CHARGING STATION

USER MANUAL

Document no: **PLUG CHARGER_80.80 X_MAN_D_EN**

TYPE	PLUG CHARGER 80 / 80 X
MANUFACTURE YEAR	2023
DOCUMENTATION VERSION	D

KEEP TO USE IN THE FUTURE

Zielona Góra 2023

Table of changes			
Revision No.	Date	Responsible for the change	Brief description
A	06.06.2022	Dominika Libera	Creation of documentation
B	02.08.2022	Dominika Libera	- General actualization, - 5.1, Tab. 2 - adding information about the compliance of the RFID reader with the relevant standards.
C	14.04.2023	Agata Kogut	Upgrade point 1.3, upgrade table 2
D	05.07.2023	Dominika Libera-Kajka	- General actualization.

Created	**Checked**	**Approved**
Dominika Libera	Julita Gmyrek	Wojciech Bordych

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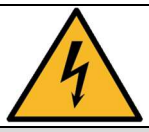
1. SAFETY

1.1. Symbols meanings

Danger	
	Not following these rules may lead to the threat of death or heavy health damage.
	Potentially dangerous situations. Not following these rules may lead to the threat of death or heavy health damage.
	Not following these rules may lead to heavy health damage.
	Not following these rules may lead to the equipment damage.
	ATTENTION – Possibility of electric shock, pay specific attention.
Information	
	INFORMATION-ADVICE - We bring this specific detail to your attention.
	Before starting read the user manual.
	The device may be serviced only by the trained staff.

1.2. General information

- There are **high voltages** in the charging station. In case of not being cautious of it or not following the rules described in this manual a serious material damage may be encountered as well as heavy health damage or even death due to electric shock.

- The charging station may be serviced and operated only by a **qualified staff**. This staff must be familiarized with this manual and all technical documentation related to this equipment type.

- **Risk of electric shock!** The charging station includes a high capacity value, so the device can maintain a high voltage values even with the switch-off power.

- The device access must be prohibited for children and unauthorized persons.
- The device can be used only for the purpose specified by the manufacturer. Any modifications and the use of spare parts that are not sold or recommended by the manufacturer may cause electric shock or damage to the device.
- It is forbidden to use adapters not authorized by the manufacturer of the station.
- Correct device operation is related to the appropriate storage, transportation, installation, electrical connections and maintenance. The instructions on those matter are provided further in this manual.
- This manual should be kept near the device and all users should refer to this manual in case of necessity.

- In case of an absolute necessity of performing tests when the device is electrically live, the safety rules must be followed thoroughly and the used measurement equipment must be checked before connecting to the charging station.
- All equipment repairs have to be performed only the service personnel of Ekoenergetyka-Service sp. o.o. (contact: +48 690 23 23 23; service@ekoenergetyka-service.com) or another authorized by Ekoenergetyka-Poland staff. Unauthorized repairs may lead to the electric shock and/or significant material damage during both the repairs and subsequent operation.
- The device requires a review every 12 months, that is a condition of safe operation and guaranty maintaining.
- The device is equipped with a safety switch.

1.3. Protections system

The main protection of the charging station at the input is a 4-pole fuse switch disconnector. Additional protection compliant with an IEC 61861-23 is ensured by a differential relay that serves to protecting people from the threat of an electric shock as well as increasing the fire safety. The station also has a surge arrester T1+T2, which is used to cut off and lead to the ground the incoming overvoltage impulse.

From the output the charging station is protected by the means of an IT circuit, where all parts are not ground connected. So even an additional earth short circuit won't create any danger. Galvanic insulation is ensured by the transformers. Another protective device is a ground insulation meter at the output that measures an insulation between the phases with regards to earth.

Another layer of safety for the user is ensured by the housing that is made in protection class I (all available metal parts are connected to the PE protective conductor). In the station also installed a safety switch connected to the safety relay, which disconnects the power supply of the power contactor coil.

For a safe and efficient charging process a communicational protocol compliant with the ISO 15118 i DIN 70121 standard is responsible. This protocol also has some implemented functions allowing for a fast disconnecting if the vehicle is at risk.

1.4. The 5 safety rules

1. Disconnect completely - meaning that the electrical installation must be disconnected from live parts on all poles.
2. Secure against re-connection - reliably prevent the accidental re-connection of an installation where work is in progress. This is achieved by replacing turned off fuses in the low-voltage system with lock-out devices.
3. Verify that the installation is dead - is the installation really dead now? Use suitable measuring / test equipment, such as a voltage detector, to verify the absence of operating voltage on all poles of the electrical installation. Check the correct function of the voltage detector prior to use.
4. Carry out earthing and short-circuiting - if the installation is dead, connect the cables and the earthing system with short-circuit-proof earthing and short-circuiting devices. Important: The relevant parts must be earthed before they are short-circuited!

5. Provide protection against adjacent live parts - according to the five safety rules, adjacent parts are parts located in the vicinity zone. If parts of an electrical installation in the vicinity zone of the work location cannot be disconnected, additional precautions must be taken before work starts. In this case use insulating protective shutters or covering material as protection against accidental contact.

2. INTRODUCTION

The instruction is a basic source of information related to the housings, employment areas, user's safety as well as charger operational conditions. Every user starting an installation, start-up and operation of the charger must familiarize himself/herself with this document and every time before starting using the equipment must check it's technical state.

Attention: safety switch may be used to stop the charging only in the case of situations that are dangerous to life or property. Its use will result in immediate shut down of the device.

Unlocking of the safety switch is done by twisting it and it is allowed only after removal of the causes of device failure.

3. FUNCTIONALITY

3.1. Description of the charging station

The DC charging system is dedicated to charging electric vehicles equipped with a Combo-2 (Type2/Mode4) connector. The charging station is built on the basis of high-frequency converter systems, which are a regulated current-voltage source with the possibility of direct communication with the battery management system in the vehicle.

The tables below are showing the maximum power and possible charging variants:

***Tab. 1* Charging power variants of Plug Charger 80 and Plug Charger 80 X**

Plug Charger 80		
Connector	Maximum charge power [kW]	
Combo-2	80	40

Plug Charger 80 X						
Connector	Maximum charge power [kW]					
Combo-2	80	-	40	-	40	20
Combo-2	-	80	40	40	-	20

3.2. Block diagram

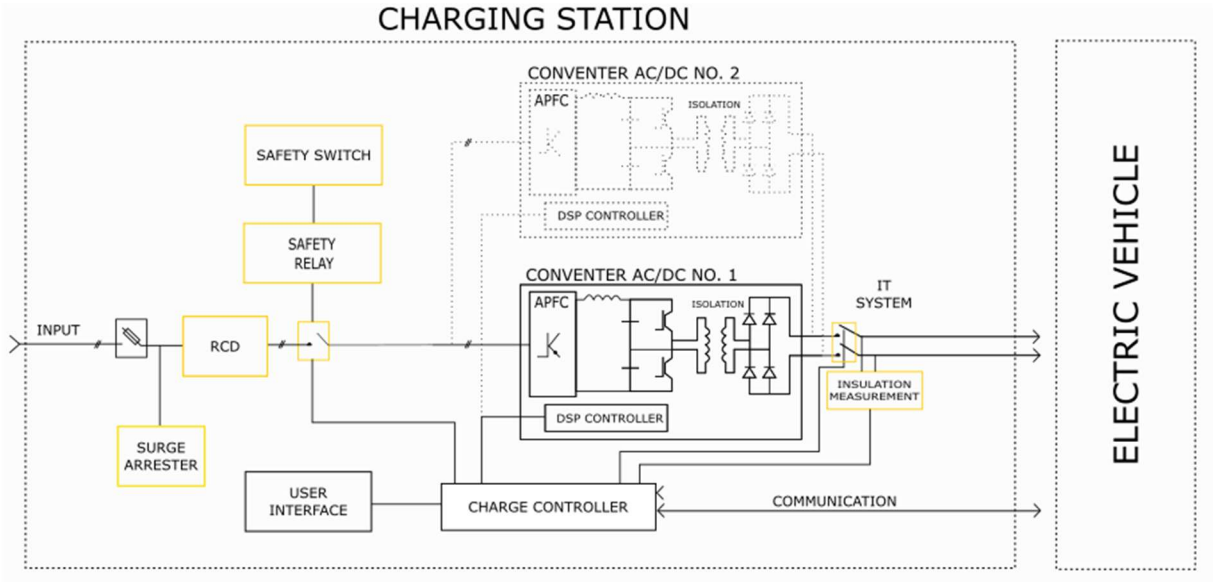


***Fig. 1* Block diagram of charging station Plug Charger 80**

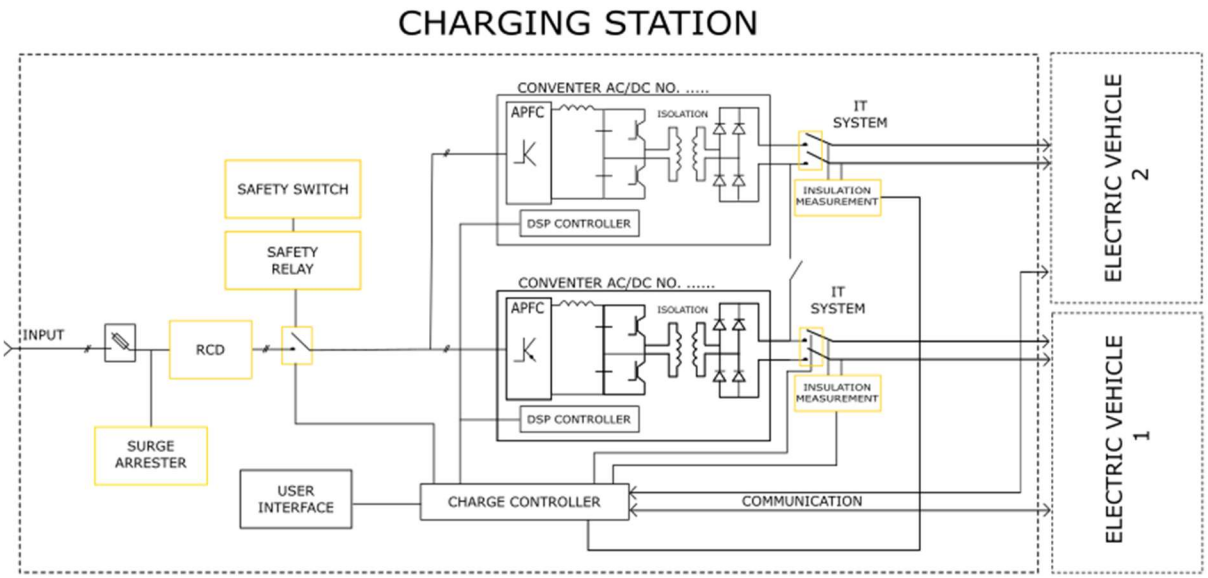


***Fig. 2* Block diagram of charging station Plug Charger 80 X**

3.3. User interface

The charging station has been equipped with an intuitive and functional user interface that signals the basic operating states. From the interface level, it is also possible to terminate the charging process using the "STOP" button **(S02)** and emergency shutdown of the charging station using the safety switch **(S03).**

The safety switch is only used to finish charging in situations where life or property is at risk. Its use will immediately turn off the device.

The safety switch is unlocked by turning it and is allowed only after removing the causes of the failure of the device.

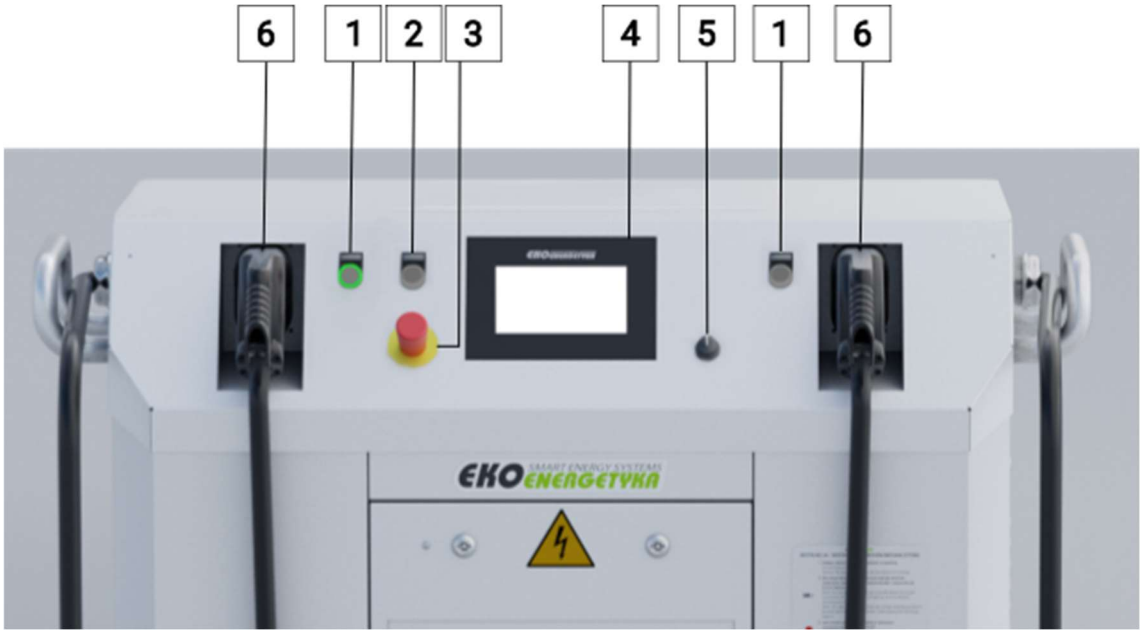


***Fig. 3* User interface**

1	RGB backlit „STOP" button - stops the charging process at any time. **- „READY TO CONNECT"** – light signal– - steady – ready to connect, - flashing – plug connected, initiation. **- „PRECHARGE/CHARGING"** – light signal – - steady – charging, - flashing fast – precharge, - slow flashing – ending charging, disconnect plug. **- „ERROR"** – light signal – informs about incorrect charging process.
2	Language change button.
3	SAFETY SWITCH – use only to end charging in life-threatening situations. Unlock by twisting.
4	Touch screen integrated with the card reader.
5	IGNITION KEY 0/I/II – starts the charging station. 0 – turned off I – 40 kW II – 80 kW
6	Charging connector. The connector in the right is available in two-output charging station version.

3.4. Proximity card reader RFID

The charging station has been equipped with a proximity card reader. Each user has his own RFID card. Cards are used to identify the users of the device. The card should then be placed against the reader field on the display frame.

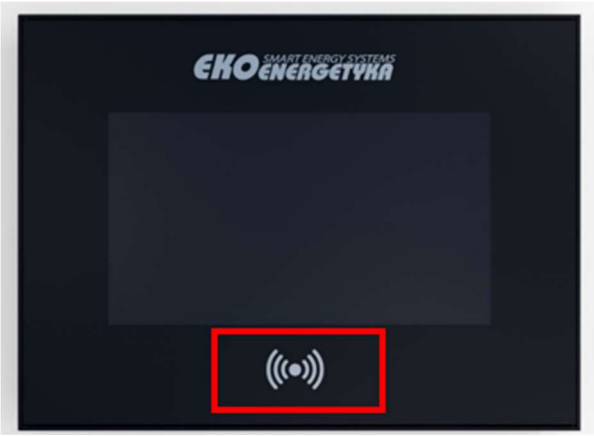


Fig. 4 **RFID proximity reader field (marked in the frame)**

3.5. Description of the charging connector

The charging connector consists of two main parts: charging connector with a cable, that is considered to be a part of the charging station and a socket that is located on a vehicle. The charging connector is characterized by an uncomplicated servicing as well as maximum safety for the user.

The plug has a built-in temperature sensor for the DC + and DC- terminals, which is used to monitor the contact temperature and in the event of its overheating, charging is terminated.

The charging connector has 5 contact pins: positive end (DC+), negative end (DC-), protective earth (PE), control pilot (CP) and proximity pilot (PP).

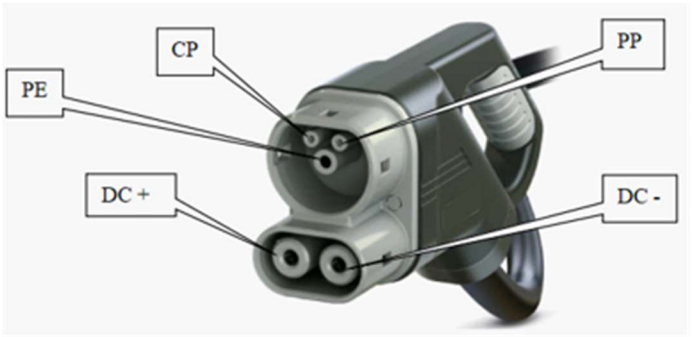


Fig. 5 **Connector view Combo-2 (Type2/mode4)**

4. CHARGING PROCESS

4.1. Starting the charging process with the use of an RFID reader

In order to start the charging process, start the charging station and set the ignition switch to position I or II using the key. After starting the charging station, the display screen will show information about the readiness to connect the vehicle for charging (*Fig. 6*), to do this, hold the card against the RFID reader to identify the user. Once the user authorization is successful, connect the charging connector to the vehicle (*Fig. 7*).

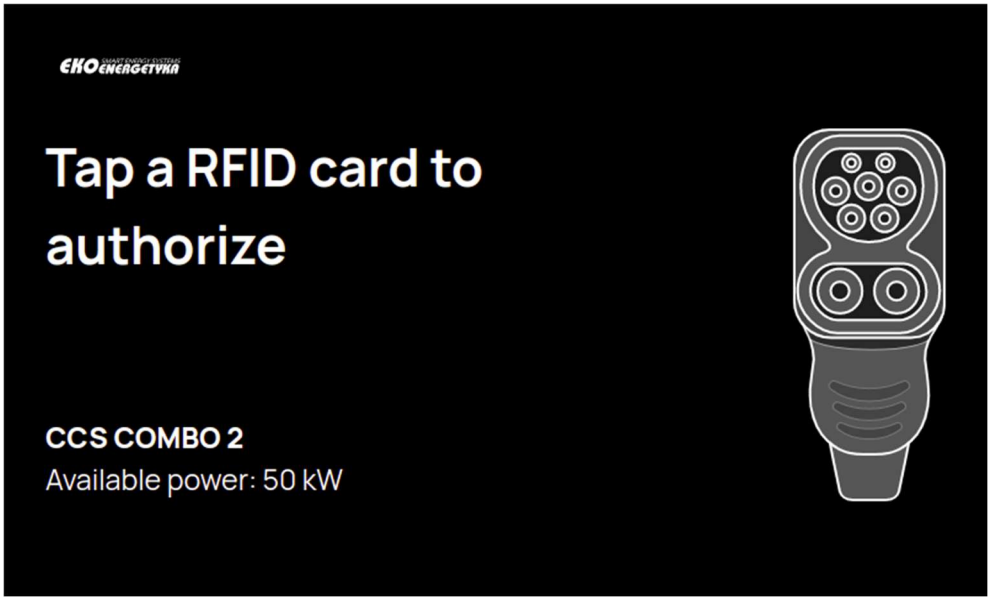


***Fig. 6* Display view after starting the charging station**

***Fig. 7* Display view during user authorization**

After the voltage-free connection is signaled by the information on the display about initialization, the correct connection is tested by analyzing the continuity of the PE conductor, communication is established and the insulation resistance of the entire system is measured (*Fig. 8*). When the connection between the charger and the vehicle is established correctly, the system will automatically start charging, which is indicated by information on the screen (*Fig. 9*).

***Fig. 8* Display view during initialization**

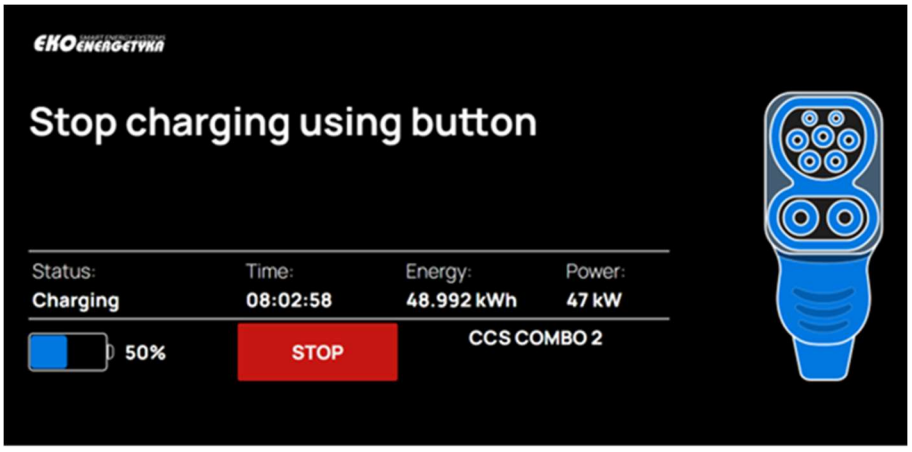


***Fig. 9* Display view during disconnecting process**

4.2. Charging process

The charging system is based on the CCS (Combined Charging System) communication protocol compliant with the ISO 15118 and DIN 70121 standards. The driver can see information about the charging status on the dashboard of the electric vehicle. When an error occurs during the charging process (caused by the infrastructure or the vehicle), the

charging stops immediately, which means that the DC track contactors in the charging station and the vehicle are disconnected. An error message will appear on the screen.

4.3. Disconnection / charging stop

The readiness to disconnect the charging connector is indicated by information about the charging status on the display. Charging can be completed at any time during the charging process. It will take place automatically when the vehicle signals that the battery is fully charged. Charging can also be completed from the charging station using the "STOP" button on the display screen, the "STOP" button (*Fig. 3*, No. 1) or in the event of an emergency - by pressing the safety switch (*Fig. 3*, No. 3). The safety switch is released by turning it. Before doing so, however, make sure that the cause of the failure has been removed.

Note!

Only use the safety switch in the event of a risk to life or property!

Beware !

5. TECHNICAL DESCRIPTION

5.1. Technical specification of the device

***Tab. 2* Technical data**

Electrical parameters			
Input AC		The way of connecting the power supply	Receiver plug CEE 125 A
		Network configuration	TNS (L1, L2, L3, N, PE)
		Nominal voltage	3 x 400V AC (+/- 10%)
		Frequency	50 Hz (+/-5%)
		Connector power	88 kVA
		Efficiency	≥ 95% (under optimal working conditions)
		Input power factor	≥0.98 for the output power >25%
		THDi	≤ 5%
		Overcurrent protection	4-pole fuse switch connector, fuse link 125A gF
		Residual current circuit breaker protection	ΔI ≤ 30mA type A
		Measuring circuit	Semi-indirect
Plug Charger 80	Output DC	Maximum charging power	80 kW (+/- 1.5%) / 40 kW (+/- 1.5%)
		Connector type	CCS Combo-2 (Type2/Mode4)
		Number of charging points in the station	1
		Output voltage range	150 - 950 V
		Maximum charging current	133 A (+/-1.5%)
		Voltage ripple	≤±0.5% mVp-p
		Communication protocol	ISO 15118, DIN 70121
		Bidirectional current flow protection	Diode built - in the power modules
		Protection from electric shock	IT circuit; Monitoring Insulation Device
		Measuring circuit	Semi-indirect
Plug Charger 80 X	Output DC	Maximum charging power	80 kW (+/- 1.5%) / 40 kW (+/- 1.5%) / 20 kW (+/- 1.5%)
		Connector type	2 x CCS Combo-2 (Type2/Mode4)

		Number of charging points in the station	2
		Output voltage range	150 - 950 V
		Maximum charging current	133 A (+/-1.5%) / 2 x 66 A (+/-1,5%) / 2 x 33 A (+/- 1,5%)
		Voltage ripple	≤±0.5% mVp-p
		Communication protocol	ISO 15118, DIN 70121
		Bidirectional current flow protection	Diode built - in the power modules
		Protection from electric shock	IT circuit; Monitoring Insulation Device
		Measuring circuit	Semi-indirect
Power modules		The power of a single module	20 kW
		Number of modules	4 pcs
Other		Insulation system	High frequency transformers
		R_{iso} input-output	3,5kV – 1 min.
Mechanical parameters			
Housing		Dimensions (H x W x D)	~ 1200 x 1260 x 860 mm
		Base (length x width)	~ 1260 x 860 mm
		The height of the user interface installation above ground level	~ 1180 mm
		Weight	~ 310 kg
		IP protection degree	IP54
		Protection IK	IK10
		Protection Class	I
		Cooling	Automatically turned on forced air cooling
		Paint finish	RAL 9016
		Sheathing	Galvanized steel, powder coated
		Type of closure	Patent insert
User interface			
Control panel			7" touch screen, safety switch, ignition key I/0/II, RGB backlit „STOP” button, language change button

RFID reader	Compliant with standards: – NFC-A / ISO14443A up to 848 kbit/s, – NFC-B / ISO14443B up to 848 kbit/s, – NFC-F / FeliCa™ up to 424 kbit/s, – NFC-V / ISO15693 up to 53 kb/s, – NFC-A / ISO14443A and NFC-F / FeliCa
Remote communication	GSM (LTE), Ethernet, OCCP 1.6-J
Other	
Certification	UE
Working temperature	-25°C /+55°C > 40°C possible output power reduction
Ambient humidity	max. 95%
Noise emission level	max. 65 dB
Location of the charging station (WGS84)	Width:
	Length:

5.2. Charging station output characteristic

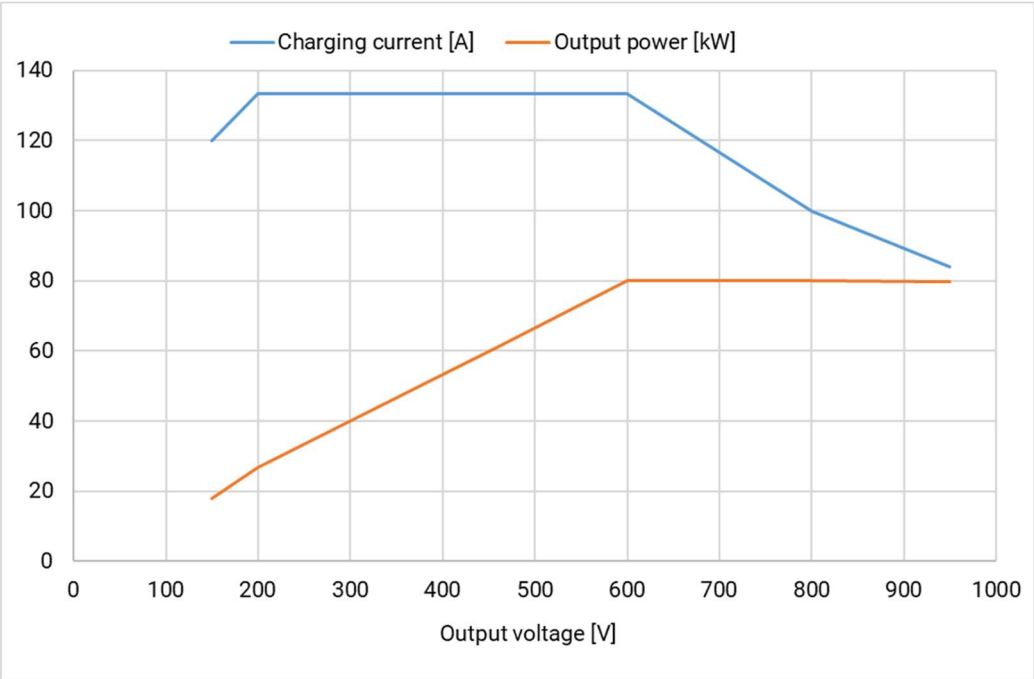


Fig. 10 **Output characteristic of charging connector Combo-2 80 kW (133A)**

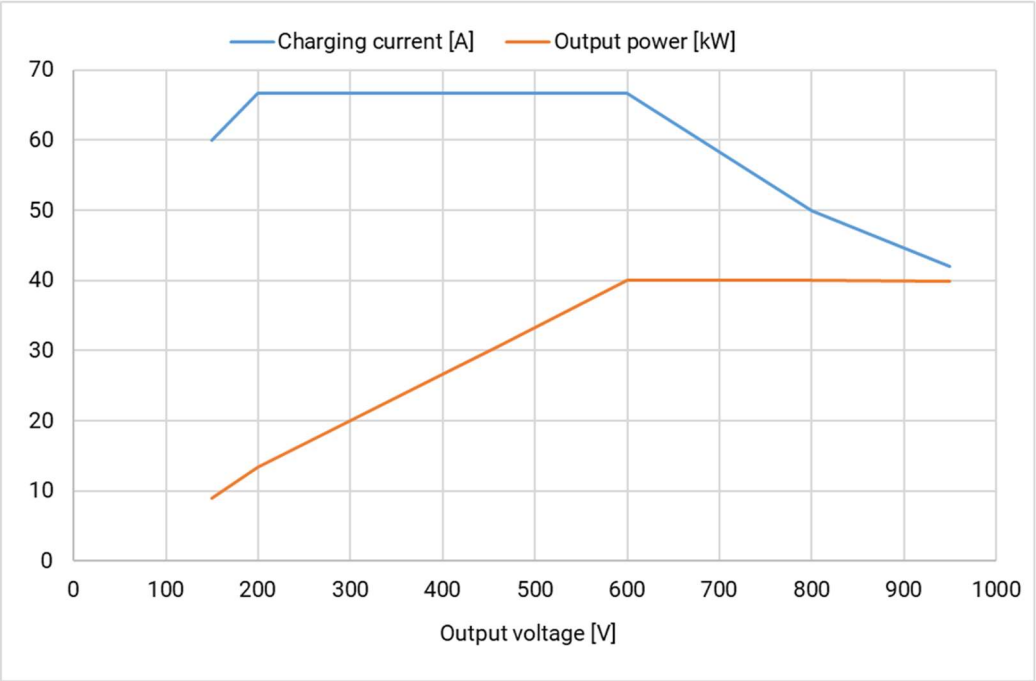


Fig. 11 **Output characteristic of charging connector Combo-2 40 kW (66A)**

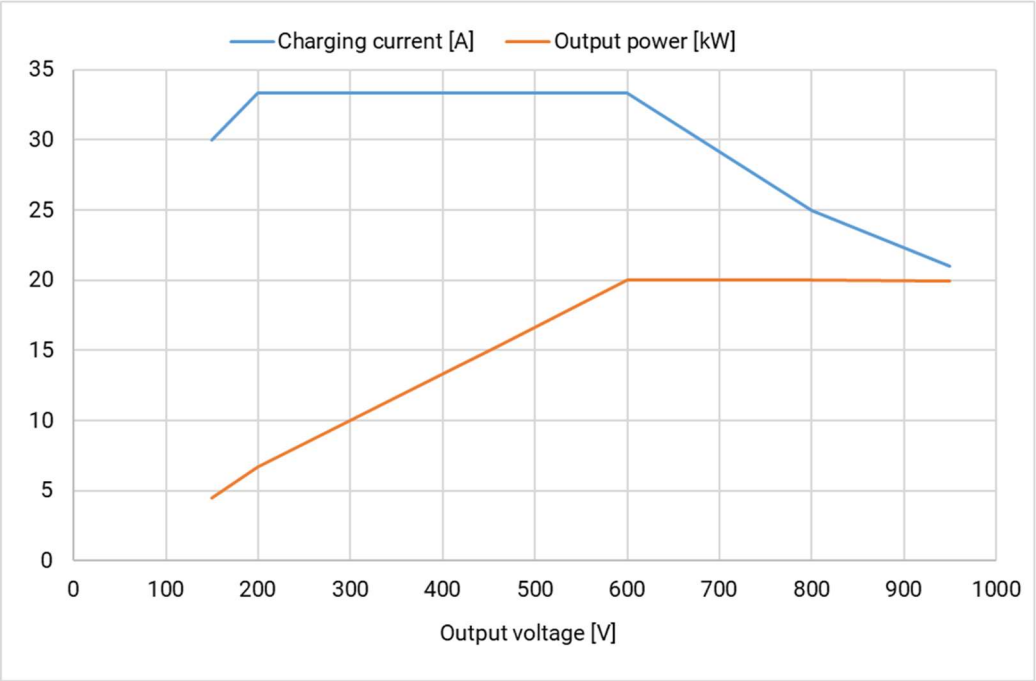


Fig. 12 **Output characteristic of charging connector Combo-2 20 kW (33A)**

6. HOUSING CONSTRUCTION

6.1. Description of the construction of the charging station housing

The charging station has a modular structure. Curtain walls, roof and the service door are made of galvanized steel and powder coated. Access to all equipment is possible through the back door. Housing design is based on a stainless steel plinth that has four wheels allowing for an easy transportation of the station from one location into another. Inside the cabinet charging station is divided into two parts, for the switching and protection circuits and for the power electronics circuits

Fig. 13 **Housing view of charging station Plug Charger 80**

(execution details may actually differ)

Fig. 14 Housing view of charging station Plug Charger 80 X

(execution details may actually differ)

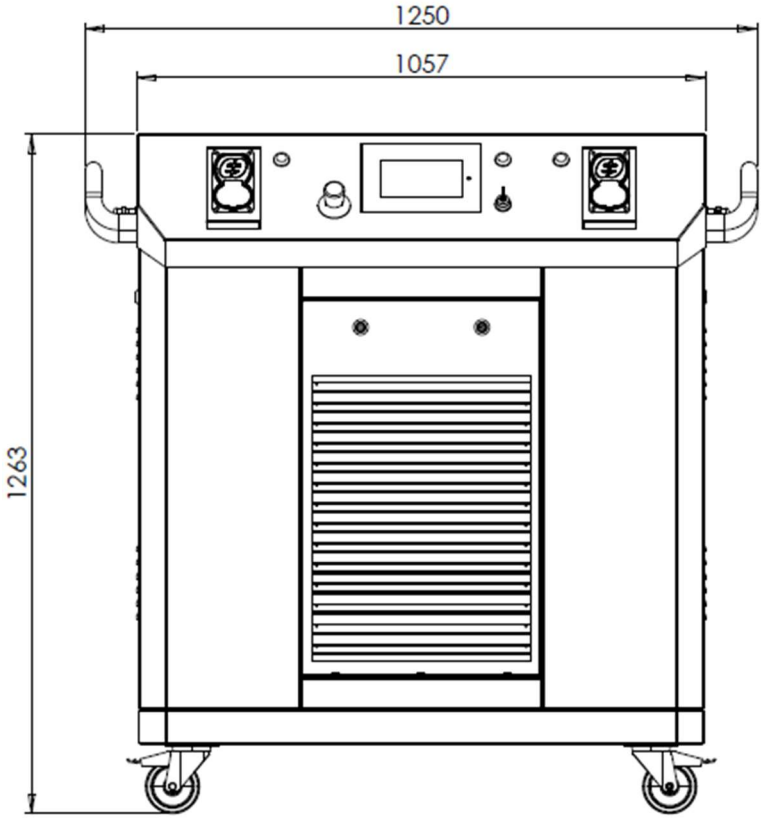


***Fig. 15* Charging station front view**

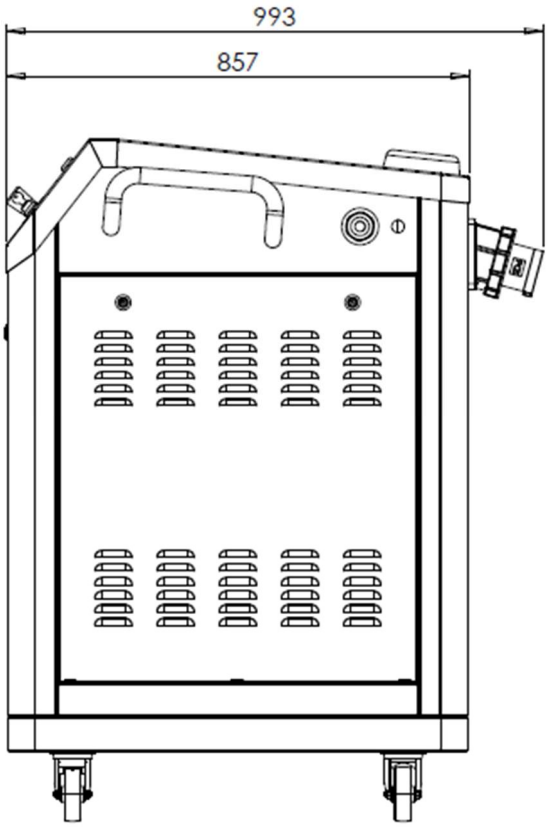
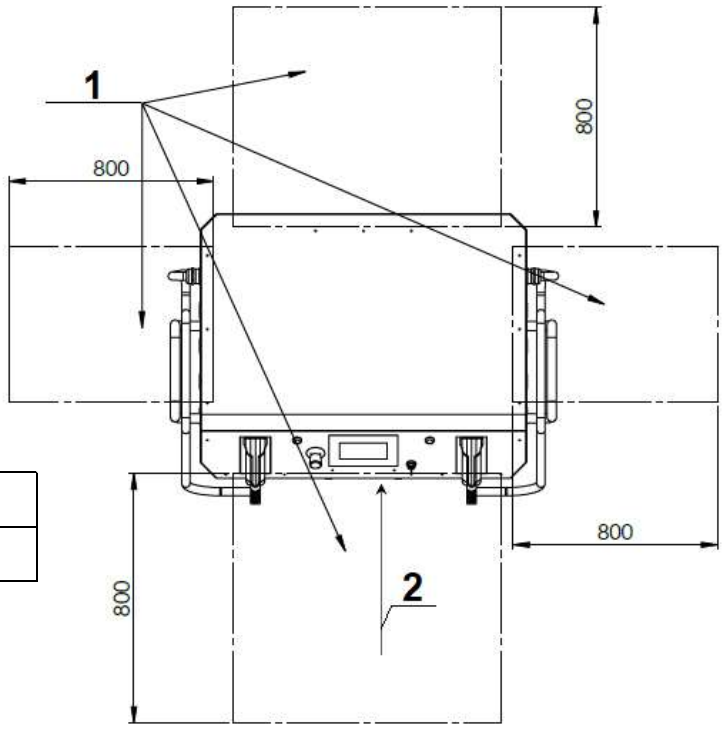


Fig. 16 Charging station side view



1	Maintenance area
2	Front

Fig. 17 Maintenance space view

6.2. Protection against mechanical damage

To prevent mechanical damage to the charging station anti-ram protection should be used. The protection must be adapted to the location and surroundings of the station, and to the extent associated with the expected risk of being hit by moving vehicles.

7. TRANSPORT AND STORAGE

7.1. Transport of the charging station

This chapter lists the recommended methods for transporting the charging station. Warnings are addressed to installers and operators of transport vehicles. For your safety, follow the sequence of discharging specified in this manual.

It is forbidden to transport and install the charging station during rainfall, high humidity, strong gusts of wind and poor visibility. 

In the interest of safety, observe the notes on transport and unloading the station specified in this manual.

The charging station must be transported in the working position. Attempting to transport and store in a different position may result in mechanical Before 

loading onto the transport vehicle, close all charging station doors and remove the keys from the locks.

The charging station is adapted to be transported on a forklift truck. To do this, insert the forks under the plinth of the charging station, keeping the fork spacing as wide as possible. Ramping with a forklift can be made only from the rear or front side of the housing.

Remember to keep the lifting height as low as possible. 

When using handing equipment, the employees should use protective helmets and footwear. In order to avoid crushing loading and unloading should be performed in a manner preventing the hazard for the staff while lifting and lowering, for instance, being crashed between the vehicle side or another fixed structural element.

The housing should be protected against mechanical damage by covering it with transport foil or corrugated cardboard (not less than two layers). The housing must always be firmly attached to the transport vehicle.

7.2. Storage of the charging station

Store in a dry place and away from direct sunlight in the working position.

8. INSTALLATION AND START-UP

8.1. Connecting the charging station's power supply and commissioning

During the installation of the equipment, one should follow closely this instruction as well as local regulations. The device installation can be divided into following steps:

- preparing a workplace – the installation location has to be secured properly from the access of the third parties,
- performing visual inspection – check that inside the station there is no damage caused by the transportation,
- switching on security devices inside the station – ensure that all elements of the protection devices are in working position,
- connecting the power cable – connect the cable to the receiver connector, pay attention to the correct clamping of the socket to the plug,

Fig. 18 **Connecting the power cable**

- before the first use check tightening torques of all devices.

To start-up the charging station, install all covers, press and pull out the safety switch, then switch the ignition key to position I or II, selecting the appropriate power of the device.

The device readiness for operation will be confirmed by lighting the “Ready” signal and information on the display.

9. MAINTENANCE AND DISPOSAL

9.1. Maintenance of the charging station

To clean the charging station from the outside, use only soft industrial cleaners. Do not use cleaners that could damage the surface of the charger's housing.

Detergents used to clean the charging station must not have flammable or extremely flammable properties.

Fig. 19 **Hazard pictogram on detergents prohibited for use**

Do not use flammable substances, such as gasoline, solvents, for cleaning!

Be especially careful when cleaning the charging station.

9.2. Package

The packaging material is 100% recyclable. During utilization, follow the applicable local regulations.

9.3. Utilization

1. The device has been made of recyclable materials. This device is marked with a crossed out waste bin icon, in accordance with the 2002/96/WE (WEEE) European directive on waste electrical and electronic equipment. By ensuring proper utilization of this device, you can help prevent potential negative consequences for the environment and human health.

2. Do not treat this device as ordinary household waste. Send it to a special facility for utilization and recycling of electrical and electronic waste. Utilize the device in accordance with the local regulations for waste utilization, taking it to a special collection point. You can find further details on utilization, scrapping and recycling of this device at the local municipal/commune office, specialist waste collection points in order to verify the logistical capabilities and the best available recovery technology in accordance with the WEEE directive, proclaiming priority of recovery over utilization.

10. RULES OF PROCEDURE IN CASE OF FAILURE OR INTERFERENCE IN THE OPERATION OF THE CHARGING STATION

Failure during charging is indicated by information on the display and by the red signal light of the illuminated "STOP" button.

In the event of any failure, it is necessary to discontinue use of the charging station and to follow the instructions below.

In the case of failure or interference during a charging session, follow these steps:

- pull the plug out of the vehicle,
- reset the vehicle,
- connect the plug and perform a charging test.

If the charging process is not starting correctly, repeat the above steps.

If the charging station is still not working properly:

- pull out the plug,
- reset the charger by pressing the safety switch and unlocking it,
- after lighting the green light "READY" to retry charging.

If the charging process does not start, repeat the above steps.

If after completing all of the above actions the charging station still does not work properly, contact the operator (or service).

Attention! By resetting the charging station by pressing the safety switch in the event of a failure on one of the charging connectors, the charging process on the other connector will be automatically interrupted. If such an interruption of the charging session is not advisable, wait until the session ends and then perform the charging station reset

11. HEALTH AND SAFETY REQUIREMENTS AND FIRE FIGHTING REGULATIONS

The electric vehicle charging station can be operated by a person who has read the user's manual.

11.1. Necessary steps before charging

Before charging, the user should read the operating instructions and check that:

- there are no people nearby who could pose a risk,
- the charger does not send error or error messages,
- the charging connector cable or the connector itself are not damaged,
- the condition of the device from the outside does not indicate its damage.

11.2. Rules for conducting a secure charging session

- The charging process must be carried out in accordance with the documentation,
- after completing the charging session, secure the charging connector by placing it in the blind socket located at the front of the charging station housing.

11.3. Correct placement of the charging connector

To properly put the charging connector back into the blind socket:

- disconnect the connector from the vehicle,
- insert the connector into the blind socket in the correct position and (if the charging station has a cable holder) roll the charging cable onto the holder.

Be careful not to damage the cable and the charging connector.

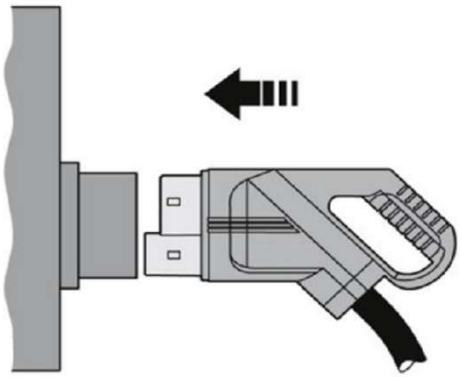


Fig. 20 **Correct position of the charging connector in the socket**

11.4. Activities prohibited for users

- Unauthorized persons must not open the inside of the charger,
- it is forbidden to use the charging station for purposes for which it is not intended,

Danger !

- it is forbidden to put the connector into the blind socket incorrectly,
- any modifications or use of spare parts that are not sold or recommended by the charging station manufacturer may cause electric shock or damage to the device.

Failure to follow these instructions and instructions listed in the service may result in a substantial material damage and may result in a serious injury or even death due to electric shock.

Warning !

11.5. Procedure in the event of a charging station fire

In the event of a fire at the charging station:

1. take care of your own safety and the safety of people at the charging station,
2. if it is possible - press the **safety switch**, which will disable vehicle charging and disconnect the power track in the charging station,
3. then turn off the charging station using the **main disconnector** located in the switchboard supplying the charging station,
4. if possible, use a fire extinguisher designed to extinguish electrical devices,
5. if necessary, notify the fire brigade of the situation,

6. after the fire is extinguished, the charging station must not be used until it is repaired or replaced,
7. the operator of the charging station must be notified of the situation.

It is recommended that there be a fire extinguisher near the charging station for extinguishing electrical appliances.

Extinguish the charging station only with equipment adapted for this purpose. **Do not extinguish with water!**

12. LIST OF FIGURES AND TABLES