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A BRAND OF THE VOLKSWAGEN GROUP

Overload Protection

Product Information and Installation Guideline

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Version 1.0 (04.09.2020)

1 Scope and General Information

This guideline is to introduce the Elli Charger's Overload Protection as well as to provide guidance the installation of the components needed. In addition, all technical parameters and restrictions of the Elli Charger's control system are listed for qualified electricians to be able to decide on a proper installation design.

The guideline will refer to the "Elli Charger". This is to cover all the respective product names of this wallbox equally, such as "ID. Charger" (Volkswagen), "SEAT Charger" (SEAT), "CUPRA Charger" (CUPRA), as well as "ŠKODA iV Charger" (ŠKODA).

2 Product Information

The Overload Protection feature of the Elli Charger is aiming to allow customers to use as much of their facility's power capacity as possible.

Due to local restrictions like physical or contractual power capacity limits, customers might face the need to have their wallbox's maximum charging power limited. This is to ensure that the sum of electrical power used for everyday life (residential load) and charging power for the electric vehicle will not exceed the given restrictions, and thus might lead to a tripping breaker or rupturing the house's main fuse.

2.1 Ordinary Charging Power Limitation

Usually, when evaluating a wallbox's maximum charging power, the residential's peak load needs to be considered. Doing so, a wallbox's charging power will usually be limited to a static as well as rather low value, since a crucial power scenario is to be prevented.

However, such crucial power scenarios occur rather seldomly, which leads to the fact that a wallbox will also operate with the limited charging power during times where the residential load would allow for the vehicle to be charged with higher power. As qualitatively illustrated in Figure 1, the customer is therefore not able to use the full potential of his power supply in order to charge the vehicle as fast as possible.

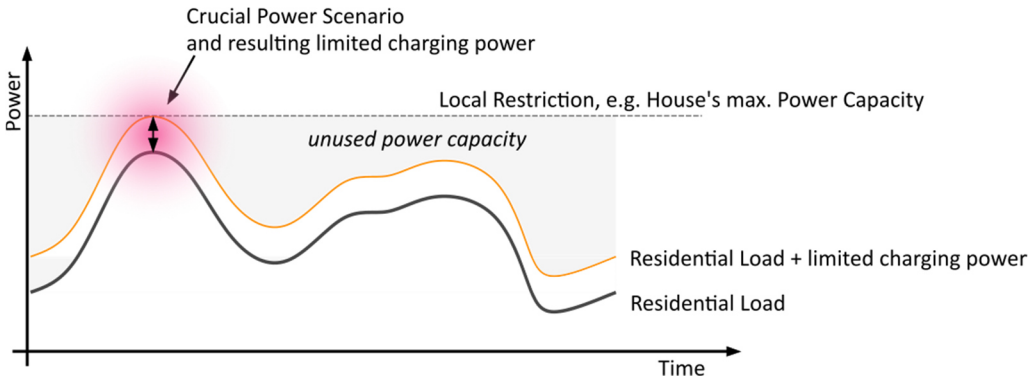

Figure 1: A static power limitation of a wallbox will leave most of the power capacity unused to charge a vehicle at higher speed.

2.2 Dynamic Power Limitation with the Elli Charger

With the Overload Protection, the Elli Charger offers a comfort feature to enable customers to always charge their vehicles at the fastest speed possible. By installing additional current sensors (Current Transformer coils = "CT coils") in the house's electric installation and configuring the Elli Charger according to the local restrictions, the Elli Charger will charge the vehicle with as much power as possible while at the same time ensuring to stay within these local restrictions. Given the same residential load and local restrictions, this will charge a vehicle with up to the full charging power as illustrated in Figure 2.

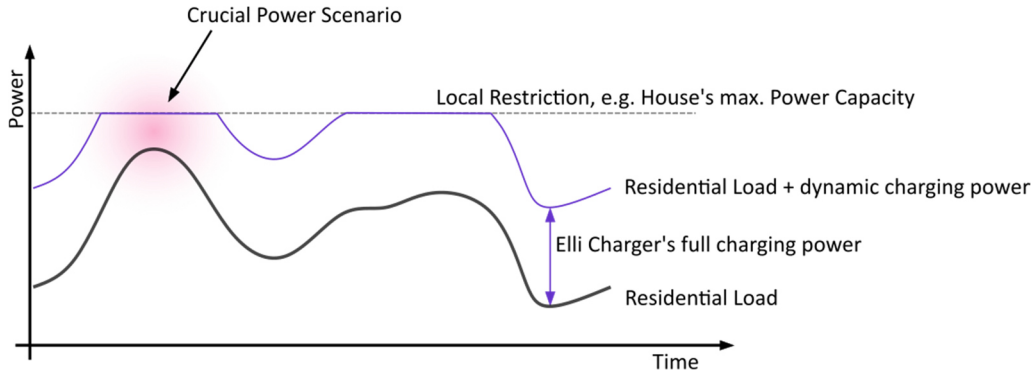

Figure 2: The Elli Charger's Overload Protection will keep charging power within local restrictions, while providing as much power and thus charge a vehicle as fast as possible.

> **NOTE**
>
> The Overload Protection is a comfort feature of the Elli Charger. It is not claiming to fulfil any country-specific standards or local requirements. The Overload Protection is neither a substitute for security devices, such as breakers, to protect electrical installations from damage due to excess currents.
>
> A qualified electrician must always check and decide about the eligibility of the intended use.

2.3 Overview of Overload Protection Setup

In order to use the Overload Protection, CT coils need to be installed at the house's critical installation point. This might be at the house's main fuse or any other sub-distribution where the residential load and the charging power might exceed the local restrictions. These CT coils need to be wired to the Elli Charger. Since usually the critical installation point and the Elli Charger are located some distance apart, a data cable in needed to properly establish this wired connection.

For the three-phase variant of the Elli Charger also three CT coils can be used, i.e. one CT coil per installation phase. To ensure a proper monitoring of the critical installation point, all these CT coils should be located at the same place of the electric installation. The Elli Charger adapt its offered charging power for all its phases, based on the installation phase with the highest load, and thus avoid any load imbalance due to the charging of the vehicle.

Figure 3 is showing an qualitative example of a house with the CT coils being installed right at the main fuse. With this setup the CT coils will detect the full residential load of all power consuming devices in the house.

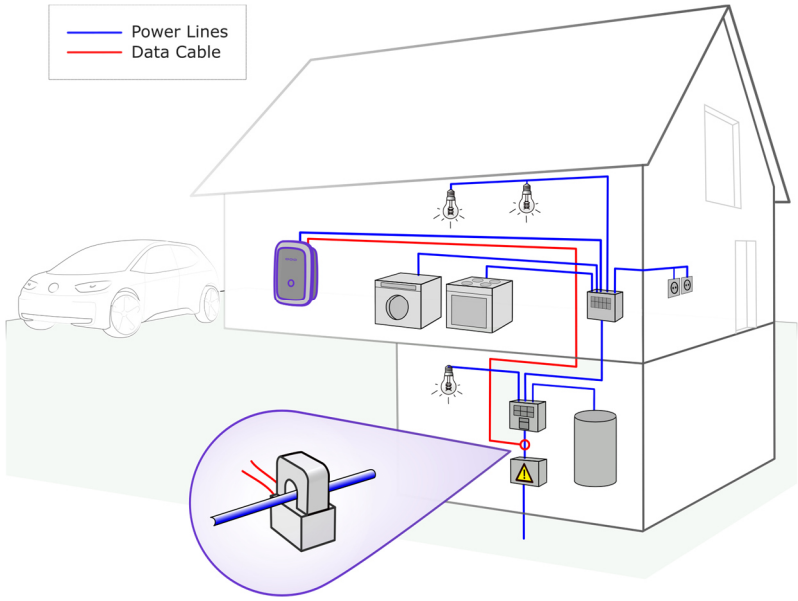

Figure 3: Example for how CT coils might be installed at the house's main fuse, in order to consider all power consuming devices.

NOTE

If the Elli Charger is being used with for Overload Protection, it will only adapt the offered charging power based on the measurements of the CT coils with respect to the configured maximum current allowed at that point of installation. When the residential load is low enough, the Elli Charger will then offer its full charging power to the vehicle, i.e. 32 A for single-phase and 16 A for three-phase version.

It is not possible to use the Elli Charger's Overload Protection and have the Elli Charger itself limited to less than its full charging power. This needs to be considered by the electrician designing the electric installation, i.e. choosing breaker and RCD sizes.

3 Installation of Overload Protection

This chapter is to state the material needed for a proper installation of the Overload Protection and how to perform the respective installation steps.

NOTE

The needed material listed in this chapter is not provided with any version of the Elli Charger. Neither can it be ordered from Elli at the moment.

Please ask your qualified electrician for an offer when planning the installation of the Elli Charger.

3.1 Needed Material

For the Overload Protection additional installation material is needed. Table 1 is listing this material with respect to the number of phases of the local installation.

Table 1: List of needed materials

NEEDED MATERIAL	QUANTITY
CT coils	one per installation phase
Wire connectors, e.g. splicing connectors	one per installation phase
Data cable, e.g. Cat-7 S/FTP	length acc. to installation distance, max. 150 m
MCVR 1.5/3-ST-3.81 connectors	one per installation phase
Optional: EMC shield connector	depending on data cable shield and drain wire

NOTE

It is recommended to use a data cable with at least a single/foil shielded data cable. In order to reduce EMC noise to a minimum, a double/foil-braid shielded data cable with twisted wire pairs (S/FTP) should be used.

3.2 Install Overload Protection

1. **Install and prepare the CT coils.**
   a. Place one CT coil per phase at the point of facility current measurement. Install the CT coils according to the CT coil manufacturer's instructions to ensure proper functionality.
   b. Shorten the CT coil's signal wires as much as possible while leaving them long enough to connect to the data cable.
   c. Strip the signal wires to a length according to the splicing connector's specification.

2. **Prepare the data cable and connect to CT coil.**
   a. Use one pair of the data cable's signal wires per installed CT coil. Strip these wires to a length according to the splicing connector's specification.
   b. Shorten the rest of this data cable so that the signal wires used are long enough to be connected to the CT coil's signal wires.
   c. Connect each signal wire of the CT coil with one of the wires of the data cable's signal wire pair, using the splicing connector.

3. **Route the data cable and insert into the Elli Charger.**

	For further details refer to the Elli Charger's installation manual chapter 5.3.

a. Route the date cable from the CT coil to the Elli Charger.
b. Insert the data cable into the Elli Charger via one of the provided knockouts of the Elli Charger and the provided cable gland.
c. Make sure to have at least 80 mm of data cable available on the inside of the Elli Charger, after the cable gland has been tightened.

4. **Connect the data cable to the Elli Charger.**

	For details refer to the Elli Charger's installation manual chapter 5.4.

a. Strip the data cable's outer insulation by 50 mm.
b. Shorten the data cable's EMC shield and protect it from undesired contact with other electric parts, with respect to the setup used.
c. Strip the signal wires by 7 mm.
d. Insert the signal wires into the MCVR 1.5/3-ST-3.81 connector and secure the wires using a screwdriver.
   Make sure that the signal wires will be attached to the center and right pin of the Elli Charger's female connector.
e. Connect the data cable's EMC shield to the MCVR 1.5/3-ST-3.81 connector using the data cable's drain wire. Alternatively, use a shield connector.
   Make sure that the EMC shield will therefore be connected to the left pin of the Elli Charger's female PCB connector for proper grounding.
f. Connect the MCVR 1.5/3-ST-3.81 connector to the female PCB connector on the Elli Charger's power board.

Figure 4 is showing the installation slots of the MCVR 1.5/3-ST-3.81 connector with respect to the female PCB connector on the Elli Charger's power board.

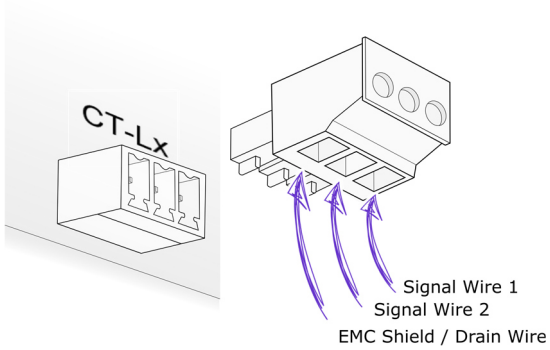

Figure 4: Installation slots of MCVR 1.5/3-ST-3.81 connector and Elli Charger's female PCB connector.

3.3 Configuration of Elli Charger for Overload Protection

For details refer to the Elli Charger's installation manual chapter 6.

5. **Set the Elli Charger's DIP-switches in order to configure the Overload Protection parameters.**
   a. Set the DIP-switches 1-4 of Group A in order to select the CT coil model used.
   b. Set the DIP-switches of Group B in order to select the max. facility current allowed at the CT coil's place of installation.
   c. Optionally, in case of an Elli Charger Connect or Pro use the Configuration Manager to conduct further CT coil settings.
   d. Optionally, in case of an Elli Charger Connect or Pro use the Configuration Manager to double check the correct Overload Protection configuration.

NOTE

The Elli Charger's control system considers a safety margin of 6 % to the set max. facility current in order to prevent exceeding the maximum current due to measurement deviation.

Unless there is a designated statement with the Elli Charger's installation manual, stating that this safety margin needs to be considered during configuration, no further precautions need to be taken. In case there is an explicit statement with the Elli Charger's installation manual, this safety margin needs to be considered when setting the DIP-switches and the configured maximum facility current allowed is to be reduced accordingly.

4 Technical Parameters

The list of CT coils that are supported by the Elli Charger by default can also be obtained from the Elli Charger's installation manual chapter 6.

In addition to the Elli Charger's installation manual, Table 2 is listing the CT coil models that are possible to use with any variant of the Elli Charger by default.

Table 2: List of recommended CT coil models supported by the Elli Charger.

MANUFACTURER	MODEL	RATED PRIMARY CURRENT (IN A RMS)	TURN RATIO
Nidec	C-CT-10	60	3.000 : 1
Nidec	C-CT-16	100	3.000 : 1
Nidec	C-CT-24	200	3.000 : 1
LEM	TT 50-SD	50	3.000 : 1
LEM	TT 100-SD	100	3.000 : 1
VAC	E4623-X002	40	2.500 : 1
VAC	E4624-X002	60	2.500 : 1
VAC	E4626-X002	100	2.500 : 1

In addition to the CT coils supported by the Elli Charger by default, the Elli Charger Connect and Pro offer the possibility to also use other CT coils with different technical parameters. However, these parameters need to be configured in the Elli Charger's Configuration Manager during electrical commissioning. Table 3 is listing the limitations of the technical parameters, that such CT coils need to fulfil.

Table 3: Limitations for CT coils used for Overload Protection with the Elli Charger.

PARAMETER	VALUE
min. rated Primary Current (in A RMS)	30
max. rated Primary Current (in A RMS)	200
min. Turn Ratio	300 : 1
max. Turn Ratio	10.000 : 1

Table 4 is giving an overview of the Elli Charger's control system parameters. These dates can be used to evaluate whether the Overload Protection meets the requirements that might need to be considered during the design of an installation.

Table 4: Parameters of the Elli Charger's Control System for Overload Protection

PARAMETER	VALUE
Sample Rate of Facility Current	10 Hz
Measurement Accuracy of Facility Current	0,1 A
max. relative Measurement Deviation of Elli Charger's Control System [1)]	6 %
Calculation Rate of max. Charging Current	2 Hz
Accuracy of max. Charging Current	0,1 A
Update Cycle of max. Charging Current	5 s [2)]

1) Already considered by the Elli Charger's control, unless communicated otherwise
2) In accordance to IEC 61851