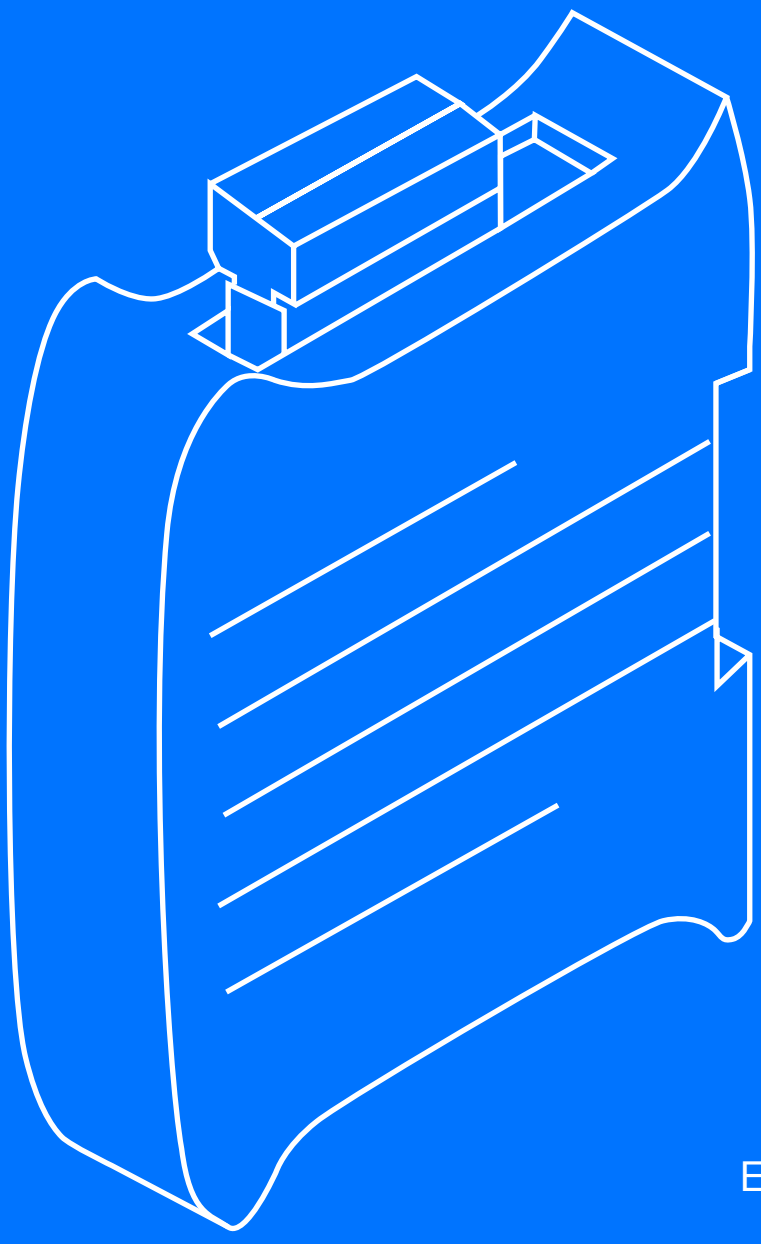
enelion

Energy Guard

Assembly manual



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Congratulations on the purchase of the **Enelion** product and thank you for your trust.

Before installation, please make sure that the module packages contain all the elements. Up to date version of the operation manual can be accessed at **http://enelion.com/help**.

Please note the contents of the manual before initiating any activities related to the installation, or activation of Energy Guard.

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Contents

1. Important information

1.1. General provisions

Installation and servicing of the device must be performed by qualified and authorized persons, and repairs may only be carried out by the manufacturer or entities authorized by the manufacturer.

Tampering with the mechanical, electrical and electronic components and the device software is forbidden and shall result in the nullification of the warranty. The exceptions include operations described herein and those agreed in writing with the manufacturer.

The manufacturer is not responsible for damage to property resulting from the forbidden interference in the product.

The electrical installation to be used by the device during its operation must meet the conditions described in the installation manual. The manufacturer is not responsible for incorrect assembly and/or protection of the electrical installation to which the device is connected.

The manufacturer is not responsible for the malfunction of the electrical installation to which the device is connected.

The electrical installation to be used by the device during its operation must comply with the legal standards in force in the place of assembly and the operation of the device. The manufacturer is not liable for any damage caused by an electrical installation that does not meet legal standards.

The device does not have a built-in switch. The device activates when the supply voltage is applied. The power supply cut off function must be provided by the appropriate electrical installation devices described in the assembly manual. Except in emergencies, the device must not be turned off during the charging process.

It is forbidden to supply the power to the device when the device casing remains open.

The manufacturer is not responsible for loss of health or life by any persons resulting from failure to comply with the above-mentioned recommendations.

The AC charger station to which the Energy Guard will be connected, must be updated to the latest software version and DLB function activation it is required, which is described in this manual.

1.2. Safety instructions

All operations described in this manual should be performed only after making sure that there is no voltage in the power cord.

Outdoor installation should not be carried out during precipitation or strong wind, if there is a risk of water or dirt getting into the device.

2. General information

Enelion Energy Guard (EEG) is a device that monitors energy consumption the whole building.
Based on the power ordered from the energy supplier and the current consumption measured by Energy Guard, it is possible to obtain information - how much power can be directed for EV charging. Energy Guard can also be used in the chain of charger stations (car parks, shopping center, fleet parking lots), which allows you to use the full potential of the current supplied energy. Current measurement is performed with the use of measuring coils, which simplifies the installation process.

Fig. 1: Enelion Energy Guard

Enelion Energy Guard is compatible with the proprietary Enelion Chain communication protocol, enabling communication with the local network of the charger stations. Thanks for that it is possible to enable Enelion DLB function, providing dynamic load balancing. This allows for more effective use of the connection's power for charging vehicles.

INFO

See User manual to learn more. The manual contains detailed information on the functionality and use of the device.

The Enelion Energy Guard comes with a set of measuring coils. The set of EEG includes four current transformers, intended for installation on the supplying power wires to the building, omitting charger stations or on the main connection supplying the entire facility. For each phase fall one current transformer.

We can distinguish, depending on the needs:

Transformers, 26 mm hole diameter and maximum input current 100 A, 300 A with 23 mm × 33 mm hole size or 500 A and 1000 A with 36 mm hole diameter.

Fig. 2: Sample measuring coils

INFO

Measuring coils with 300A and 500A of maximum current are in opening coils version. It is a possibility of individual choice of measuring coils, according to the customer requirements.

3. Design indications of the installation

3.1. Recommended power connection

Enelion Energy Guard is adapted to be powered from five or three-wire (with avoiding the PE conductor), in the TN-S and TT type of networks.

HINT

Energy Guard can work in 3 or 1 phase configuration. This Assembly manual is based on 3-phase version. All connection should be done taking into account the number of phases.

Devices for communication with charging terminals are supported by the Enelion Chain communication interface. For implementation of it, a wired connection between devices using a CAT 5 or CAT 6 Ethernet cable is required.

WARNING

The location of the measuring coils should be noticed in the Dealer Tool Box configuration.

The device should not be located in a place of high exposure to sunlight, which could cause overheating. Do not install the device near heat sources nor in the locations exposed to high humidity.

It is forbidden to install the device in explosion hazard zone.

Before installation, make sure that the mounting space inside the switchboard is sufficient for the device. For more information see the *Switchboard modification*.

WARNING

The manufacturer accepts no responsibility for any damage resulting from failure to comply with the above-mentioned recommendations.

3.2. Location selection criteria

This device is designed to be installed inside of the electrical switchboard, near of the powering cords, on which should be attached the measuring coils.

WARNING

It is forbidden to install the device in easily accessible locations.

INFO

It is possible to choose the place of installation of measuring coils. They can be installed on lines feeding the building load [Fig.3] or together with the charging stations lines feeding the building load only [Fig.4].

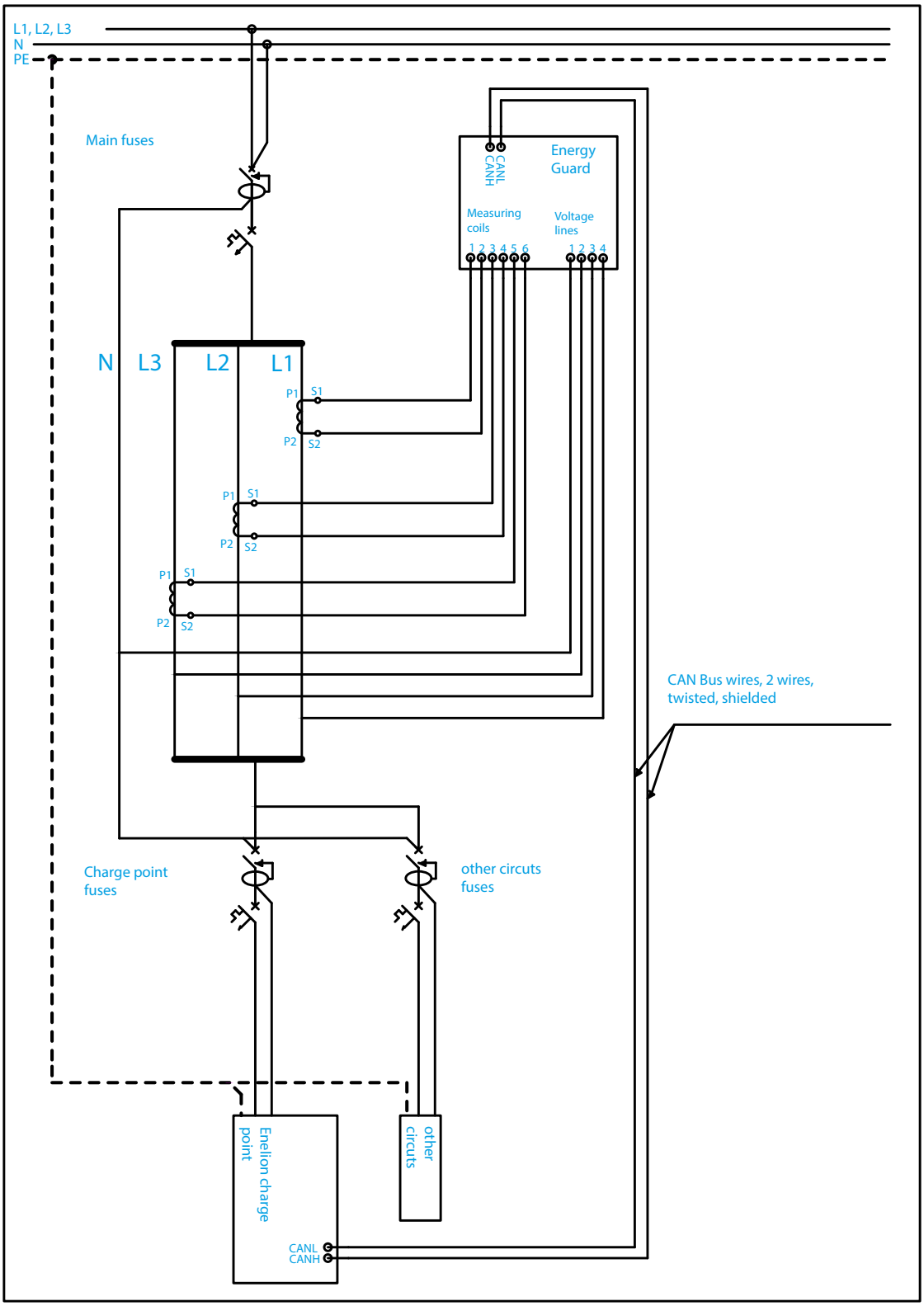


Fig. 3: Measurement of the entire connection with the charging terminals.

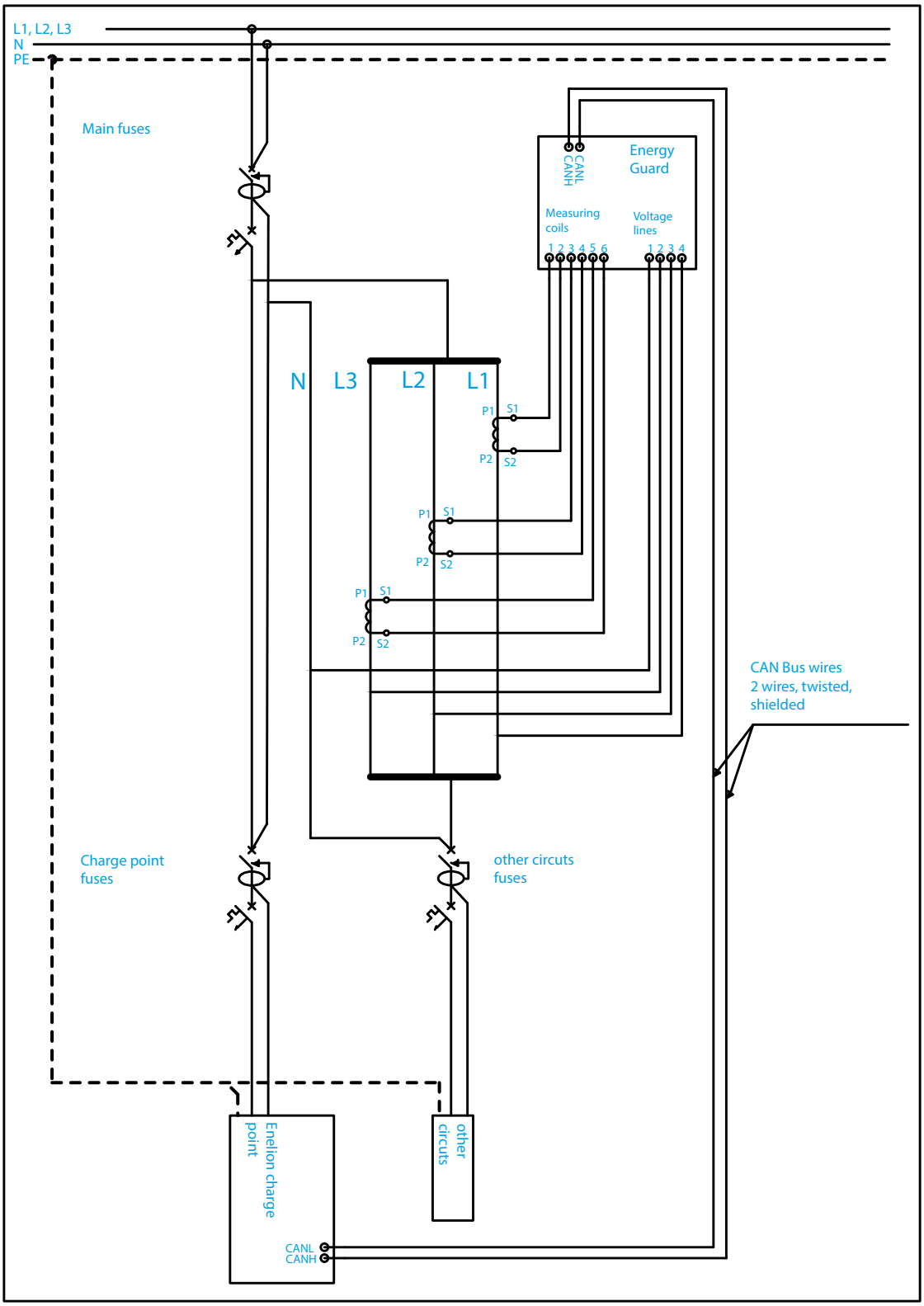


Fig. 4: Measurement of the load excluding charging terminals.

4. Assembly

WARNING

Before commencing the installation, switch off the power supplied to the cables.

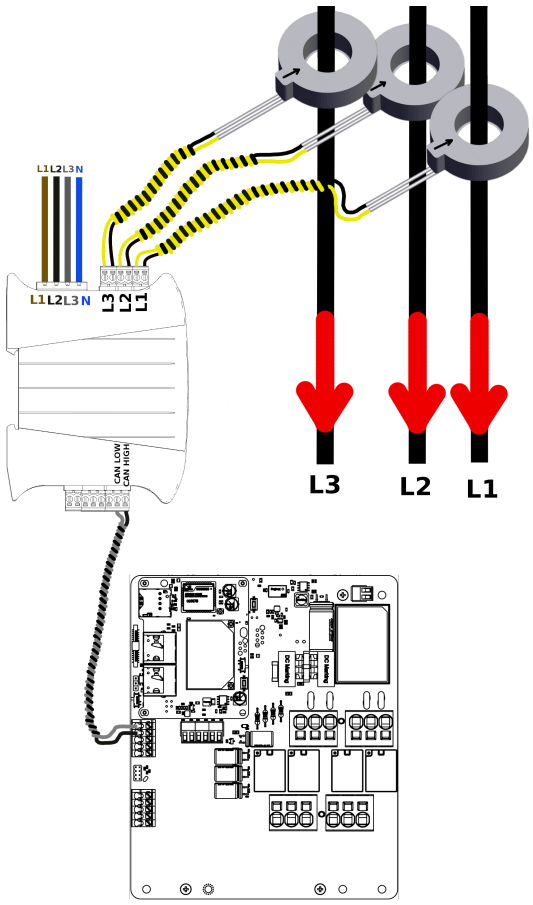


Fig. 5: Energy Guard 3-phase variant connection diagram.

INFO

In case of 1-phase version, only one measuring coil should be connected and belonging to it voltage line.

4.1. Mounting the device

Enelion Energy Guard is designed for mounting on a DIN rail, inside the switchboard.

1. Cables should be prepared and connected to the CAN bus in accordance to the diagram above. The order of the wires does not matter. We suggest using a twisted pair cable with a maximum length of 500 m.

INFO

Pay attention to communication bus termiantion, both in Energy Guard and charging station.

Use termination for devices at the beginning and end of the network. Termination is done by moving the switch in the green connector direction. Termination in enabled by default. [Fig.6].

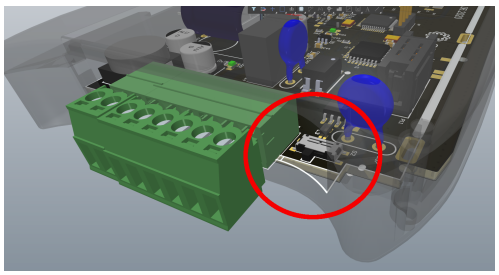


Fig. 6: Termination switch.

2. Measuring coils should be installed on wires of all phases according with the order indicated above.

WARNING

Red arrows show the direction of the current flow. Wrong order or incorrect installation of the current transformers will prevent the properly operation of the EEG.

Direction of the installation, according to the arrow on the transformer (disconnect the power supply cables to the switchboard and insert through the transformer from the side marked with the arrow).

INFO

Transformers are not equipped with wires. Suggested cables with a conductor cross-section of 0.5 mm^2. In the case of custom-made transformers, it is possible to equip them with the necessary wires and connectors to be plugged into the EEG.

3. Voltage lines (power supply) EEG should be connected under the order indicated in the diagram [Fig.5]. The device does not require additional protection. The cables on the switchboard side should be connected to the terminals of the apparatus located before branching the circuits in the switchboard (e.g. a meter or the main protection - overcurrent switch). We suggest using stranded type cables with a core cross-section of 0,5 mm^2.

WARNING

A reliable and stable voltage source must be provided. Connecting the Energy Guard voltage lines to a point constituting a side branch of the installation may result the loss of the power source in the case that this branch would be disconnected, for example by triggering its protection.

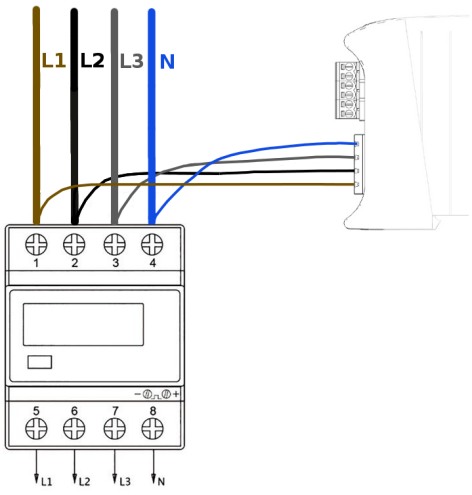


Fig. 7: Sample connection of the voltage lines to the selected apparatus in the switchboard.

4.2. Modification of the electrical switchboard

Since the Enelion Energy Guard has different dimensions than the standard fuse which is installed in the switchboard, it is required to enlarge the hole in the blend.

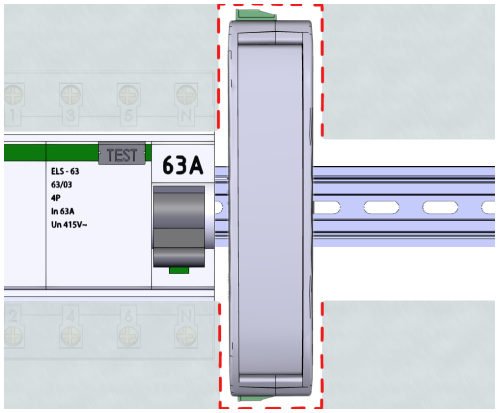


Fig. 8: EEG installed in the electrical switchboard.

INFO

It is permissible to mount the EEG in other orientations than directly on the DIN rail, if required by the switchboard design.

4.3. Controll after commissioning

After connecting the wiring and mounting the EEG, the power can be restored. The EEG has a very simple interface:

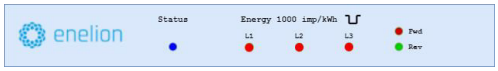


Fig. 9: LED interface on the front of the device.

Status led:

(a) Pulsing Blue - correct state, charging does not take place.

(b) Pulsing Yellow or Green (depending on installed LED - no connection with charging station (CAN bus)

(c) Red - Fault/Damage

Phase diodes:

(a) Red - power consumption on a given phase

(b) Green - energy return on a given phase

4.4. FAQ

Problem	Remedy
The LEDs of the given phases are green, and no renewable energy sources are connected to the electrical system.	The measuring coils were installed frontside back
The status LED flashes yellow or green	Check the connection of the CAN bus wires.
The status LED is red	Contact with the service

5. Dynamic Load Balancing

5.1. DLB system

Dynamic Load Balancing - DLB - is a smart system of load management used during EV charging process. It allows dividing the total input power between connectors in a way, that allows maintaining consumption below a given level. It helps to prevent surcharging network of the charger's operator with extra fees from an electric power supplier. DLB also allows using available power, which appears after disconnecting any car from the charger in the network. It can be used from the quantity of just two connectors, up to couple of hundreds of them, so it can be applied as well as in the single household as well as in the whole parking lot.

In the basic version, an internet connection is not necessary for DLB to work. After energizing chargers, they'll know what to do.

Nevertheless, after fitting „master" unit in the Bridge communication module and Enelion administration system, you gain access to many developed functions allowing remote management of charging.

5.2. Energy Guard - impact on DLB

The combination of EnergyGuard with a network of chargers allows the DLB functionality to be extended to include other electrical devices than chargers in the power distribution. From this point on, the connection limitation will determine the total power allocated to the building including chargers. The chargers will adjust the charging power of the cars so that, together with other electrical devices, the current limit of the connection will not be exceeded.

When energy-consuming devices are turned on, the Energy Guard, measuring the load, transmits the information about the current energy consumption to the charging station, thanks to which there is a proportional reduction of the available power for EV charging - there is no risk of overloading the home electrical installation, and thus triggering electrical protection.

Energy Guard can also be used in a network of chargers (parking, shopping centres, fleet parking), which allows you to use the full potential of the current supplied energy, without increasing it - that is profitable and thus valued by accountants in every company. During peak hours, cars can be charged with the minimum required power adequately distributed by Enelion's charging terminals. The undoubted advantage of using EEG is the possibility of having a network of chargers with a total power exceeding that available - having 22kW available for chargers, we can have several 22kW chargers that will always charge with the maximum available power.

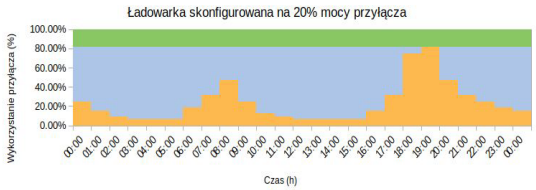


Fig. 10: No DLB system

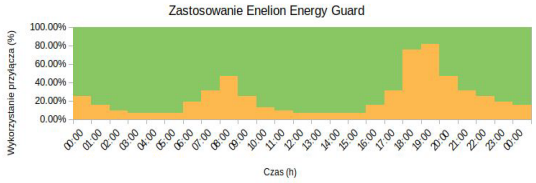


Fig. 11: Active DLB system

When the charging stations are connected to the internet, system status can be monitored and managed via the administration system Enelink.

5.3. Configuration

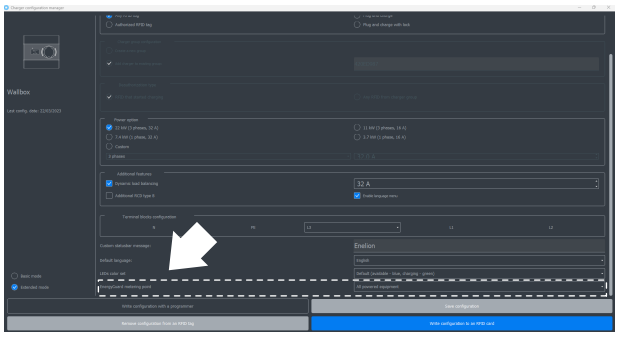
Configuration can be done via DealerToolBox. This software is available on the manufacturer website. To configure the network of chargers, it is necessary to know the maximum current limit of the connection. Typically, this parameter corresponds to the tripping value of the fuse protecting the connection in the switchgear.

Another configuration parameter involves declaring the location of measuring transformers.
It is set when configuring the charger in the DealerToolbox app.

Once the extended view has been selected, navigate to the 'EnergyGuard metering point' and select the appropriate option depending on where the current transformers are located in the network.

The charging station must be configured by selecting one of two measurement methods:

1. „All powered equipment” (default option), i.e. measurement of the entire connection including charging stations [Fig. 3].



2. „Power equipment without charging network”, i.e. measurement of the connection without charging stations [Fig. 4].

INFO

Information on the connection variants with diagrams can be found in the chapter *Design indications of the installation*.

By default, the chargers will treat the measurement as if they did not include chargers, but it is possible to configure the device using the Delaer Toolbox.

WARNING

Incorrect configuration may lead to unexpected behavior of the charging power sharing algorithm.

Configuration parameters	Comment
Current limitation of the mains connection 32 A	Corresponds to the limitation per phase - for a single-phase 7,4 kW and three-phase installation 22 kW the limitation value will be the same and will be 32 A
Measurement of the mains connection with chargers	EnergyGuard installed at the very beginning of the mains connection - it is followed by branches to chargers and other devices
Measurement of the mains connection without chargers	EnergyGuard installed on a branch to the devices themselves - a branch to the chargers is made before the EnergyGuard

5.4. Queuing

According to the IEC 61296 standard, the charger must not limit the car charging current below 6 A per phase (1,4 kW single-phase or 4,1 kW three-phase charging). If there is not enough power, the charger goes into standby mode. Charging will resume when minimum charging power is available again.

If the suspension occurs while charging more than one car, the charging suspension is queued. The car that has charged the most energy during that charging session will pause first. If necessary, the next cars with the highest energy consumption will be turned off one by one.

In a situation where, during the pause, another car gets a higher state of charge than the paused car, the switch will occur. First, the charging car will pause, allowing the second car to resume charging.

INFO

Queuing is to evenly distribute energy among all charged cars.

5.5. Maintenance

The device is designed to operate in temperatures from –25 ℃ do 55 ℃. The manufacturer does not guarantee the proper functioning of the device in temperatures outside the specified range. Chargers that are damaged because of exposure to temperatures below –25 ℃ or above 55 ℃ are not covered under the warranty.

WARNING

The device may only be opened by a qualified and authorized person.

6. Technical data

6.1. Enelion Energy Guard

Electrical data	
Nominal supply voltage	1x 230V AC / 3x 230V AC (+-10%)
Network type	TN-C; TN-S; TN-C-S; TT
Voltage frequency	50 Hz/60 Hz
Overvoltage category	III according to EN 60664–1
Maximum value of measuring current	Depends on the current transformers 100 A, 300 A, 500 A and 1000 A); possibility to individual choose for higher value of current
Accuracy	Accuracy class 0,5
Maximum temporary overload*	100%
Bidirectional current measurement	Yes
Measurement point parameters	Three or one phase system (included correct amount of measuring coils.)
Typical reaction time from switch on to change the charging power	< 1,5 s
Maximum charging hold time	3 s, according with IEC 61296
Maximum charging station reaction time on change of available power	5 s, (according with IEC 61296)
Maximum EnergyGuard reaction time on higher current consumption detection	1 s
Maximum connection overload time**	9 s
Maximum connection current limitation	3 kA

*must be executed following conditions:

1. Connection was in 100% used by cars
2. At the same moment the external load has been launched using 100% of the main connection

**must be executed following conditions:

1. Start the load immediately after the last Energy-Guard measurement (1 s of delay)
2. The previous change in charging current occurred immediately before switching on the load (5 s of delay)
3. Connected load was so high, that charging had to be stopped.
4. The car did not react to the suspension of charging from the charging station. (3 s of delay)

Mechanical data	
Housing	Plastic PC/ABS, mountage on DIN rail
IP protection	Mountage inside the switchboard
Maximum diameter of cables	Depends on the measuring coils
Height (mm)	105 mm
Width (mm)	20 mm
Depth (mm)	80 mm

Interfaces	
Maximum count of car chargers	to 90 pieces – for custom-made transformers – determined individually
User interface	Front pannel LEDs

External conditions	
Working temperature	from –25 ℃ to 55 ℃
Storage temperature range	from –35 ℃ to 55 ℃
Permitted relative air humidity	from 5% to 95%
Elevation above the sea level	maximum 2000 m

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