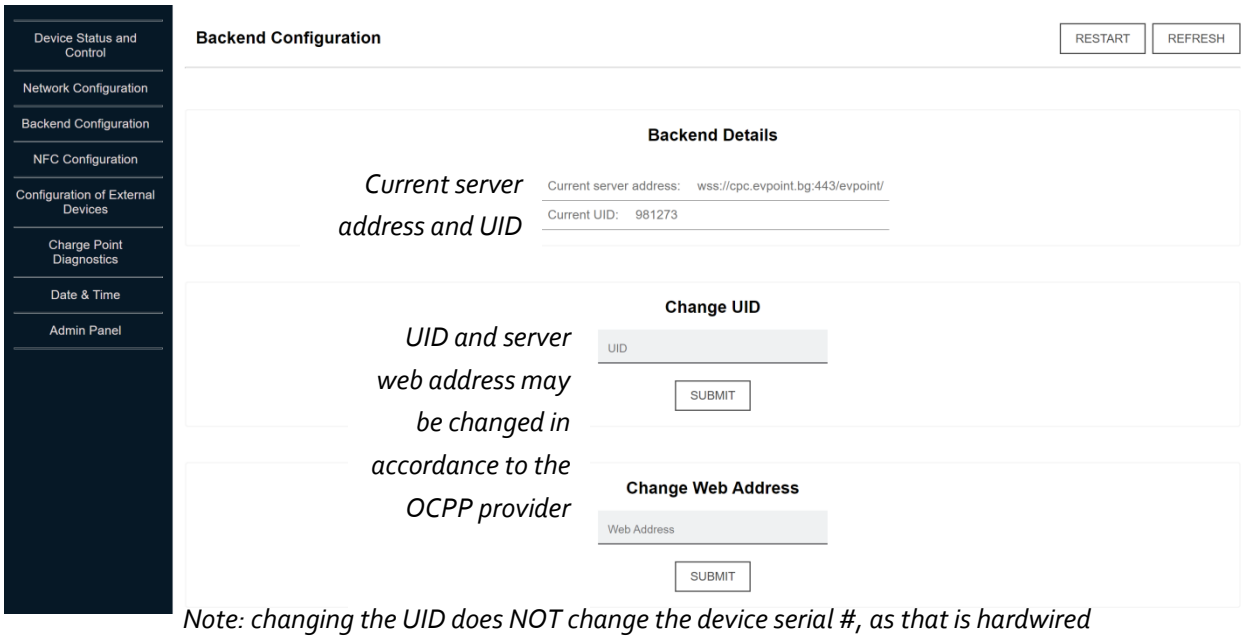



To configure RFID access cards, open the "NFC Configuration" tab. Here, the EVNET can be set into a "Learn" mode via the "ADD NEW" button, whereby tapping an access card on the reader section of the device will cause it to be entered and memorized:



The EVNET will come with a preconfigured backend server address and UID, which can be found and, if necessary, changed, in the "Backend Configuration" tab:

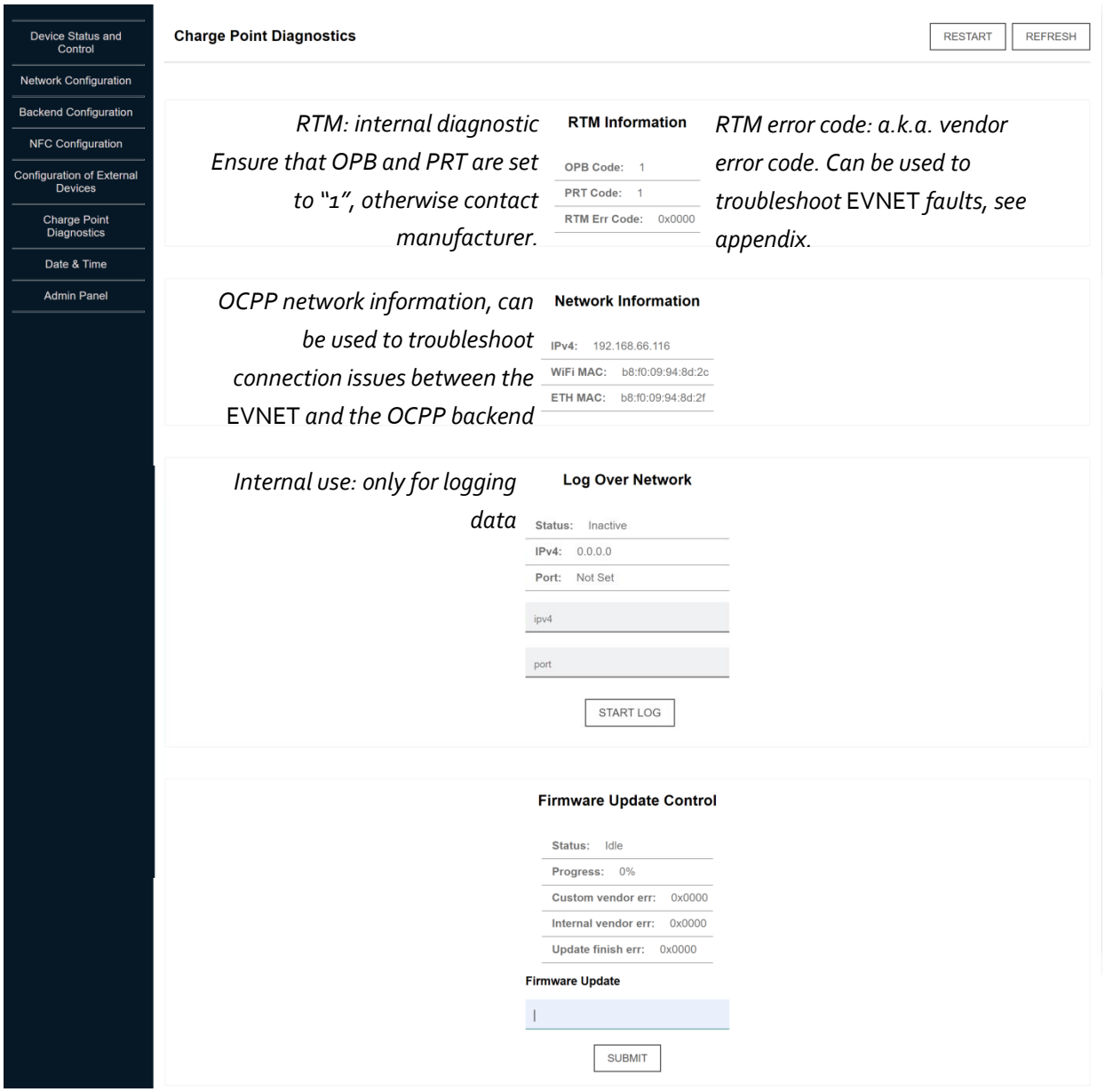



*Current server address and UID*

*UID and server web address may be changed in accordance to the OCPP provider*

*Note: changing the UID does NOT change the device serial #, as that is hardwired*

The "Charge Point Diagnostics" tab contains useful troubleshooting information:




The "Update" section allows the configurator to set a firmware update via an Internet address pointing to a firmware update package. The address is set in the address text box and "Submit" is clicked. The update details are monitored above. Note that the EVNET will enter one or more several reset states while the update is being executed and the web client may become unresponsive at these times. Updates are usually done remotely via the OCPP server but may need to be executed locally for troubleshooting and diagnostics.

**Hint:** to verify that the firmware update URL is valid, it can be copied into an HTML browser and accessed, whereby a download should automatically begin of a ".bin" file type. If either the download does not begin or the downloaded file is not consistent with a firmware upgrade file, the user should verify that the address is valid and correct.

# 2.6. Installation: Troubleshooting

## 2.6.1. Verifying charger functionality:

At power on, the EVNET has default settings and configuration, which allow it to work as a basic charger in the offline state. It is possible to verify its basic functionality by plugging in an EV and observing that the charger starts a charging session. The web client main page can be used to verify that the charger is properly measuring electrical values.

## 2.6.2. Common issues during commissioning:

1. No sound or light indication at power-on: the EVNET is designed to always beep and light its RGB ring at power on, to indicate that all components of the device are functional. The most common cause of missing indication is that there is a bad connection along the circuit and the EVNET's power terminals are not receiving mains voltage. Verify that the circuit is properly connected and that the "L" terminal is receiving 230VAC nominal from the phase conductor.
    a. An alternative failure mode is a defective or disconnected RGB ring. Verify that the RBG ring's flexible connector (located below the antenna port) is properly connected to the main assembly.
    b. All other cases of no light or sound indication point to a defective EVNET unit. Refer back to the supplier for servicing.
2. The LED ring lights up red/blinking red: The EVNET is indicating a fault. This means that all components of the device are functional, but there is an issue that prevents the overall device from proper operation.
    a. The most common cause of faults when commissioning is a phase reversal. The EVNET is incorrectly connected to mains and the neutral, live, or earth conductors are switched. Verify that the EVNET is correctly wired to the grid.
    b. Another common case is overvoltage due to incorrect supply wiring. In 3-phase installations, verify that the EVNET is not across two phases of the grid, but between a phase and neutral. Verify that there are no excessive voltages present on the power line. Check the circuit voltage drop to verify that the voltage is within nominal range.
    c. Any specific fault can be identified and reset via the web client's main and diagnostics pages. Note that clearing a fault without removing the underlying problem will result in the EVNET to enter the same fault state after the reset.
    d. Internal errors may be cleared by a power-cycle of the device. Disconnect it from power and after a short period, power it on again. Note that this does not work on every fault and is reserved as a simple troubleshooting step.

### 2.6.3. Hardware reset

The configurator may determine that a factory reset of the device is necessary. A factory reset returns the device to its original software at the point of manufacture. Any firmware updates are not rolled back.
The hardware reset button is located on the main board of the EVNET, as shown in Fig 8.

**To reset the device, it must be disconnected from mains power. Any vehicle connected to the device must be detached.** The charging assembly is removed from the main body of the device and the "reset" button is depressed for at least 60 seconds. The EVNET is then reassembled and powered on.

# 3. Appendix I: Error state description with error codes and light indication explained

| EVNET RGB Light Ring Status Indicators | | | | | |
|---|---|---|---|---|---|
| **Status** | **Online Illumination** | | **Offline Illumination** | | **Description** |
| Available | | | | | Device is available to start a charging session. In the online state, it is connected to the OCPP backend. Offline, it may be set up as Plug-in Charge" |
| Preparing | | | | | The charger is preparing to start a charging session. Occurs when an EV is plugged in and the charger is waiting for authorization to being charging. |
| Charging | | | | | The EVNET is charging the EV as per app settings. |
| SuspendedEV | | | | | The EV has caused the EVNET to stop the charging session. |
| SuspendedEVSE | | | | | The EVNET has stopped the charging session. |
| Finishing | | | | | The EVNET is preparing to terminate the charging session. |
| Unavailable | | | | | The charger is not available. This may have been set by the OCPP backend for diagnostic or service purposes. |
| Faulted | | | | | The EVNET has encountered a problem and is in a fault state. More information can be accessed via the web client (see 2.5.1). |

Note: The two adjacent patches indicate whether the status lights are constantly lit (identical colors) or blinking - switching between the two different colors

**Temperature Current Limit Thresholds**

The EVNET monitors its internal temperature at two points. If the temperature exceeds values considered to be dangerous to the electronics and safety, the charger will first limit its maximum charging current to lower its power dissipation. If the temperature still increases beyond that setpoint (79°C), the charger will stop the session and enter a "Fault" state.

| Temperature, °C | Current limit, A |
|---|---|
| 72 | 31.8 |
| 73 | 29.4 |
| 74 | 26.8 |
| 75 | 24 |
| 76 | 20.8 |
| 77 | 17 |
| 78 | 12 |
| 79 | 6 |
| >79 | Fault |

| RTM Errors<br>RTM errors are generated byEVNET when an error occurs and the charging is stopped. They can be found as “RTM err code” in the Diagnostics tab of the web client. | | | |
|---|---|---|---|
| **Code** | **Name** | **Description** | **Detailed Description** |
| 0x0001 | EVSE_FAULT_ RCD | RCD protection error | This error code is sent when the AC RCD protection is triggered. RCD or “Residual Current Device” is a fault current protection hardware used in chargers to protect the user from current leakage. |
| 0x0002 | EVSE_FAULT_ NEUTRAL | Neutral line error | This error code is sent when one of the following occurs: |
| | | | The line terminal and the N terminal are swapped |
| | | | There is more than 70VAC between the N line and the earth |
| | | | There is a bad earth |
| 0x0004 | EVSE_FAULT_ OVERCURRENT | Overcurrent error | This error code is sent when the car decides to import higher current than charge point offers. If the current demand is 10% above the set current limit and lasts more than 6 seconds, the fault is generated. Note that the thresholdis 10% of the present current limit, not the absolute maximum. |
| | | | This fault can be cleared by power cycling the system, by unplugging the charging cable or via the web client. |
| 0x0008 | EVSE_FAULT_ RCD_DC | RCD DC protection error | This error code is sent when the DC RCD protection is triggered. |
| | | | Note that when the DC RCD is triggered the error code 0x0001 is also sent! |
| 0x0100 | EVSE_FAULT_ DIODE_UNPRESENT | EV diode error - diode in EV not detected | Every car has a diode on the CP line as part of the charging standard. This error code is sent if the EVNET cannot detect the diode in the EV. The fault is in a problematic EV diode and is cleared by removing the plug |
| 0x0200 | EVSE_FAULT_ PP_UNPRESENT | Proximity pilot not detected | This error code is sent when you plug in the charging cable and try to start a charging session, but the charging station cannot read the specifications of the charging cable. The charging session will not start. |
| 0x0400 | EVSE_FAULT_ MISSING_HOST | Internal host error | For internal use only |

| | | | |
|---|---|---|---|
| 0x0800 | EVSE_FAULT_ TEMPERATURE | Overheating error | This error code is sent when the temperature of the charging station reaches more than 79 degrees. At this point the charging station will stop charging at all. This fault is cleared when the charging station is power cycled or through the web client. |
| 0x1000 | EVSE_FAULT_ OVERVOLTAGE | Overvoltage error | This error code is sent when the power supply voltage risesby more than 10% of nominal |
| 0x2000 | EVSE_FAULT_ UNDERVOLTAGE | Undervoltag e error | This error code is sent when the power supply voltage drops by more than 10% of nominal |
| 0x4000 | EVSE_FAULTS_ AUTO_RECOVERY | Auto Recovery | The EVNET is designed to automatically recover from noncritical faults. This is an auto-recovery flag, sent together with another fault flag to indicate that the EVNET will attempt to recover from the fault. For example, in over/undervoltage situations, the EVNET will recover once the supply voltage falls back within its nominal value. |
| 0x8000 | EVSE_FAULT_CAL | EVSE calibration data error | The RTM has calibration data such as Voltage, Current, Power, Energy and RCD as well as the device Serial Number. The fault indicates that the RTM cannot accessthese data. This may require a technician to come and reset the charger to default values with a special tool. |

# 4. Appendix II: OCPP and Manufacturer Configuration Keys

| Configuration Key | Custom Key | In use | Example Value | Description |
|---|---|---|---|---|
| AllowOfflineTxForUnknownId | | **yes** | TRUE | When offline, the device can be set to allow automatic authorization of any "unknown" identifiers that cannot be explicitly authorized by Local Authorization List or Authorization Cache entries. |
| AuthorizationEnabled | | | TRUE | |
| AuthorizeRemoteTxRequests | | | TRUE | |
| ChargeProfileMaxStackLevel | | | 100 | |
| ChargingScheduleAllowedChargingRateUnit | | **yes** | A,W | Configures the units of "charge power" to be used in a charging schedule. |
| ChargingScheduleMaxPeriods | | | 60 | |
| ClockAlignedDataInterval | | | 0 | |
| ConnectionTimeOut | | | 60 | Interval of time from status “Preparing” until the transaction is automatically canceled, due to failure of the EV driver to insert the charging cable into the charger or vehicle. The charger will revert to the original state. |
| ConnectorSwitch3to1PhaseSupported | | | FALSE | |
| c_ChargingVentilatedEnabled | **yes** | **yes** | FALSE | Allows the charger to offer charge when the vehicle enters in state "D" |
| c_DeviceLimit_I | **yes** | **yes** | 320 | Sets a hard limit on the maximum current the device will offer. The limit cannot be overriden by profiles. |
| c_MainFuseLimit | **yes** | **yes** | 600 | CT clamp current limit (nominally 600, equivalent to 60A) |
| c_RCDProtectionType | **yes** | **yes** | 0<br><br>0 - Both AC + DC protection is on<br><br>2 - Only AC protection is on | Configures RCD protection type. Permitted states: |
| c_VoltageProtectionOffset | **yes** | **yes** | 0 | Enables configuration of expanded voltage protection limits. The default range with the key set to "0" is +-10% of the nominal supply (207-253VAC). Values of 1-23 are allowed, which expand both lower and upper threshold by the respective amount in VAC. |
| GetConfigurationMaxKeys | | **yes** | 5 | The number of OCPP configuration keys that can be acquired from a single get configuration command. |
| HeartbeatInterval | | **yes** | 60 | The interval bettween each heartbeat PDU. |
| LightIntensity | | **yes** | 20 | The light intensity of the LED ring of the charger. |
| LocalAuthListEnabled | | | FALSE | |
| LocalAuthListMaxLength | | | 0 | |
| LocalAuthorizeOffline | | | TRUE | |

| | | | | |
|---|---|---|---|---|
| LocalPreAuthorize | | | FALSE | |
| MaxChargingProfilesInstalled | | | 10 | |
| MeterValueSampleInterval | | **yes** | 60 | The time interval between each meter value during a session. |
| MeterValuesSampledData | | **yes** | Voltage.L1-N,Voltage.N,Temperature,Current.Offered.L1,Current.Import.L1,Power.Active.Import.L1,Energy.Active.Import.Register.L1 | A list of measurands sent for each meter value during a session. |
| NumberOfConnectors | | | 1 | |
| SendLocalListMaxLength | | | 0 | |
| StopTransactionOnEVSideDisconnect | | | TRUE | |
| StopTransactionOnInvalidId | | | TRUE | |

# 5. Decommissioning and disposal

For disposal and decommissioning, the EVNET is designated as electronics waste and must be properly handled and disposed of as per national, regional, and local regulations.

To prevent hazardous electric shocks and the risk of arcing and fire, before decommissioning, ensure that power to the device is disconnected and it is not wired to any active systems